

Trading Blocs in East Asia: Empirical Evidence from Gravity Model*

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ABSTRACT

In this paper we apply the gravity model to seek empirical evidence of trading blocs in East Asia for the era after 1980. Special attention is paid on the role of the openness of mainland China in shaping East Asia's trade pattern. Several trading blocs are empirically supported from the regression. (1) Firstly, there is significant evidence of a trading bloc within a Chinese circle, including Taiwan, Hong Kong, and mainland China. Although the trade flows between Taiwan and mainland China were severely suppressed before 1987, the Chinese circle as a whole is highly integrated in terms of trade, indicating the important role Hong Kong plays as a trading agent in the Chinese circle. (2) Empirical results from after 1990 show that mainland China's openness in trade after 1990 is still empirically supported. (3) On the contrary, East Asia as a whole is fostering a trading bloc in the empirical sense.

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1. Introduction

This paper studies the trading bloc in East Asia of Taiwan, Hong Kong, mainland China, South Korea, and Japan. More specifically, we apply the gravity model to investigate whether trade flows among the East Asian economies go beyond the ‘normal’ level implied by their corresponding *GDP* level, *GNP per capita*, geographical distance, and contiguous factors.

Studies using the gravity equation to analyze the globalization of trade or regionalism of trade are many in the literature. Eichengreen and Irwin (1995) apply the gravity equation to analyze the effect of trade blocs and currency blocs on trade flows during the period from 1928 up to the World War II. Trade blocs that were formed during the Great Depression in the late 1920s did not fade away along with the formation of GATT. On the contrary, regional trade arrangements, like preferential trade arrangements, free trade areas, and customs union, seem to have become even more popular in the recent decades.¹ Frankel (1992) applies the model to test whether a Yen bloc was fostered by the large volume of trade related with Japan in East Asia and Pacific Rim countries. Similarly, other related empirical studies include Frankel and Wei (1995) and Frankel et al (1995, 1996).

The trade pattern in East Asia is quite distinct from other regions. As we will discuss below, Japan and the U.S. have been playing an important role in the pattern of trade for Asian Pacific countries since the early 1960s. However, the openness of mainland China’s market in the early 1980s gave a considerable shock to the pattern, probably due to its huge market size which changed the direction of trade in East Asian countries, and/or its abundance of cheap labor that consistently attracts foreign capital. A brief overview on the trade flows in the last two or three decades gives us a rough impression that East Asia is to some extent an integrated production center that provides manufacturing goods to the U.S. or the ‘western’ market. The openness of mainland China in the early 1980s made this pattern even more significant. The purpose of this paper is to apply the gravity model to search for empirical support for such a view if it does exist.

The rest of this paper is organized as below. Section 2 briefly discusses the trade pattern in the East Asian countries, especially the so-call triangular trade

¹ See Grant et al (1993).

pattern.² In addition, the economic relations among the Chinese circle, namely Taiwan, Hong Kong, and mainland China will be addressed. In section 3 the gravity model will be discussed and applied to our study. The empirical strategy for exploring whether there is a bloc-phenomenon in the area's trade will be introduced here. Section 4 reports the empirical results and section 5 concludes the paper.

2. Trade Pattern in East Asia

2.1 Triangular Trade Pattern in EA

Ever since the World War II, the trade pattern in East Asia has been highly dominated by the United States and Japan. For the export side, the U.S. is the largest export market for the East Asian *NICs* including Taiwan, South Korea, Singapore, and Hong Kong. For the import side, the roles of the U.S. and Japan are reversed. Japan is the major source of imports for all the Asian countries. For geographical and/or some historical reasons, Taiwan, South Korea, and Japan are to some extent in a special contiguity, economically and culturally. Beginning in the late 1960s, to overcome increasing costs from a high wage rate, Japanese firms especially those in labor-intensive manufacturing sectors or production stages relocated their production to Taiwan and South Korea and even to other South East Asian countries. The direct investment from Japanese firms to Taiwan and South Korea contributed more trade flows between them, leading to a vertically-integrated production linkage between the economies. The other East Asian countries became the downstream producers of Japanese firms. As a result, Japan has been the major supplier of parts and components for manufacturing goods in other East Asian countries since the early 1960s. The trade relationship among the U.S., Japan, and other East Asian countries is thus usually called a 'triangular trade' pattern, unique to the Pacific Asian trade.

2.2 Role of Mainland China's Openness in the Early 1980s

An important event that may have changed Asian Pacific's triangular-trade pattern was the openness of mainland China to the world market in the early 1980s. With the advantage of lower wages than other East and South East Asian countries, the PRC became the most attractive new land for multinational firms, including not just those from the U.S. and Japan, but also from Taiwan and South Korea, once

² The triangular pattern of trade in East Asia refers to the phenomenon of importing parts and components from Japan to the other East Asian countries, which in turn export the final manufacturing goods to the U.S.

having been on the major receiving end of international capital. Consequently, the openness of mainland China's market not only enhances the trade relation among East Asian countries, but also dilutes to some extent the role of U.S. and Japan in the trade pattern of the area. Among the changes, the impact on the economic relationship among the Chinese circle, namely, Taiwan, Hong Kong, and mainland China is probably the most remarkable one.

In 1988 the PRC officially launched an announcement to attract investment from Taiwan. At the other side, Taiwan's government lifted Martial Law in 1987 and during the same year loosened the control over capital outflows. In 1990 the rule of 'Indirect Investment and Technical Cooperation in Mainland China' became effective, and thus Taiwanese investment through Hong Kong or another 3rd country in mainland China became legal. Cultural and ethical similarities across the Taiwan Strait facilitated the speed of economic integration among the three economies of Taiwan, Hong Kong, and mainland China. As a result, during the period of 1979 to 1992, the accumulated FDI in mainland China mostly came from East Asia, accounting for 71.41%, in which 9.27% was from Taiwan, 53.14% from Hong Kong, and 9.00% from Japan, while only 10.8% was from the United States.³ In the late 1990s, roughly one decade after its openness, the PRC became Taiwan's largest FDI target, inducing a great volume of flows in mostly parts and components of manufacturing goods from Taiwan to mainland China. As a result, mainland China surpassed the U.S. and became Taiwan's largest export market in 2001.⁴

Mainland China's FDI from Taiwan did not appear in the official record until 1987. One year later, the FDI in the PRC from Taiwan already surpassed that from Japan and the United States. The trend of growing FDI in mainland China from its neighbor countries has prevailed not only in the 1990s, but also into the 21st century. As a result, mainland China became one of the world's major producers for many labor-intensive products in the early 1990s and even for information technology (IT) products in the late 1990s. For example, in the 2002 mainland China became the 3rd largest supplier of IT products, of which 70% can be attributed to FDI by Taiwanese firms. This pattern of vertically-integrated production across the Taiwan Strait in the IT industry has induced an intensive relationship in the phase of commodity trade.

³ See The Year Books of Statistics on Foreign Investment and Trade, People's Republic of China, various years.

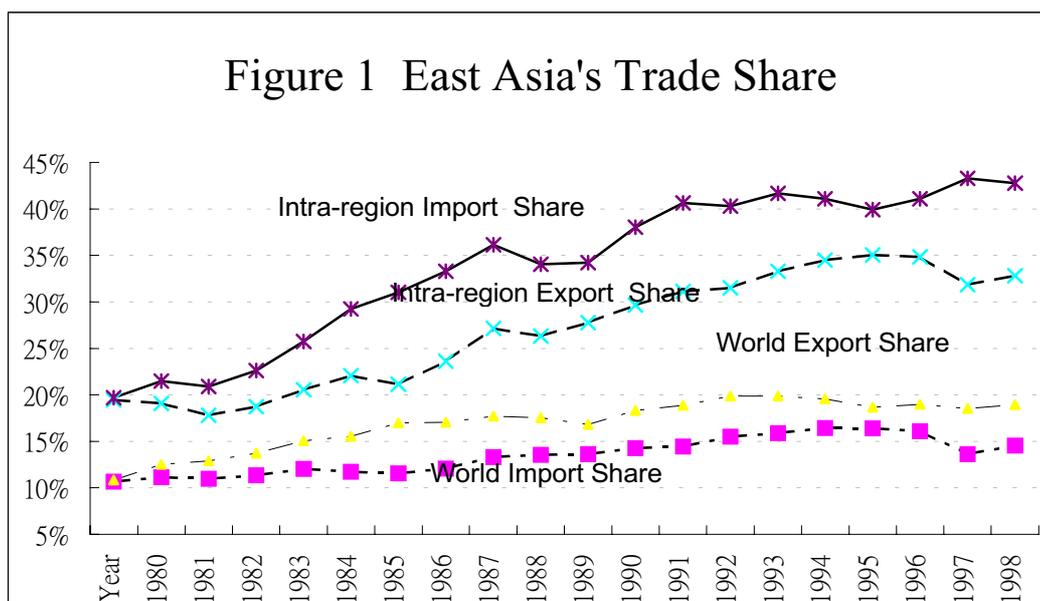
⁴ Related statistics are from *Taiwan Statistical Data Book* (various years.), published by the Council for Economic Planning and Development, Taiwan, R.O.C.

The joining of mainland China into the East Asian production linkage may have changed the relative position of the U.S. in the export markets for some individual countries, like Taiwan. However, for the East Asia economy as a whole, the U.S. is still the largest export market. In fact, there is a huge trade-deficit of the U.S. against mainland China after the late 1990s, and the huge deficit is still on the rising trend. That is, the joining of mainland China into the world trade system seems to have enlarged the production system in East Asia. As a result, the trade surplus of East Asia as a whole has not been reduced by the joining of mainland China into the production system. We will turn to this point in the following section.

2.3 Trade Share of the East Asia

In Figure 1, East Asia's share of the world's total exports and imports has risen steadily over the last two decades. A higher export share than import share over the years indicates a long lasting trade surplus for East Asia, disregarding the openness of mainland China in the early 1980s. Indeed, the trade surplus was expanding in the late 1980s and early 1990s.

As we can see from the figure, the export share exceeds 15% in 1984 and keeps rising to a peak of 20% in the early 1990s. The import share, although always smaller than the export share, has been rising over the same period and passes the level of 15% in 1992. Although the Asian Crisis in 1997 has made the import share decline, the ratio rebounded quickly the next year. All in all, East Asia has been a trade surplus area in the world since the 1980s. The trade status has not changed



despite the joining of mainland China with its huge domestic market.

The EA region on the other hand seems to be more vertically integrated in terms

of the production chain. In Figure 1 the intra-regional import (export) share is defined as the ratio of total imports (exports) from other countries in the same region to the region's total imports (exports). As shown in the figure, the intra-region import share is far greater than the intra-region export share in the last two decades. After 1991, more than 40% of EA's imports is intra-regional, much higher than the share of intra-regional export, which did not reach its peak of 35% not until 1996. The fact of a higher intra-regional import share than export share reflects the vertical relationship in the production process for the EA.

Another facet worth noting is that for the East Asian economies, not only is the share of intra-regional exports greater than its share of the world's total exports, but also the share of intra-regional imports is greater than its share of the world's total import value. This phenomenon intuitively reflects the existence of a 'trading bloc' for the EA as a whole. As noted earlier, we will apply the gravity model to conduct an empirical test, to which we now turn to.

3. The Gravity Model

3.1 Basic Model

Starting from Tinbergen (1962) and Linneman (1966), the gravity model has been shown to be empirically successful in explaining the bilateral trade flows.⁵ The theoretical foundation of the gravity model can be found in Anderson (1979), Bergstrand (1985), and Feenstra et al (2001). The traditional gravity equation usually takes the following log-linear form:⁶

$$\log(VOT_{ij}) = \alpha + \beta_1 \log(GDP_i \cdot GDP_j) + \beta_2 \log(GNPPC_i \cdot GNPPC_j) + \gamma_3 \log(DIST_{ij}) + \sum_k \delta_k CNTG_k + \sum_l \eta_l RGN_l + u_{ij}$$

where VOT_{ij} denotes the volume of trade between country i and j , GDP_i is the gross national product of country i , $GNPPC_i$ is GNP per capita of i , and $DIST_{ij}$ is the transport distance between i and j . In addition, $CNTG_k$ is a contiguity dummy, which is defined as follows: If both i and j are of the k cluster (for example, common language or cultural background), then $CNTG_k = 1$, otherwise $CNTG_k = 0$.

⁵ See Deardorff (1984) for a survey.

⁶ See Frankel (1992), Feenstra et al. (2001) and references therein.

The term RGN_l is a region dummy, which is defined as $RGN_l = 1$, if both i and j belong to the same region of l . Otherwise, $RGN_l = 0$. Obviously, u_{ij} denotes an error term.

For convenience we redefine the log variables as $LVOT_{ij} \equiv \log(VOT_{ij})$. The above equation can then be rewritten as follows:

$$LVOT_{ij} = \alpha + \beta_1 LGDP_{ij} + \beta_2 LGNPPC_{ij} + \gamma_3 LDIST_{ij} + \sum_k \delta_k CNTG_k + \sum_l \eta_l RGN_l + u_{ij} \quad (1)$$

Except for the regional dummy variables, the other three groups of factors determine the basic gravity model. That is, bilateral trade flows between countries are in principle determined by the following three kinds of factors: (1) gross domestic products and GNP per capita, (2) transport distance, and (3) contiguity factors. Among the three, the first category denotes economic variables. They reflect the trade needs arising from economic incentives, as discussed in the conventional trade theory. Normally, a greater GDP and national income would induce a larger demand for foreign goods and thus lead to more trade flows between the countries. That is, theoretically we would expect a positive relationship between volume of trade and the two variables of $LGDP_{ij}$ and $LGNPPC_{ij}$, i.e., $\beta_1 > 0$, $\beta_2 > 0$. Intuitively, a positive coefficient of $LGDP_{ij}$ also indicates a positive relationship between market size and volume of trade. A positive coefficient of the variable $LGNPPC_{ij}$ also reflects a positive marginal import propensity as indicated by the trade theory. It also represents the income similarity argument in the new-trade theory of the 1980s. That is, the higher the degree is of income similarity between countries, the greater the intra-industry trade will be.⁷

Transport distance is a natural barrier of trade as a longer distance represents more transaction costs required. Thus, we expect a negative impact of $LDIST_{ij}$ on bilateral volume of trade, i.e., $\gamma_3 < 0$. The contiguity variable, $CNTG_k$, captures the effect of other indirect transaction costs. For example, trade partners sharing a common cultural background or same language tend to have lower transaction costs. In this case the estimated coefficient is expected to be positive.⁸ On the contrary, for

⁷ This is also called Linder's Hypothesis. According to the related literature, the causes of intra-industry trade include economies of scale, heterogeneity of commodity, income similarity and multinational firms, and the degree of economic developments. See Chow et al (1994) and Greenaway and Milner (1986) for a discussion. See also Feenstra et al (2001).

⁸ From Rauch (1999)'s gravity equation estimation, trade flows attributed from a common language and colonial relationship are greater than those induced by product differences. Applying the same approach on the trade blocs in the 1930s, Eichengreen and Irwin (1995,1996) also find empirical

those common features that disturb any trade possibility, we would expect a negative coefficient.

The region dummy *RGN* captures other factors, to be designed later to suit our purpose of seeking evidence of a trading bloc. For example, the harsh political relationship across the Taiwan Strait has enlarged the trading cost between the two economies of Taiwan and mainland China. Thus, one would expect a below average level of trade flows between them. On the contrary, FDI has encouraged higher trade flows, because of the required intra-firm trade in intermediate products.

3.2 Data

To estimate the gravity equation we need the basic data as bilateral trade flows, GDP, GNP per capita, and the transport distance between countries. Our sample covers the years of 1980, 1985, 1990, 1995, 1998, and 2000, simply due to the consideration of the two critical years 1987 and 1997. The year 1987 was a turning point for East Asia, especially for the Chinese area, when Taiwan's government officially lifted martial law, deregulated capital controls, and allowed more economic activities with mainland China. At the same time, mainland China's open policies began to be effective. The year 1997 refers to the Asian Crisis and some structural change may occur after this event. The trade flows are extracted from the World Trade Database of Statistics Canada. The database is derived from United Nations COMTRADE data, while *GDP*, *GNP*, and population data are from the World Development Indicators, published by the World Bank.

The sample should ideally cover all the countries in the world. However, due to the availability constraints, some countries' data may not be available. This makes the sample size differ across years. The transport distance is basically the sum of sea and inland routes. For the sea route, the distance between major ports is calculated. However, if more than one port is the case, then the average distances of all the navigation routes is adopted. The inland transport distance is measured between the ports and the capital, and an average distance is taken if necessary.

3.3 Empirical Strategy

As mentioned before, a basic model for the gravity equation should include the economic variables of *GDP*, *GNP per capita*, distance, and other contiguous variables.

support for the effects of historical and colonial relationships on trade flows.

To seek whether there are plausible trading blocs in East Asia, the following empirical strategy will be taken. Firstly, in addition to the above-mentioned variables in the gravity equation, we include the regional dummies of EU, NAFTA, and ASEAN. It should be noted that the countries that are included in a dummy variable are the same for all the sampling years, even before the regional agreement became effective.

Model 1 will focus only on the trading bloc of the Chinese circle, including Taiwan, Hong Kong, and mainland China. It is believed that the trade across the Taiwan Strait was far below normal before the early 1980s, when mainland China's 'open' policy was in its infant stage, and for the Taiwan side capital flows were still under rigid regulation and direct trade with mainland China was still prohibited. As a result, Hong Kong played the role of transferring trade across the Strait. Two regional dummies, *CnT* and *CHT* (to be explained later) will be designed to find the empirical evidences.

In the 3rd step, Model 2 extends the model to include more other East Asian related dummies, especially considering the role of mainland China, South Korea, and Japan in the EA group. Finally, Model 3 considers additional dummies reflecting trade intensities within the EA region and the intensity between the EA region and the rest of the world. (The latter one is called the openness dummy for EA, as defined by Frankel et al. 1996.)

In all the models the ridge regression approach is adopted, by that we are able to screen out variables that explain most of the trade relation. Pragmatically, a stepwise approach is adopted during the estimation. That is, we add in the regional dummies into regression one after another and keep only those having an explanation power higher than the 15% as usual.

4. Empirical Results

4.1 Model 1: Trading Blocs in the Chinese Circle

To find plausible trading bloc in East Asia, we begin with a simple model, considering only the Chinese economies of Taiwan, Hong Kong, and mainland China. More specifically, we consider the two regional dummies: *CnT* (mainland China and Taiwan) and *CHT* (mainland China, Hong Kong, and Taiwan.). A regional dummy is defined as below: It takes a value of one if both the exporting and importing countries belong to the corresponding region, otherwise it takes zero. Taking *CHT* as example, if the exporting country is one of the three economies (mainland China,

Hong Kong, and Taiwan.) and so is the importing country, then the dummy CHT equals 1, otherwise CHT equals 0. Similarly, the dummy CnT takes one if the observation is between mainland China and Taiwan. As is normal for gravity models, we have the basic results from Table 1, including a significantly positive effect of $LGDP_{ij}$ and $LGNPPC_{ij}$, and a negative effect of the distance, $LDIST_{ij}$, on bilateral trade volume.⁹

As can be seen from Table 1, bilateral trade between mainland China and Taiwan was far below the average level before the mid-1980s, as indicated by the negative coefficient of the dummy CnT in 1980 and 1985. However, the trade flow moved up to normal level during the 1990s, as indicated by the results from 1990, 1995, 1998, and 2000. Here the coefficients are not significant and thus are excluded during the Ridge regression process. On the contrary, the estimated coefficients for dummy CHT are significantly positive for all the years. It represents highly intensive trade for the three economies of mainland China, Hong Kong, and Taiwan, even in the year 1980 and 1985 when bilateral trade between Taiwan and the PRC was politically discouraged to a great extent. This finding implies the role of Hong Kong in making a successful ‘indirect’ trade across the Strait.

These results represent a more and more integrated economic relation in the great Chinese circle. The reasons for this pattern change are many, including i) the open policies adopted in mainland China beginning in the early 1980s, ii) Taiwan government’s removal of the Martial Law in 1987. As a result, entrepreneurs earned more freedom to conduct their cross-strait business and thus induced more trade flows between Taiwan and mainland China either directly or indirectly through Hong Kong.

⁹ Another contiguity variable, representing common language, is also considered during the regression and a positive coefficient is found. There is not a significant change in the results, no matter whether the common language dummy is included or not.

Table 1: Ridge Regressions including Chinese Area (China, HK and Taiwan)

Dependent Variable: <i>Log(Volume of Trade)</i>						
Exp. Vars.	1980	1985	1990	1995	1998	2000
Lgdp12	0.28631 (0.01270)	0.22209 (0.01285)	0.21577 (0.01240)	0.12033 (0.00993)	0.16644 (0.00892)	0.12974 (0.00885)
Lgnppc12	0.33110 (0.02821)	0.39120 (0.02808)	0.43227 (0.02796)	0.33915 (0.02360)	0.23734 (0.02198)	0.34166 (0.02182)
Ldist	-1.27065 (0.05094)	-1.02829 (0.04956)	-1.03483 (0.04691)	-0.29461 (0.02950)	-0.32408 (0.02537)	-0.29800 (0.02561)
CnT	-16.11271 (4.54839)	-16.65562 (4.72732)	-	-	-	-
CHT	4.05303 (2.62839)	4.78260 (2.73268)	4.31567 (2.11104)	6.90691 (2.08699)	6.31641 (1.92845)	6.46064 (1.91692)
NAFTA	4.24925 (2.14707)	4.94639 (2.23201)	4.65013 (2.10937)	6.99497 (2.08605)	6.73978 (1.92776)	6.80560 (1.91630)
EU	2.17153 (0.40928)	2.96838 (0.42534)	2.51261 (0.40717)	4.30050 (0.39392)	4.19198 (0.36350)	3.95386 (0.36135)
ASEAN	3.61995 (1.17763)	2.34729 (1.11971)	-	3.47107 (0.81168)	3.22878 (0.64589)	3.38296 (0.64191)
N	4810	5244	5181	6335	6705	6315
R ²	0.8385	0.8104	0.8471	0.8517	0.8791	0.8830
F Value	3116.21	2797.10	4778.27	5192.69	6958.03	6802.18

Notes: (1) Number in parenthesis is standard error. (2) Ridge regression is applied to the models and all variables left in the model are significant at the 0.1500 level.

4.2 Model 2: Role of a Japan, South Korea, and Mainland China in EA's Trade

In the second experiment, we consider the trade relationship of a particular country within EA. Take Japan as an example. The regional dummy to tackle the role of Japan's trade in East Asia is *EAnJPN*, which takes a value one if the observation is between Japan and other East Asian economies, otherwise zero. Similarly, *EAnKOR* is the dummy for South Korea and other EA nations. A similar notation system applies to *EAnTWN* for Taiwan and *EAnCHN* for mainland China. The results are reported in Table 2.

In addition to the findings in the last model, several results regarding *EA* trade, especially the role of Japan, South Korea, and mainland China are summarized as below:

1. Although trade flows within the Chinese circle are quite intensive (reflected by a significantly positive coefficient of *CHT*), mainland China's trade with EA as a whole and with the rest of the world is below the normal level, as indicated by the negative coefficients of *EAnCHN* in 1980 and *CHN* (the openness dummy for mainland China) in 1985. In the 1990s, the openness of mainland China finally led to its high trade intensity (indicated by significantly positive coefficients for the dummy *CHN* in 1990, 1995, 1998, and 2000.)
2. Japan performs at an above 'normal' trade intensity with other East Asian countries, including mainland China, Taiwan, Hong Kong, and South Korea, as indicated by the positive coefficients of *EAnJPN* for all the sample years.
3. South Korea's trade with its neighboring countries in East Asia appears to be at a normal level for the years 1980, 1985, and 1990, as reflected by the insignificant coefficient for dummy *EAnKOR*. However, the trade intensity of South Korea with EA becomes higher than average in 1995, 1998, and 2000's estimations.

[Insert Table 2 here]

Table 2: Regressions including Japan and Korea in EA Blocs

Dependent Variable: Lvot

Exp. Vars.	1980	1985	1990	1995	1998	2000
Lgdp12	0.28592 (0.01272)	0.22464 (0.01301)	0.19596 (0.01251)	0.10191 (0.01002)	0.15019 (0.00901)	0.11097 (0.00889)
Lgnppc12	0.32968 (0.02821)	0.37872 (0.02871)	0.48799 (0.02852)	0.37842 (0.02379)	0.27255 (0.02217)	0.38185 (0.02188)
Ldist	-1.26614 (0.05101)	-1.0186 (0.04963)	-1.03294 (0.04657)	-0.27157 (0.02936)	-0.30453 (0.02526)	-0.27512 (0.02540)
CnT	-13.94694 (4.711)	-16.29241 (4.72633)	-	-	-	-
CHT	6.22841 (2.90218)	5.1683 (2.73577)	-	4.85605 (2.08163)	4.54414 (1.92429)	4.21072 (1.90564)
EAnCHN	-4.32694 (2.47619)	-	-	-	-	-
CHN	-	-0.76357 (0.36458)	2.98594 (0.34435)	3.31016 (0.35011)	2.85467 (0.31142)	3.60720 (0.31723)
EAnJPN	5.33055 (1.9586)	5.04623 (1.93494)	3.65554 (1.81725)	4.66476 (1.85171)	4.33995 (1.71235)	4.25013 (1.69529)
EAnKOR	-	-	-	3.92432 (1.85157)	3.78355 (1.71219)	3.81913 (1.69514)
NAFTA	4.26229 (2.14568)	4.96205 (2.23017)	4.69501 (2.09411)	7.11095 (2.06898)	6.83292 (1.91354)	6.91325 (1.89443)
EU	2.18617 (0.40908)	2.99435 (0.42508)	2.46975 (0.40429)	4.33816 (0.39076)	4.22036 (0.36087)	3.99765 (0.35729)
ASEAN	3.62651 (1.17688)	2.34681 (1.11885)	-	3.63831 (0.80519)	3.38331 (0.64131)	3.56031 (0.63475)
N	4810	5244	5181	6335	6705	6315
R ²	0.8388	0.8108	0.8493	0.8542	0.8809	0.8857
F Value	2497.07	2242.49	4166.55	3706.03	4953.68	4887.21

Note: Note: Same as Table 1.

4.3 Model 3: Regressions including the EA Bloc

In addition to the regional dummies included in the last two models, we consider the regional dummy for EA as a whole, and the openness dummy of East Asia (*EAnROW*, i.e., *EA* and the rest of the world). The major findings, as compared with the results from Model 2, are as follows:

1. The Chinese circle as a trading bloc is reconfirmed for the years 1980 and 1985; that is, highly-suppressed trade between mainland China and Taiwan (negative *CnT*) is accompanied with intensive indirect trade through Hong Kong (positive *CHT* and *CHTnCHN* — defined as the region dummy between the group of *CHT* and mainland China). Mainland China's openness in terms of trade is far below the average (negative *CHT*).
2. The Chinese circle performs 'normal' in the intra-regional trade for the 1990s (insignificant *CHT* in 1990 and after).
3. Japan in the EA region appears to have strong trade intensity in 1980 and 1985, but not in other years (significantly positive *EAnJPN* in 1980 and 1985).
4. The openness of mainland China after 1990 is still empirically supported (positive *CHN*). As a complement, there is an above average performance of intra-region trade for East Asia as a whole during the same period (significantly positive *EA* after 1990.)
5. A declining coefficient of the openness dummy for East Asia (*EAnROW*) seems to imply a plausible trend for the *EA* trading bloc. This view earns further support from the finding in 4.

Table 3: Regressions including all EA Blocs

Dependent Variable: Lvot

	1980	1985	1990	1995	1998	2000
Lgdp12	0.27544 (0.01284)	0.22793 (0.01276)	0.20791 (0.01244)	0.10816 (0.00996)	0.15488 (0.00894)	0.11564 (0.00883)
Lgnppc12	0.33277 (0.02851)	0.37457 (0.02818)	0.45319 (0.02837)	0.34423 (0.02383)	0.24365 (0.02213)	0.35369 (0.02191)
Ldist	-1.24108 (0.05022)	-1.05988 (0.04874)	-1.05918 (0.04631)	-0.26067 (0.02914)	-0.29419 (0.02506)	-0.26467 (0.02524)
CnT	-15.05147 (4.46732)	-18.17069 (5.35120)	-	-	-	-
CHT	5.38975 (2.58646)	-	-	-	-	-
CHTnCHN	-	9.51885 (3.80514)	-	-	-	-
EAnCHN	-	-	-	-	-	-
CHN	-2.02881 (0.39608)	-3.13142 (0.39451)	1.10488 (0.38027)	1.57201 (0.38589)	1.21932 (0.34223)	2.14686 (0.34873)
CHTnTWN	-	-	-	-	-	-
EAnTWN	-	-	-	-	-	-
EAnJPN	5.08170 (1.82847)	5.81925 (1.89934)	-	-	-	-
EAnKOR	-	-	-	-	-	-
EA	-	-	3.78085 (1.15003)	6.04391 (1.13855)	5.71819 (1.05094)	5.49590 (1.04301)
EAnROW	2.49491 (0.18524)	2.65050 (0.18567)	1.94987 (0.17826)	1.81943 (0.17879)	1.72792 (0.15845)	1.54074 (0.16089)
NAFTA	4.59026 (2.10726)	5.15930 (2.18829)	4.87337 (2.07012)	7.32534 (2.05210)	7.04591 (1.89662)	7.12066 (1.88069)
EU	2.49588 (0.40239)	3.18238 (0.41728)	2.68984 (0.40025)	4.61353 (0.38849)	4.47649 (0.35843)	4.23586 (0.35554)
ASEAN	3.90600 (1.15609)	2.52368 (1.09789)	-	3.76470 (0.79868)	3.48309 (0.63567)	3.65735 (0.63018)
N	4810	5244	5181	6335	6705	6315
R ²	0.8445	0.8178	0.8528	0.8566	0.8830	0.8874
F Value	2370.20	2135.99	3746.29	4197.84	5616.68	5520.83

Note: Same as Table 1.

5. Concluding Remarks

In this paper the gravity model has been applied to the years 1980, 1985, 1990, 1995, 1998, and 2000 to find empirical evidence of a trading bloc in the East Asia made up of mainland China, Taiwan, Hong Kong, Japan, and South Korea.

The standard results for the gravity model, such as positive effects of *GDP* and *GNP per capita*, and a negative effect of transport distance on the volume of bilateral trade, are confirmed. In addition, major findings regarding the plausible trading bloc in East Asia are as below:

The Chinese circle of Taiwan, Hong Kong, and mainland China as a trading bloc is empirically supported for the years 1980 and 1985. More specifically, there has occurred highly-suppressed trade between mainland China and Taiwan, accompanied by intensive indirect trade through Hong Kong. Mainland China's openness in terms of trade has been far below the average during the same period before the critical year of 1987.

After 1990, the Chinese trading bloc may or may not be significant, depending on whether the EA bloc as a whole is considered in the regression. Including the *EA* bloc in the regression produces evidence of a trading bloc for East Asia as a whole, while the bloc of the Chinese circle becomes insignificant.

Like the Chinese circle, Japan in the East Asian region appears to have a strong trade intensity for all the sample years, if the regional dummy for EA is excluded. Including the EA dummy in the model makes trade intensity between Japan and EA insignificant in the years after 1990. The openness of mainland China after 1990 is still empirically supported. As a complement, there is an above average performance of intra-region trade for East Asia as a whole during the same period. These results to some extent imply the existence of a trading bloc in East Asia whereas mainland China's openness has become really effective after the 1990s.

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