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Forces Underlying Trade Integration in the APEC Region: A Gravity Model Analysis of Trade, *FDI*, and Complementarity

Shigeru T. Otsubo
Nagoya University

Tetsuo Umemura
University of the Ryukyus

Abstract

Accompanying the wave of liberalization in motion since the mid 1980s, trade complementarity and its underlying structure of comparative advantage have started to dictate the directions of international trade flows. The vibrant FDI-export-led Asian growth has revealed the role of FDI as a financial gravity for trade integration in the APEC region. Analyses of forces underlying trade integration using trade gravity models with dummies for regional trading arrangements, augmented by the additions of trade complementarity and FDI flows as gravity variables of emerging significance, suggest that 1) APEC is more potent in the creation of intra-regional trade compared to other regional trading arrangements (RTAs); 2) intra-regional trade generation is much more significant in North-North and North-South RTAs as compared to that for the South-South RTAs; 3) trade complementarity is a significant determinant of the directions of trade, and its significance has grown since the mid 1980s with reductions in trade distortions; and 4) inward FDI is a significant determinant of the direction of intra-APEC trade transactions.

• **JEL Classifications**: F15, F36, F02, F14
• **Key words** : APEC, FDI, Gravity model, Trade complementarity, Regional trading arrangements, Integration

*Corresponding address: Professor Shigeru Otsubo, Graduate School of International Development, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan Tel & Fax: +81-52-789-4966, E-mail: p1otsubos@m.gsid.nagoya-u.ac.jp.
Professor Tetsuo Umemura, Faculty of Law and Letters, University of the Ryukyus

I. Introduction

Developing East and South-East Asia, taken as a group, recorded an annual average growth rate of 7.6% during the decade from the mid 1980s to the mid 1990s, well in excess of the world average of 3.4%, and became the 4th growth pole of the world economy.[1] During the same period, foreign direct investment (*FDI*) flowing into this region from Japan, the United States, and from other developed economies increased at a rapid pace. Asia's intra-*FDI* concurrently increased, and together with the *FDI* from the developed economies played a major role in Asia's vibrant export-led growth. *FDI* flows not only expanded productive capacities of the recipient countries and productions for exports, but also provided export channels and market access for the recipients as well as the donors. Thus, *FDI* in the Asia Pacific region brought about closer integration of the region's economies, developed and developing alike.

As Otsubo (1996) has shown earlier, there was a marked evolution in the process of global trade integration in the mid 1980s, supported by financial flows. The waves of unilateral liberalization on the part of the developing economies earmarked a shift in the nature of the basic development strategy, from inward-looking to outward-oriented. Asia led other developing regions in its quest for a virtuous cycle of trade/financial integration and economic growth. Given a reduction in factors that distort trade flows, such as import tariffs and export redirections, supported by the dissipation of protective sentiment, trade started to flow more in line both with partners' import needs and with structures of export industries. Trade complementarity and its underlying structure of comparative advantage began to dictate the flows of international trade transactions, resulting in gains in the allocative efficiency of productive resources both domestically and globally.

One of the prominent characteristics of the ongoing process of global economic integration is a parallel advancement of regional trading arrangements (*RTAs*). Given the rather dismal performance of past RTA initiatives, it is worthwhile to evaluate newer arrangements in light of the forces underlying economic integration. Asia-Pacific Economic Cooperation (*APEC*), as it includes the world's emerging growth pole in Asia as well as its traditional growth poles (North America and Japan), draws particular attention in this regard.

Table 1 shows economic performance of the *APEC* region up to the mid 1990s. The region continued to lead the world economy in growth in real *GDP*, international trade, and *FDI*, and to account for more than half of the world economic

Table 1. *APEC* Growth Summary

					Real growth rates (%)		
	1980	1985	1990	1995	1980-85	1985-90	1990-95
GDP at market price (US$ billions)							
World	10,768	12,350	21,031	27,846	1.75	3.22	1.89
APEC	4,950	6,814	10,771	15,450	3.15	3.86	2.76
Share (%)	46.0	55.2	51.2	55.5	-	-	-
Merchandise exports (US$ billions)							
World	2,004	1,915	3,517	5,145	3.85	5.70	6.5
APEC	613	733	1,323	2,252	4.1	8.8	8.5
Share (%)	30.6	38.3	37.6	43.8	-	-	-
Merchandise imports (US$ billions)							
World	2,027	1,975	3,579	5,246	2.9	6.6	6.5
APEC	660.9	802	1,391	2,335	1.4	12.0	9.1
Share (%)	32.6	40.6	38.9	44.5	-	-	-
Net FDI inflow (US$ millions)							
World	-	50,975	201,230	316,441	-	31.6	9.5
APEC	-	25,585	86,743	169,896	-	27.7	14.4
Share (%)	-	50.2	43.1	53.7	-	-	-

Source: World Bank, *World Development Indicators 1997*.
IMF, *Balance of Payments Statistics Yearbook*, various issues.
Asian Development Bank, *Key Indicators of Developing Asian and Pacific Countries 1996*.

output. With the advent of East Asia as a major target for investments from economies both inside and outside the *APEC* region, *FDIs* into and within the region continued to grow at a rapid pace in the 1990s.[2]

This paper introduces some earlier findings on the factors of trade integration in the next section. Section III deals with the trends and economic consequences of *FDI*, as a major financial gravity in international trade transactions. Section IV introduces trends in revealed trade complementarity and its relationship to the directions of trade transactions. A gravity model is then introduced in Section V in order to explain the directions of world trade flows. This paper shows that traditional gravity variables such as the sizes of *GDP* and distances between trade partners, if used alone, underestimate the vibrant intra-*APEC* trade transactions. With a compilation of an intra-*APEC FDI* flow matrix, a gravity model is re-estimated for *APEC* economies with this financial gravity as one of the explanatory variables for their intra-regional trade flows. Finally, Section VI summarizes the findings of this paper.

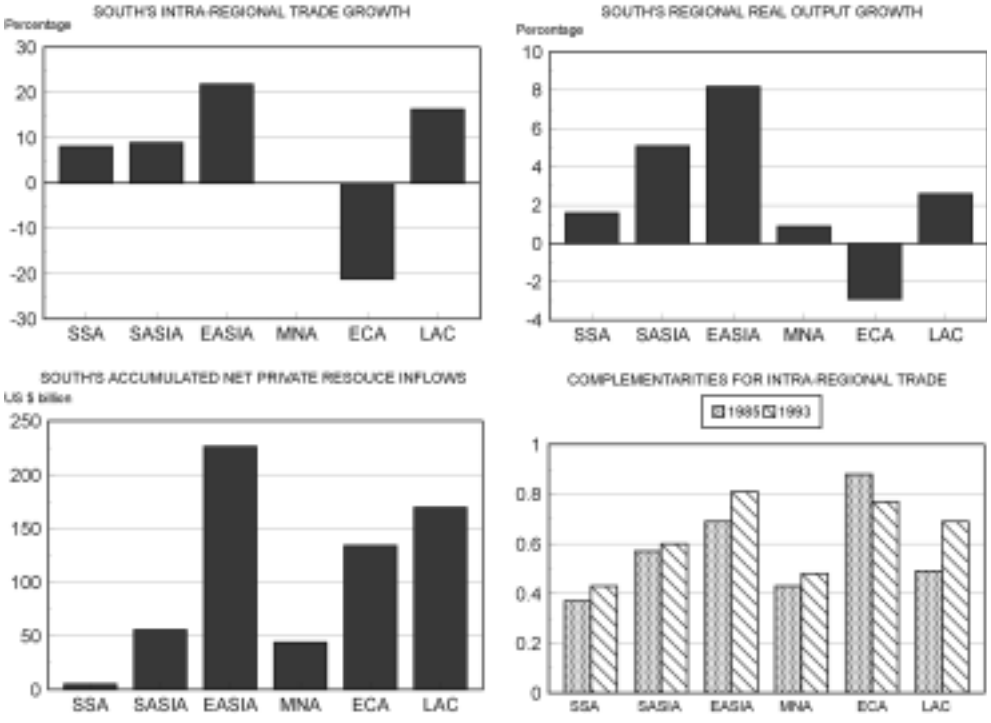
II. Economic Forces of Connection

Otsubo (1995, 1998a), after reviewing developments both in geographical intra-regional trade among developing countries and in policy-driven *RTAs*, asserts that an economic gravity and its dynamism have been the primary impetus for developments in intra-regional trade.

Figure 1 shows the growth of the intra-regional trade (in nominal terms) in developing regions, in relation to economic gravities, such as regional outputs (in constant dollar terms), accumulated net private resource inflows, and levels and developments in complementarity in intra-regional trade transactions during 1985-1993. Intra-regional trade grew rapidly in East Asia and Latin America with average annual rates of 22% and 16%, respectively. Starting from a very small base, it also grew in South Asia and Sub-Saharan Africa with average annual rates of 8.9% and 8.1%, respectively. In Europe and Central Asia on the other hand, intra-regional trade shrank at an annual rate of 21%. There was virtually no growth in intra-regional transactions in the Middle East and North Africa during the same period.

By comparing the four panels in Figure 1, one can say that an economic dynamism represented by high output growth seems to be the most important factor for the growth in intra-regional trade transactions. It was also affected by resource flows that augment import capacity and expand production for exports (particularly in the case of *FDI*) and by the levels and developments in trade complementarity.[3]

Figure 1. Intra-regional Trade and Economic Forces of Connection, 1985-93



The index of trade complementarity used for the 4th panel in Figure 1 is obtained using the folowing formula:

$$CMP_{ij} = 1 - \left(\sum_k \left| \frac{M_j^k}{M_j} - \frac{X_i^k}{X_i} \right| \right) / 2 \quad \left(0 \leqq CMP_{ij} \leqq 1 \right) \tag{1}$$

where i is an exporting region, j is an importing region, and k represents goods categories. This index takes the value of one when a composition of import needs in an importing country matches perfectly with the export bundle of an exporting country. At the other extreme, where an export bundle of an exporting country has no relevance to the import needs of an importing country, the index takes the value of zero.[4]

The reduction and elimination of distortionary trade policies such as export redirection, export taxes/subsidies, import tariffs/subsidies, and non-tariff barriers enabled developing countries to gradually shift concentration of production into goods where they have a comparative advantage. Exports from every developing region started to flow in line with their complementarity with trading partners, suggesting gains in distributional efficiency.

To the mid 1990s, East and South-East Asia was the only developing region where the share of intra-regional trade in total trade increased from less than 20 percent in the mid 1970s to about 40 percent in 1995. The fact that East Asia was the region most integrated with the developed economies, followed by Latin America, suggests that trade integration proceeded in line with these economic forces of connection. *APEC*, as a North-South RTA, includes this self-integrating region in Asia and major suppliers of capital, Japan and the United States ─ two centers of economic gravity. *APEC* thus sees high levels of intra-regional trade flows both in goods with dissimilar factor contents (interindustry trade) and those with similar factor contents (intraindustry trade).

III. Foreign Direct Investment as a Financial Gravity for Integration

Table 2 shows trends in *APEC* as well as world foreign direct investment (*FDI*) flows. According to *IMF* statistics, the world's total amount of foreign direct investment flows was a little over 50 billion dollars in 1985. This total rapidly increased to over 200 billion dollars in 1990, and to 316 billion dollars in 1995, with average annual growth rates of 31.6 percent and 9.5 percent, respectively for

Table 2. Trends in Net *FDI* Inflows to *APEC* Region

(US $ millions, *percent*)

	1985	1990	1991	1992	1993	1994	1995	Average growth rate 85-90	90-95
World net FDI Inflow	50,975	201,230	153,840	165,862	210,272	230,953	316,441	*31.6*	*9.5*
APEC net FDI Inflow	25,585	86,743	57,048	61,973	103,337	129,855	157,694	*27.7*	*12.7*
(share in world)	*50.2*	*43.1*	*37.1*	*37.4*	*49.1*	*56.2*	*49.8*	-	-
Subgroups in APEC									
Industrial Countries [a]	20,384	65,750	31,375	31,982	53,614	65,207	87,291	*26.4*	*5.8*
EASIA [b]	4,596	17,854	20,408	24,899	44,525	51,903	61,745	*31.2*	*28.2*
China	1,659	3,487	4,366	11,156	27,515	33,787	35,849	*16.0*	*59.4*
ASEAN4 [c]	1,180	6,400	8,038	9,301	10,052	9,414	13,694	*40.2*	*16.4*
ANIEs [d]	1,757	7,967	8,004	4,442	6,958	8,702	12,202	*35.3*	*8.9*
Americas e	605	3,139	5,265	5,092	5,198	12,745	8,658	*39.0*	*22.5*
Shares in APEC									
Industrial Countries	*79.7*	*75.8*	*55.0*	*51.6*	*51.9*	*50.2*	*55.4*		
EASIA	*18.0*	*20.6*	*35.8*	*40.2*	*43.1*	*40.0*	*39.2*		
China	*6.5*	*4.0*	*7.7*	*18.0*	*26.6*	*26.0*	*22.7*		
ASEAN4	*4.6*	*7.4*	*14.1*	*15.0*	*9.7*	*7.2*	*8.7*		
ANIEs	*6.9*	*9.2*	*14.0*	*7.2*	*6.7*	*6.7*	*7.7*		
Americas	*2.4*	*3.6*	*9.2*	*8.2*	*5.0*	*9.8*	*5.5*		

Note: a. Australia, Canada, Japan, New Zealand and the United States.
b. Indonesia, Malaysia, Philippines and Thailand.
c. Korea, Hong Kong, Singapore and Taiwan.
d. Chile and Mexico.

Source: IMF, *Balance of Payments Statistics Yearbook*, various issues.
Institute for International Trade and Investment, *Sekai Shuyokoku no Chokusetsu-Toshi-Tokeishu*, 1997.

the periods of 1985-90 and 1990-95. World aggregate *FDI* flows thus increased six-fold during that decade, while world trade expanded by only 2.7 times during the same period. Exchange rate adjustments after the Plaza Accord and the wave of liberalization both in trade and investment regimes after the mid 1980s were conducive to this rapid expansion of *FDI* flows.

APEC's share in world total *FDI* was about 50% in 1985, and withstanding some fluctuations in the following decade, the share was once again 50% in 1995. Looking at the developments in the subgroups within *APEC* presented in Table 2, one notices the dynamics of *APEC* and Asian *FDIs* in the decade after 1985. Between 1985 and 1990, *APEC*'s inward *FDI* increased at an annual average rate in excess of 30% in every subgroup except China, where the pace of *FDI* expansion was about half of that observed in other subgroups. In the first half of the 1990s however, China became a major recipient of inward *FDI*. Changes in period average growth rates and year-to-year shifts in intra-*APEC* shares show that the center of *FDI* activities (at least, the dynamism of it) shifted from the area's industrial countries to the Asian *NIEs*, then to *ASEAN4*, and finally to China. The shifts largely correspond to increases in production costs (particularly labor costs) for export-oriented *FDIs* as observed in the Asian *NIEs*, and to the expansion of

middle classes (i.e., their purchasing power) for domestic-market-oriented *FDIs* as observed in China.

Otsubo *et al.* (1998b) and Otsubo (1999) examined economic consequences of *FDI* flows into the developing economies of Asia using an applied general equilibrium world trade model. Comparative static analyses in these studies show four major channels through which *FDI* exerts economic impacts: 1) stock effects, that is, an expansion in productive capacity due to capital infusion; 2) productivity increases, as *FDI* brings with it production, managerial, and marketing technologies and know-how; 3) cofinance effects, where domestic savings and investment activities are stimulated due to the inflow of capital that embodies higher productivity levels and rates of return; and lastly, 4) trade effects, where industrial and trade structures in both donor and recipient countries are altered, and additional trade transactions are created − often in both directions. The current study focuses on this last channel and specifically, the consequences of *FDI* in directional flows of trade transactions.

Table 3 shows the pattern of intra-*APEC FDI* flows in the first part of the 1990s (1992-94). It reveals another noticeable feature in the Asian *FDI* flows during the decade from the mid 1980s, which is the increasing role of *NIEs* as suppliers of *FDI* to *ASEAN4* and China.[5]

Table 3. Intra-APEC *FDI* Flows (annual average for 1992-94)

(A) Nominal US$ Values (US$ millions)

	FDI Recipients						
FDI Donors	North America	Japan	ANZ	China	ASEAN4	ANIEs	Americas
North America	7,779	541	2,580	1,830	1,565	2,666	6,307
Japan	5,116	0	450	1,373	1,374	1,746	1,008
ANZ	411	5	749	118	351	-43	53
China	52	3	21	0	33	24	5
ASEAN4	206	0	17	451	132	82	0
ANIEs	529	88	567	18,388	2,909	433	15
Americas	683	0	0	1	0	0	7
Total	14,776	638	4,385	22,161	6,363	4,908	7,394

(B) Shares in APEC (percent)

	FDI Recipients						
FDI Donors	North America	Japan	ANZ	China	ASEAN4	ANIEs	Americas
North America	52.6	84.8	58.8	8.3	24.6	54.3	85.3
Japan	34.6	0.0	10.3	6.2	21.6	35.6	13.6
ANZ	2.8	0.8	17.1	0.5	5.5	-0.9	0.7
China	0.4	0.5	0.5	0.0	0.5	0.5	0.1
ASEAN4	1.4	0.0	0.4	2.0	2.1	1.7	0.0
ANIEs	3.6	13.8	12.9	83.0	45.7	8.8	0.2
Americas	4.6	0.0	0.0	0.0	0.0	0.0	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: North America includes Canada and the United States.
ANZ includes Australia and New Zealand.

Source: IMF, *Balance of Payments Statistics Yearbook*, various issues.

Table 4. Intra-*APEC* Trade Flows (annual average for 1992-94)

(A) Nominal US$ Values (US$ millions)

	Importers							
Exporters	North America	Japan	ANZ	China	ASEAN4	ANIEs	Americas	Total
North America	218,400	56,183	11,022	10,073	17,181	56,553	47,759	417,170
Japan	113,872	-	9,147	16,002	33,712	82,362	4,892	259,988
ANZ	5,691	12,561	4,733	1,901	4,265	10,406	326	39,881
China	16,748	16,324	1,209	-	2,818	37,619	377	75,095
ASEAN4	29,387	25,760	2,535	3,393	6,234	32,211	635	100,153
ANIEs	95,366	34,525	7,221	49,346	35,196	56,783	3,248	281,686
Americas	37,832	2,757	108	259	327	1,400	338	43,021
Total	517,296	148,110	35,974	80,973	99,732	277,334	57,575	1,216,994

(B) Export Shares in APEC (percent)

	Importers							
Exporters	North America	Japan	ANZ	China	ASEAN4	ANIEs	Americas	Total
North America	52.4	13.5	2.6	2.4	4.1	13.6	11.4	100.0
Japan	43.8	-	3.5	6.2	13.0	31.7	1.9	100.0
ANZ	14.3	31.5	11.9	4.8	10.7	26.1	0.8	100.0
China	22.3	21.7	1.6	-	3.8	50.1	0.5	100.0
ASEAN4	29.3	25.7	2.5	3.4	6.2	32.2	0.6	100.0
ANIEs	33.9	12.3	2.6	17.5	12.5	20.2	1.2	100.0
Americas	87.9	6.4	0.3	0.6	0.8	3.3	0.8	100.0

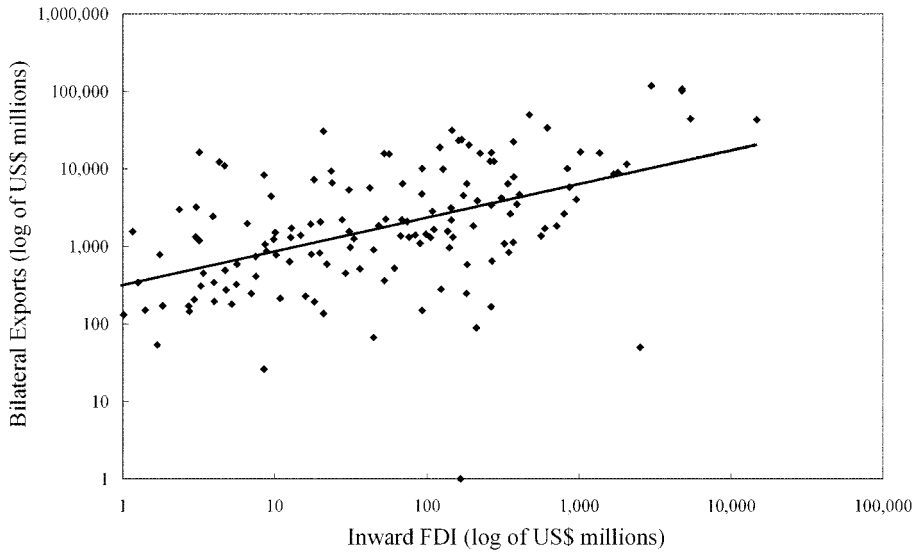
(C) Import Shares in APEC (percent)

	Importers						
Exporters	North America	Japan	ANZ	China	ASEAN4	ANIEs	Americas
North America	42.2	37.9	30.6	12.4	17.2	20.4	83.0
Japan	22.0	-	25.4	19.8	33.8	29.7	8.5
ANZ	1.1	8.5	13.2	2.3	4.3	3.8	0.6
China	3.2	11.0	3.4	-	2.8	13.6	0.7
ASEAN4	5.7	17.4	7.0	4.2	6.3	11.6	1.1
ANIEs	18.4	23.3	20.1	60.9	35.3	20.5	5.6
Americas	7.3	1.9	0.3	0.3	0.3	0.5	0.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: UN/COMTRADE Database.
IMF, *Directions of Trade Statistics*.

Table 4 shows: (A) intra-*APEC* trade flows, (B) export shares in *APEC*, and (C) import shares in *APEC*. By comparing the pattern of intra-*APEC FDI* flows depicted in panel (B) in Table 3 with the patterns of intra-*APEC* trade flows in panels (B) and (C) in Table 4, one can see positive connections between *FDI* and trade flows among the groups of economies within *APEC*. For instance, 83% of inward *FDI* flows to China came from the Asian *NIEs* during the period of 1992-94. During the same period, China sourced more than 60% of her imports from the Asian *NIEs* (*ANIEs*), while 18% of *ANIEs*' exports were directed to China. *ASEAN4* economies sourced their *FDI* inflows from *ANIEs* (46%), North America (25%), and Japan (22%). Their exports were directed to *ANIEs* (32%), North America (29%), and Japan (26%), showing strong correlation with *FDI* inflows from these export destinations.

Figure 2. Intra-*APEC FDI* and Trade Flows (average for 1992-94)



A scatter diagram (Figure 2) showing interrelations between *FDI* and trade flows was created using full intra-*APEC* bilateral transaction matrices (16×16). Positive connections are again highly visible in this diagram.

IV. Complementarity as a Gravity for Integration

This paper has so far shown that given the wave of liberalization in motion since the mid 1980s, trade complementarity and its underlying structure of comparative advantage started to dictate the flows of international trade transactions. Earlier, the World Bank (1995) evaluated the importance of trade complementarity for the success of policy-driven RTAs. The results replicated in Table 5 clearly show higher trade complementarities for successful arrangements such as the *EEC*, the Canada-US Free Trade Area, and the North America Free Trade Agreement (*NAFTA*); lower trade complementarities emerge for unsuccessful arrangements such as the Latin America Free Trade Association (*LAFTA*) and the Andean Pact. In terms of the computed value of trade complementarity (0.35), *APEC* was regarded as having the potential to succeed.

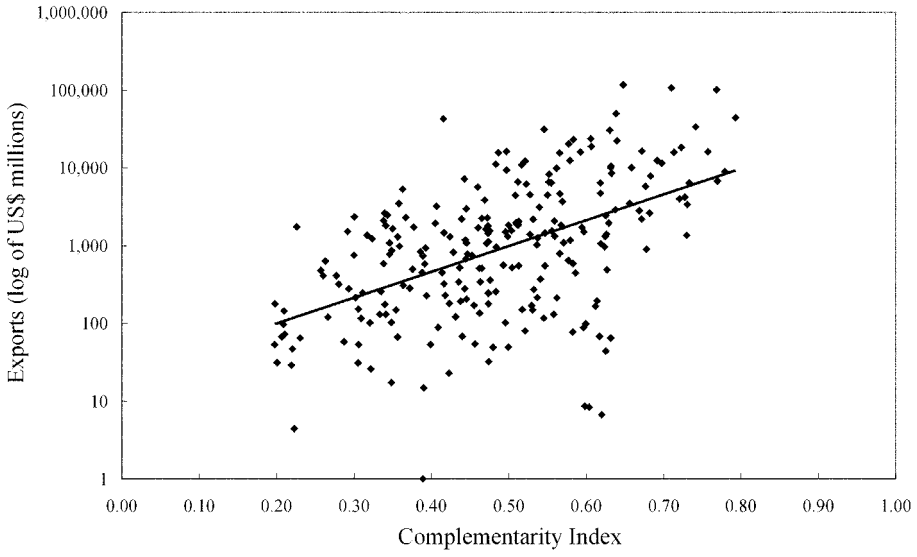
A scatter diagram (Figure 3) showing interrelations between trade complementarities and trade flows was created using full intra-*APEC* bilateral trade and complementarity matrices computed for 1992-94 (see Table 6 for computed intra-

Table 5. Trade Complementarity Indices for Selected Trade Arrangements

Trading arrangements	*Index*	*Trading arrangements*	*Index*
Successful arrangements		*Recent arrangements*	
EEC (6)	0.53	NAFTA	0.56
Canada-U.S. FTA	0.64	Mercosur	0.29
Unsuccessful arrangements		*Potential arrangements*	
LAFTA	0.22	Americas "AFTA"(NAFTA+5)[a]	0.31
Andean Pact	0.07	Asia-Pacific "APEC" (17)	0.35
		Sub-Saharan Africa (20)	0.09

[a] The Americas free trade area is proxied by NAFTA plus the next five biggest economies: Argentina, Brazil, Chile, Colombia, and Venezuela.
Source: World Bank, *Global Economic Prospects and the Developing Countries 1995.*

Figure 3. Intra-APEC Trade Complementarities and Trade Flows (average for 1992-94)



APEC bilateral trade complementarities). Positive connections are again highly visible in this diagram.

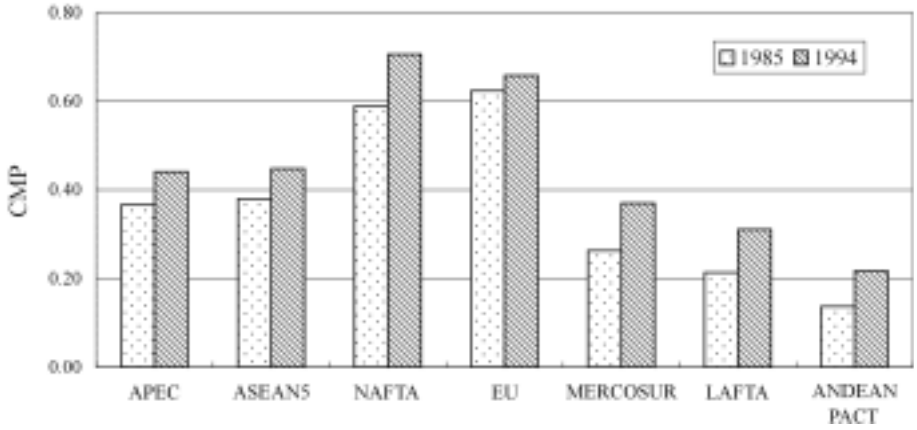
Given rising trade complementarities due to reductions in trade distortions (see Figure 4), rising intra-*APEC FDI* flows (Tables 2 and 3) thanks to initiatives in the liberalization of investments, and an observed positive correlation between these economic gravities and the directions of trade flows, it seems safe to say that *APEC* will continue on the path of integration.

Table 6. Intra-*APEC* Bilateral Trade Complementarities (average for 1992-94)

	AUS	CAN	CHL	CHN	HKG	IDN	JPN	KOR	MEX	MYS	NZL	PHL	SGP	THA	TWN	USA
AUS	0.34	0.35	0.36	0.35	0.34	0.36	0.52	0.45	0.35	0.35	0.34	0.39	0.34	0.35	0.41	0.36
CAN	0.58	0.66	0.61	0.50	0.44	0.46	0.62	0.56	0.58	0.47	0.60	0.52	0.47	0.53	0.57	0.65
CHL	0.22	0.23	0.20	0.20	0.21	0.21	0.38	0.26	0.21	0.20	0.22	0.22	0.20	0.21	0.26	0.23
CHN	0.47	0.45	0.45	0.42	0.63	0.39	0.50	0.41	0.46	0.43	0.46	0.42	0.47	0.39	0.42	0.49
HKG	0.51	0.47	0.44	0.42	0.71	0.39	0.44	0.44	0.51	0.48	0.47	0.47	0.57	0.47	0.47	0.55
IDN	0.30	0.28	0.31	0.32	0.36	0.26	0.48	0.37	0.27	0.26	0.29	0.29	0.30	0.28	0.29	0.36
JPN	0.68	0.73	0.68	0.59	0.58	0.55	0.42	0.58	0.72	0.66	0.62	0.62	0.67	0.69	0.64	0.71
KOR	0.58	0.55	0.54	0.57	0.77	0.53	0.52	0.51	0.62	0.63	0.56	0.62	0.66	0.59	0.63	0.61
MEX	0.62	0.67	0.61	0.52	0.58	0.48	0.54	0.55	0.70	0.60	0.62	0.60	0.63	0.63	0.60	0.74
MYS	0.45	0.41	0.40	0.42	0.51	0.34	0.52	0.48	0.48	0.54	0.39	0.50	0.63	0.47	0.50	0.56
NZL	0.34	0.34	0.32	0.31	0.34	0.33	0.47	0.38	0.34	0.30	0.34	0.32	0.31	0.31	0.37	0.32
PHL	0.43	0.42	0.35	0.35	0.55	0.31	0.51	0.42	0.47	0.53	0.39	0.48	0.59	0.41	0.48	0.51
SGP	0.50	0.46	0.44	0.46	0.51	0.39	0.46	0.51	0.53	0.58	0.44	0.54	0.68	0.53	0.54	0.57
THA	0.49	0.47	0.42	0.39	0.63	0.36	0.55	0.44	0.50	0.44	0.46	0.44	0.55	0.44	0.45	0.55
TWN	0.60	0.56	0.54	0.50	0.72	0.50	0.50	0.53	0.63	0.57	0.56	0.57	0.64	0.56	0.58	0.61
USA	0.78	0.77	0.68	0.63	0.63	0.67	0.64	0.71	0.79	0.68	0.73	0.73	0.70	0.73	0.76	0.73

Source: Authors' own computation using UN/COMTRADE database.

Figure 4. Computed Complementarity Indices for *RTAs*



Note: Calculated at the SITC 2-digit level.
Source: Authors' own computation using UN/COMTRADE database.

V. Gravity Model Analysis

A. Gravity Model

In this section, gravity models are used to examine factors that affect directions of bilateral trade flows among countries. The application of a gravity model – that originates from the field of physics to international trade transactions came as a result of questioning the zero–transaction-cost assumptions used in traditional trade theories such as Ricardo's. Studies by Isard and Peck (1954) that dealt with the logistics of U.S. railroads and of international shipping, and by Beckerman (1956) that examined intra-regional trade transactions within Western Europe, found that geographical distances (as proxies for transaction costs) and the sizes of

trade flows were negatively correlated. Tinbergen (1962) and Poyhonen (1963) examined the relationships among bilateral trade flows, sizes of *GDP* and distances between trading countries. They found that the trading partners' *GDP* sizes affected bilateral trade flows positively, and that distance affected trade flows negatively. Aitken (1973), Thursby and Thursby (1987), and Bergstrand (1985, 1989) included dummy variables for regional trading arrangements ─ *EEC* and EFTA dummies in Aitken, for instance ─ and found that these *RTA* dummies were statistically significant in explaining the direction of bilateral trade flows. Havrylyshyn and Pritchett (1991) applied a gravity model to analyze structural changes among Eastern European economies in transition. Using the results, they forecast an increasing importance of trade with Western Europe in Eastern Europe's shifting trade pattern. Dhar and Panagariya (1994), using a gravity model with regional dummies, showed that North America and the *EEC* were tilted more toward intra-regional trade compared to East Asia. In more recent applications of gravity models that included RTA dummies, Wei and Frankel (1997) and Endoh (1997) found highly significant *APEC* dummies in their respective studies. Wei and Frankel (1997) tested the stock of *FDI* from the exporting country to the importer as an additional regressor in a global gravity model and found a positive and significant coefficient. Umemura (1997) included indices of trade complementarity as new gravity variables in his gravity model analysis together with RTA dummies and found the statistical significance of these variables.

The gravity model of trade flows is often said to stand without any theoretical foundation. It simply states that the sizes of bilateral trade flows should be positively related to the trading partners' incomes and negatively related to the distance between them due to transportation costs. However, this commonsense trade model can be drawn from various theoretical frameworks. Bergstrand (1985, 1989) presented a mathematical derivation of a trade gravity model as a set of reduced-form equations of a general equilibrium model of trade demand ─ derived by maximizing utility (*CES* preferences over Armington-differentiated products) subject to an income constraint in each importing country ─ and trade supply derived by maximizing producer profit in each exporting country. Newer trade theories that deal with monopolistic competition in the models of differentiated products and transportation costs, can thus support the gravity model of trade as shown in Frankel, Stein, and Wei (1995). Deardorff (1995) showed that the gravity models could be derived even from the standard Heckscher-Ohlin models with or without trade frictions/impediments. Therefore, although a gravity model of trade

cannot be used to test any specific trade theory, it can be supported by many.

A typical gravity model expresses bilateral trade flows between a pair of countries as a function of the two countries' sizes, income levels, geographical distance, populations, and qualitative factors such as adjacency, a common language, and membership in *RTAs*. Following the implications drawn in the preceding section, complementarity indices (as a measurement of compatibility in their trading bundles), and *FDI* flows (as a financial gravity), are introduced on top of the traditional gravity variables.

Summarizing, the gravity model for this study is in the form:

$$Trade_{ij} = f\,[GDP_i,\ pcGDP_i,\ POP_i,\ GDP_j,\ pcGDP_j,\ POP_j,\ Distance_{ij},\ FDI_{ij}\ (and/or\ FDI_{ji}),\ CMP_{ij},\ RTAD_{ijk},\ Other\ Dummies], \quad (2)$$

where $Trade_{ij}$ is trade flow from country *i* to country *j*, *pcGDP* is *GDP* per capita, *POP* is population, *FDI* is foreign direct investment (either direction), *CMP* is complementarity index, *RTAD* is a set of dummy variables for a set of *k* different regional trade arrangements (=1 if both *i* and *j* are members of the particular *RTA*). Positive and statistically significant estimated coefficients on *RTA* dummies generally indicate greater trade among constituting members. Table 7 shows a list of *RTAs* included in the model, their members, starting years, and other characteristics. Figure 4 presents computed complementarity indices for the intra-*RTA* trade transactions. Other dummies could include elements such as a common language or religion, or a shared border. Only border dummies are included in this study. A similarity index $|\,pcGDP_i - pcGDP_j\,|$ that represents the Linder Hypothesis is not included in the current study so as to focus on trade complementarity given the flying-geese pattern of Asian production and trade.

Gravity model analyses in the following sections are geared to address the following questions:

1) Is *APEC* more potent in the creation of intra-regional trade compared to the other *RTAs* ?

2) Are there any differences in the significance of *RTA* dummies among North-North, North-South, and South-South *RTAs* ?

3) Given the simultaneous expansion in vertical as well as horizontal trade, within *APEC* in particular, what can we say about the significance of complementarity factors ?

4) Does *FDI* create gravity that affects the direction of intra-*APEC* trade flows ?

Table 7. Regional Trading Arrangements

Name	APEC [a]	EU	NAFTA	MERCOSUR	LAFTA	Andean Pact	ASEAN5
	Asia Pacific Economic Cooperation	European Union	North America Free Trade Agreement	Mercado Comun del Sur (Southern Cone Common Market)	Latin America Free Trade Association	Andean Subregional Integration Agreement	Association of South-East Asian Nations
Year of Creation	1989 [b]	1958 [c]	1994	1995	1961	1969	1967
Type of Agreement [d]	FTA	CM	FTA	CM	FTA	CU	FTA
Type [e]	N-S	N-N	N-S	S-S	S-S	S-S	S-S
1	Australia	Austria	Canada	Argentina	Argentina	Bolivia	Indonesia
2	Canada	Belgium-Luxembourg	Mexico	Brazil	Bolivia	Colombia	Malaysia
3	Chile	Denmark	United States	Paraguay	Brazil	Ecuador	Philippines
4	China	Finland		Uruguay	Chile	Peru	Singapore
5	Hong Kong, China	France			Colombia	Venezuela	Thailand
6	Indonesia	Germany			Ecuador		
7	Japan	Greece			Mexico		
8	Korea, Rep.	Ireland			Paraguay		
9	Malaysia	Italy			Peru		
10	Mexico	Netherlands			Uruguay		
11	New Zealand	Portugal			Venezuela		
12	Philippines	Spain					
13	Singapore	Sweden					
14	Taiwan	United Kingdom					
15	Thailand						
16	United States						

Note: a. Brunei and P.N.G are excluded in this analysis due to insufficient data.
b. The year for the first council of ministers.
c. Date put in effect.
d. CU = customs union; FTA = free trade area; CM = common market.
e. N-S, N-N, and S-S mean North-South, North-North, and South-South Trade respectively.

Source: Braga, C. A. Primo (1994), "The New Regionalism and its Consequences," World Bank, International Economics Department.

B. World Trade Transactions and *RTAs*

Gravity models in the form of equation (2) are estimated for 113 countries, listed in Appendix A, for the two time periods of 1984 (average annual values for 1983-85) and 1993 (averages for 1992-94) using (exporter-reported data on) exports as dependent variables. *RTA* dummies are included for both periods. Cross-section estimations were conducted in this study. Some of the world models are estimated over pooled data covering only two distant time points (1984 and 1993). Thus, serial correlation problems should be non-existent or negligible. The authors adopted fixed-coefficient models because fixed or random effects models were not suitable choices in this context.[7] Ordinary least squares (*OLS*) estimates are unbiased and consistent but not efficient in the presence of heteroskedasticity. Conventional computed standard errors are no longer valid in this case. This issue of heteroskedasticity in cross-section data is addressed by White's heteroskedasticity test (White, 1980) and by the use of the White covariance estimators in place of the standard *OLS* estimators.

The results of both cross-section and panel estimations are tabulated in Table 8. As variables are used in natural logarithms except for complementarity indices and

dummies, estimated coefficients show elasticity. F statistics indicate that all of the 8 estimated equation forms (4 models, pooled and two-period cross-section estimates) are significant at the 1% significance level.

Column 1 in Table 8 shows panel estimation results for a basic gravity model. Each one of the gravity variables included is statistically significant at the 1% significance level with an intuitive sign attached to its estimated coefficient. The basic gravity model alone explains 62% of the variations in direction of trade flows. An inclusion of complementarities in the set of gravity variables increased the explanatory power to 65%, with a correct positive sign attached to its highly significant coefficient (column 2).

Columns 3 to 5 show results from panel (column 3) and cross-section (columns 4 and 5) estimations of gravity models with dummies for *RTAs*, but without complementarities. Columns 6 to 8 show the results from similar gravity model estimations, but with complementarities included as gravity variables. All of the estimated coefficients on the basic gravity variables are significant with correct estimated signs. Complementarities again turn out to be significant, adding to the explanatory power of the gravity models (a partial answer to question 3).

Pairwise comparisons of estimated results in columns 1 and 3, and columns 2 and 6, reveal general significance of *RTA* dummies, showing increased intra-*RTA* trade transactions as a result of the trade creation and diversion effects. Following Kmenta (1986), the standard F test for choosing between nested and expanded models was conducted between models 1 and 3, and between models 2 and 6. Obtained test statistics of F=327.60 (1-3) and F=311.48 (2-6) significantly exceed the critical value of F(7, 23,909 or 23,908)=2.64 at the 1% significance level. Thus the estimation results confirm that *RTAs* generally influence the directions of trade flows in a significant manner. Estimated coefficients attached to *NAFTA* and *ASEAN5* dummies are insignificant (even at the 5% significance level) as these *RTAs* are included in the *APEC* framework whose estimated coefficients are most significant among all the *RTA* dummies tested in the current study (an answer to question 1). For the comprising members of *NAFTA* and *ASEAN5*, coefficients to these sub-*RTAs* and to *APEC* have to be added to see the combined effects of the multiple RTA memberships.

For the *RTAs* in existence before 1984 (*EU*, *LAFTA*, Andean Pact, *ASEAN5*), the significance of *RTA* dummies increase over time. As a result, a gravity model that includes both complementarity and *RTA* dummies explain more than 70% of variations in trade flows in the first part of the 1990s (see column 8). In answer to

question 2, the results reveal that the estimated coefficients attached to North-South (*APEC*, *NAFTA+APEC*) and North-North (*EU*) *RTAs* are more significant compared to those attached to South-South arrangements (*MERCOSUR*, *LAFTA*, Andean Pact, *ASEAN5*).

Table 8. Estimation Results for World Trade Gravity Models with *RTAs* (113 countries)
(Dependent variable is Export ij)

	1	2	3	4	5	6	7	8
Year	1984 & 93	1984 & 93	1984 & 93	1984	1993	1984 & 93	1984	1993
Constant	-15.26	-12.44	-14.57	-13.53	-15.71	-11.94	-10.81	-13.17
	(-76.82)[a]	(-57.21)	(-76.76)	(-48.99)	(-58.69)	(-57.95)	(-36.68)	(-44.55)
Distance ij	-0.68	-0.64	-0.61	-0.56	-0.65	-0.58	-0.53	-0.63
	(-53.93)	(-52.56)	(-48.20)	(-31.08)	(-37.34)	(-47.38)	(-30.18)	(-37.07)
GNP i	0.44	0.33	0.41	0.37	0.46	0.31	0.27	0.36
	(57.97)	(39.74)	(58.26)	(37.51)	(44.79)	(40.67)	(25.53)	(31.72)
GNP j	0.38	0.38	0.36	0.33	0.39	0.36	0.33	0.39
	(56.65)	(57.40)	(57.00)	(37.57)	(42.99)	(57.96)	(38.73)	(43.28)
Per capita GNP i	0.28	0.12	0.26	0.30	0.23	0.12	0.14	0.09
	(30.13)	(14.47)	(29.93)	(24.64)	(18.38)	(14.35)	(11.70)	(8.53)
Per capita GNP j	0.20	0.18	0.18	0.19	0.18	0.17	0.16	0.16
	(23.90)	(21.03)	(23.19)	(16.68)	(15.75)	(20.75)	(14.48)	(14.39)
Border Dummy[b]	0.62	0.59	0.53	0.61	0.46	0.52	0.59	0.44
	(8.92)	(8.76)	(8.29)	(6.25)	(5.43)	(8.22)	(6.24)	(5.32)
Complementarity		3.01				2.82	2.93	2.72
		(33.70)				(33.06)	(24.92)	(21.92)
RTA Dummies[c]								
APEC			2.46	2.26	2.64	2.39	2.20	2.55
			(28.99)	(17.71)	(23.95)	(30.09)	(18.43)	(24.80)
EU			1.46	1.53	1.36	1.07	1.07	1.03
			(25.11)	(16.85)	(18.36)	(19.08)	(12.28)	(14.41)
NAFTA			0.52[x]	0.77[x]	0.28[x]	0.29[x]	0.62[x]	-0.03[x]
			(1.55)	(1.57)	(0.61)	(0.98)	(1.45)	(-0.07)
MERCOSUR			0.97	1.01	0.93	0.93	0.95	0.90
			(4.43)	(3.41)	(3.03)	(4.45)	(3.55)	(2.96)
LAFTA			0.52	0.37	0.67	0.66	0.56	0.75
			(4.67)	(2.14)	(4.79)	(6.01)	(3.45)	(5.22)
ANDEAN PACT			0.27[x]	-0.05[x]	0.60	0.47	0.17[x]	0.78
			(1.22)	(-0.14)	(2.27)	(2.19)	(0.56)	(2.94)
ASEAN5			-0.08[x]	0.13[x]	-0.29[x]	-0.18[x]	0.04[x]	-0.39[x]
			(-0.28)	(0.31)	(-0.67)	(-0.64)	(0.09)	(-0.96)
Sample size	23,923	23,923	23,923	11,740	12,183	23,923	11,740	12,183
F-statistics	6,576	6,286	3,502	1,354	2,123	3,584	1,426	2,133
SSE	41,554	38,775	37,917	18,061	19,528	35,535	16,717	18,479
Adjusted R^2	0.623	0.648	0.660	0.600	0.694	0.677	0.630	0.710

Note:
a. Numbers in the parentheses are t-statistics.
b. This dummy takes the value of one when two countries share a border.
c. These dummies take the value of one when two countries are members of the same RTA.
x = Insignificant at the 5% significance level (t-value<1.645)

C. *FDI* and Intra-*APEC* Trade Transactions

Results from the world trade gravity model analyses reveal that an *RTA* dummy for *APEC* is the most significant among *RTA* dummies tested. An increase over time in the size and significance of the estimated coefficient attached to *APEC*

Table 9. Results for *APEC* Trade Gravity Models with *FDI*)

(Dependent variable is Export ij)

	1	2	3	4	5	6	7	8	9	10	11
Year	1984	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
Constant	-8.44	-6.03	-6.46	-6.77	-7.11	-7.25	-5.02	-5.22	-5.81	-5.94	-6.21
	(-4.65)[a]	(-3.34)	(-3.54)	(-4.19)	(-4.32)	(-4.27)	(-3.11)	(-3.17)	(-4.03)	(-4.00)	(-3.97)
Distance ij	-1.19	-1.03	-1.03	-0.87	-0.87	-0.93	-0.92	-0.93	-0.78	-0.78	-0.86
	(-7.84)	(-8.98)	(-8.92)	(-7.50)	(-7.50)	(-7.91)	(-7.55)	(-7.55)	(-6.43)	(-6.42)	(-7.05)
GNP i	0.22	0.25	0.23	0.21	0.19	0.19	0.19	0.18	0.16	0.15	0.15
	(4.01)	(5.11)	(4.84)	(4.61)	(4.36)	(4.25)	(4.67)	(4.58)	(4.11)	(4.05)	(3.92)
GNP j	0.28	0.26	0.27	0.18	0.19	0.23	0.25	0.25	0.18	0.18	0.23
	(4.76)	(5.23)	(5.48)	(4.20)	(4.48)	(5.15)	(4.97)	(5.07)	(4.04)	(4.12)	(4.95)
Per capita GNP i	0.76	0.51	0.45	0.57	0.52	0.44	0.36	0.35	0.43	0.42	0.34
	(8.20)	(7.25)	(5.85)	(8.71)	(7.18)	(6.58)	(4.51)	(4.18)	(5.61)	(5.33)	(4.38)
Per capita GNP j	0.69	0.50	0.50	0.31	0.31	0.39	0.42	0.43	0.26	0.26	0.35
	(7.09)	(6.87)	(6.84)	(4.26)	(4.30)	(5.47)	(6.09)	(6.05)	(3.57)	(3.57)	(5.05)
Border Dummy[b]	0.62	0.69	0.66	0.40[x]	0.39[x]	0.47[x]	0.67	0.66	0.40[x]	0.40[x]	0.49
	(1.71)	(2.02)	(1.93)	(1.21)	(1.14)	(1.37)	(2.31)	(2.26)	(1.41)	(1.38)	(1.65)
Complementarity							3.67	3.52	3.29	3.20	2.92
							(4.41)	(4.09)	(4.13)	(3.84)	(3.51)
FDI ij			0.22		0.18			0.08[x]		0.06[x]	
			(2.03)		(1.70)			(0.77)		(0.54)	
FDI ji				0.68	0.66				0.62	0.62	
				(7.02)	(6.98)				(7.00)	(7.03)	
FDI ij x FDI ji						0.40					0.32
						(4.84)					(3.99)
Sample size	238	240	240	240	240	240	240	240	240	240	240
F-statistics	41.07	43.33	38.05	46.19	41.01	44.41	44.26	38.70	46.63	41.34	43.14
SSE	642.08	460.19	453.30	406.80	402.33	416.11	416.95	416.05	372.39	371.98	390.42
Adjusted R^2	0.504	0.515	0.520	0.570	0.573	0.600	0.559	0.558	0.604	0.603	0.585

Note:

a. Numbers in the parentheses are t-statistics.

b. This dummy takes the value one when two countries share the border.

x = Insignificant at the 5% significance level (t-value<1.645)

shows that a standard gravity model tends to increasingly underestimate intra-*APEC* trade transactions. Given these findings and the positive correlations between intra-*APEC* trade and *FDI* flows, and between trade flows and trade complementarities detected in the earlier sections, this paper estimates gravity models for intra-*APEC* trade transactions with *FDI* as a financial gravity, again using (exporter-reported data on) exports as dependent variables. Variables are used in natural logarithms except for complementarity indices and dummies. Table 9 presents results from these cross-section (fixed-coefficient) estimations. White's estimator with heteroskedasticity-consistent standard errors and covariance is again used. *F* statistics indicate that all of the 8 estimated equation forms (4 models, pooled and two-period cross-section estimates) are significant at the 1% significance level.

All the estimated coefficients attached to standard gravity variables are significant at the 1% significance level and have intuitive signs in all variations of the estimated gravity model. Although the signs are still correct, statistical significance of the border dummies is much reduced in this estimation over the intra-

APEC trade transactions. The patterns of trade transactions presented in Table 4 show that, except for trade between Canada and the U.S., and between the U.S. and Mexico, the major action lies in transactions among the three growth poles of the world economy that preside over *APEC* and are separated by the Pacific Ocean (the United States, Japan, and developing East Asia).

In answer to the third question raised in Section V.A, results show that complementarity is a significant determinant of intra-*APEC* trade flows (significant at the 1% significance level). Significance seems to be reduced in the intra-*APEC* trade data set, though, as compared to the level observed under the world gravity model. Similarity factors seem to be working as well, in support of intra-industry trade among *APEC* members. With the various liberalization initiatives enacted or to be enacted under the *APEC* framework, the importance of comparative advantage is expected to rise in determining directions of intra-*APEC* trade transactions.

By examining estimation results both with and without complementarities (columns 3-11), one can say that inward *FDI* is a significant determinant of export directions (significant at the 1% significance level) in intra-*APEC* trade transactions in the first half of the 1990s (an answer to question 4). On the contrary, for the *APEC* member economies in the 1990s, outward *FDI* is not a significant factor in determining export directions. This finding also differs from that of Wei and Frankel (1997) that found, on average, positive and significant effects of the stock of *FDI* from the exporting country to the importer in the world's trade transactions. This reflects the fact that, on average, intra-*APEC FDI* activities are in their intermediate to mature stages in terms of the widely-observed *FDI*-related trade cycles. In the early stages of *FDI*, capital and intermediate goods flow from the investment donor country to the recipient country. In the later stage, however, the flows of final products back to the donor country (as well as to a third country) start to exceed the continuing flows of intermediate goods in the reverse direction.

As a result, a gravity model with complementarity and inward *FDI* (column 9) records the highest explanatory power in explaining variations in the directions of intra-*APEC* trade transactions in the early 1990s. The F test for choosing between nested and expanded models (models 2 and 9) produces the test statistic of F=27.27 that significantly exceeds the critical value of F(2, 231)=4.16 at the 1% significance level. Thus the estimation results prove the significance of trade complementarity and inward *FDI* in explaining the directions of trade flows in the *APEC* region.

VI. Conclusions

This paper first reviewed trends and developments in economic forces underlying trade integration such as the dynamism of output growth, financial flows, and trade complementarity. Given the vibrant Asian growth led by export expansion that was supported by inward foreign direct investment and dynamic patterns of integration within and among groups of economies in the *APEC* region, this paper examined the role of *FDI* as a financial gravity for trade and regional integration.

Profiting from the reduction in distortions in trade flows such as import tariffs and export redirections, supported by the dissipation of protective sentiment in the decade from the mid 1980s, trade started to flow more in line both with partners' import needs and with structures of export industries. Trade complementarity and its underlying structure of comparative advantage began to dictate the flows of international trade transactions, resulting in gains in the allocative efficiency of productive resources both domestically and globally. The paper re-examined the positive relations between trade complementarity and directions of trade flows in the world.

A standard trade gravity model was introduced and augmented by the additions of complementarity and dummies for regional trading arrangements in its application to the world's trade transactions. *RTAs* included are North-North (*EU*), North-South (*APEC*, *NAFTA*), and South-South (*MERCOSUR*, *LAFTA*, Andean Pact, *ASEAN5*) arrangements. Gravity models augmented by additions of complementarity and inward-*FDI* flows as gravity variables of emerging significance are applied to the intra-*APEC* directions of trade flows. The applied gravity model analyses are geared to address the following set of questions:

1) Is *APEC* more potent in the creation of intra-regional trade compared to the other *RTAs* ?
2) Are there any differences in the significance of *RTA* dummies among North-North, North-South, and South-South *RTAs* ?
3) Given the simultaneous expansion in vertical as well as horizontal trade, within *APEC* in particular, what can we say about the significance of comple-mentarity factors?
4) Does *FDI* create gravity that affects the direction of intra-*APEC* trade flows?

The results from the gravity analyses provide an affirmative answer to each one

of the postulated questions. The regional dummy attached to *APEC* in the world trade analysis is by far the most significant of all. This is an interesting finding given that *APEC* is not an *RTA* in the formal sense as it does not discriminate against non-members in tariff arrangements. Results show the strength of market forces of integration over and above a level for which traditional trade gravity factors can account. Regional dummies are much more significant in North-North and North-South *RTAs* compared to those for South-South *RTAs*. Trade complementarity turns out to be a significant determinant of the directions of trade, and its significance grew in the decade since the mid 1980s. Results from *APEC* trade gravity models prove that *FDI*, and inward *FDI* in particular, is a significant determinant of the directions of intra-*APEC* trade transactions, and thus the results demonstrate an importance of this financial gravity.

Notes

(1) The current paper deals with the period of continuous integration with trade liberalization and a surge in *FDI*. The issues related to volatile short-term financial flows and financial crises in the latter half of the 1990s are not included within the scope of this study.
'Developing East and South-East Asia' as a group corresponds to the 'East Asia and the Pacific' group in the *World Development Indicators*, World Bank.

(2) *FDI* flows in the *APEC* region have been rather robust even with the advent of the Asian financial crisis.

(3) The set of graphs in Figure 1, however, does not constitute a rigorous test for causality. The regions correspond to those in the *Global Economic Prospects and the Developing Countries*, World Bank.

(4) The indices are computed based on the United Nations/COMTRADE bilateral trade flow data at the *SITC* two-digit level. As Michaely (1994) stated, this index of trade complementarity may not be a reliable indicator of trade compatibility if the structure of trade is heavily distorted by trade barriers in the two partners. Furthermore, if a small country with a limited range of traded products can dispose of all its exports (under more favorable terms) in the larger partner country, it may still find free regional trade attractive even though the structure of its exports does not match very well that of its partnersí imports.

(5) See Notes on Data Sources and *FDI* Matrix.

(6) In the analyses of intra-*APEC* trade flows, the 16 member economies of *APEC* are individually represented (Table 7). Brunei and Papua New Guinea are not included due to insufficient data on foreign direct investment.
(7) For further theoretical arguments on the choice of models, readers should refer to Judge, Griffiths, Hill, Lutkepohl, and Lee (1985, p. 515).

Notes on Data Sources and *FDI* Matrix

(1) Exports: IMF, *Direction of Trade Statistics* Database.
(2) Distance: Gray L. Fitzpatrick and Marilyn J. Modlin (1986), *DIRECT-LINE DISTANCES*,
International Edition, The Scarecrow Press, Inc., Metuchen, N.J.
(3) GDP: World Bank (1997), *World Development Indicators 1997*.
Asian Development Bank (1996), *Key Indicators of Developing Asian and Pacific* Countries 1996.
(4) Per Capita GDP: World Bank (1997), *World Development Indicators 1997*.
(5) Complementarity Index: Computed from United Nations/COMTRADE Database.
(6) *FDI*: IMF, *Balance of Payments Statistics Yearbook*, various issues (net inward flows). Institute for International Trade and Investment, *Sekai Shuyokoku no Choku-setsu-Toshi-Tokeishu* (*Foreign Direct Investment by Major World Economies*), 1997.

As Otsubo *et al.* (1998b) notes, there are no consistent matrices for bilateral directions of *FDI* flows readily available. Their study describes differences between IMF statistics and country statistics, and provides *FDI* data descriptions for major Asian economies. The *FDI* matrix used in the current study is formed by first compiling *APEC*'s individual country's reporting of inward *FDI* (disbursed flows, stocks, contracted amounts, etc.), then computing sourcing distributions (shares) out of individual country statistics, and finally, applying computed distributional shares to the BOP-based aggregate net inward flows reported for each country in the IMF's Balance of Payments Statistics. For a greater stability of the matrix, 3-year averages (1992-94) were used in the computations.

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Appendix A. List of Countries included in the World Trade Gravity Model Analysis

No.	Country Name	Code	No.	Country Name	Code	No.	Country Name	Code
1	Angola	AGO	41	Gambia, The	GMB	81	Panama	PAN
2	Albania	ALB	42	Greece	GRC	82	Peru	PER
3	Argentina	ARG	43	Guatemala	GTM	83	Philippines	PHL
4	Australia	AUS	44	Guyana	GUY	84	Papua New Guinea	PNG
5	Austria	AUT	45	Hong Kong	HKG	85	Poland	POL
6	Burundi	BDI	46	Honduras	HND	86	Portugal	PRT
7	Benin	BEN	47	Haiti	HTI	87	Paraguay	PRY
8	Burkina Faso	BFA	48	Hungary	HUN	88	Romania	ROM
9	Bangladesh	BGD	49	Indonesia	IDN	89	Rwanda	RWA
10	Bulgaria	BGR	50	India	IND	90	Sudan	SDN
11	Belgium/Luxembourg	BLX	51	Ireland	IRL	91	Senegal	SEN
12	Bolivia	BOL	52	Iran, Islamic Rep.	IRN	92	Singapore	SGP
13	Brazil	BRA	53	Iraq	IRQ	93	Sierra Leone	SLE
14	Barbados	BRB	54	Iceland	ISL	94	El Salvador	SLV
15	Central African Republic	CAF	55	Israel	ISR	95	Suriname	SUR
16	Canada	CAN	56	Italy	ITA	96	Sweden	SWE
17	Switzerland	CHE	57	Jamaica	JAM	97	Syrian Arab Republic	SYR
18	Chile	CHL	58	Jordan	JOR	98	Taiwan	TWN
19	China	CHN	59	Japan	JPN	99	Togo	TGO
20	Cote d'Ivoire	CIV	60	Kenya	KEN	100	Thailand	THA
21	Cameroon	CMR	61	Korea, Rep.	KOR	101	Trinidad and Tobago	TTO
22	Congo	COG	62	Liberia	LBR	102	Tunisia	TUN
23	Colombia	COL	63	Sri Lanka	LKA	103	Turkey	TUR
24	Costa Rica	CRI	64	Morocco	MAR	104	Tanzania	TZA
25	Cyprus	CYP	65	Mexico	MEX	105	Uganda	UGA
26	Germany	DEU	66	Mali	MLI	106	Uruguay	URY
27	Denmark	DNK	67	Malta	MLT	107	United States	USA
28	Dominican Republic	DOM	68	Myanmar	MMR	108	Venezuela	VEN
29	Algeria	DZA	69	Mauritania	MRT	109	Vietnam	VNM
30	Ecuador	ECU	70	Mauritius	MUS	110	South Africa	ZAF
31	Egypt, Arab Rep.	EGY	71	Malawi	MWI	111	Zaire	ZAR
32	Spain	ESP	72	Malaysia	MYS	112	Zambia	ZMB
33	Ethiopia	ETH	73	Niger	NER	113	Zimbabwe	ZWE
34	Finland	FIN	74	Nigeria	NGA			
35	Fiji	FJI	75	Nicaragua	NIC			
36	France	FRA	76	Netherlands	NLD			
37	Gabon	GAB	77	Norway	NOR			
38	United Kingdom	GBR	78	Nepal	NPL			
39	Ghana	GHA	79	New Zealand	NZL			
40	Guinea	GIN	80	Pakistan	PAK			