Trade Potential between Mainland China and Taiwan

Xinpeng Xu and Yu Sheng

September 22, 2009

Abstract

We examine the value and pattern of trade across the Taiwan Strait if trade restriction is removed. To this end, we use a gravity equation model to estimate trade potential between Mainland China and Taiwan, given the conventional determinants of trade. Our results suggest that given their sizes, the stages of their economic development, bilateral distance as well as other characteristics, Taiwan's imports from Mainland China should be more than double that of the current value if Taiwan can import freely from Mainland China, as other East Asian economies do. Interestingly, Taiwan's actual exports outperforms what the model predicts, suggesting that Mainland market is more open to Taiwan than Taiwan's market to Mainland.

JEL Classifications: F17, O53.

Keywords*: Trade flows; Gravity equation; Taiwan Strait; Mainland China.*

Paper prepared for the PAFTAD Conference, Taipei, 5-8 Oct 2009. Correspondence address: Xinpeng Xu, Faculty of Business, The Hong Kong Polytechnic University, Hong Kong. Email: *afxxu@polyu.edu.hk*; Yu Sheng, The Australian National University, Australia.

Trade Potential between Mainland China and Taiwan

1. **Introduction**

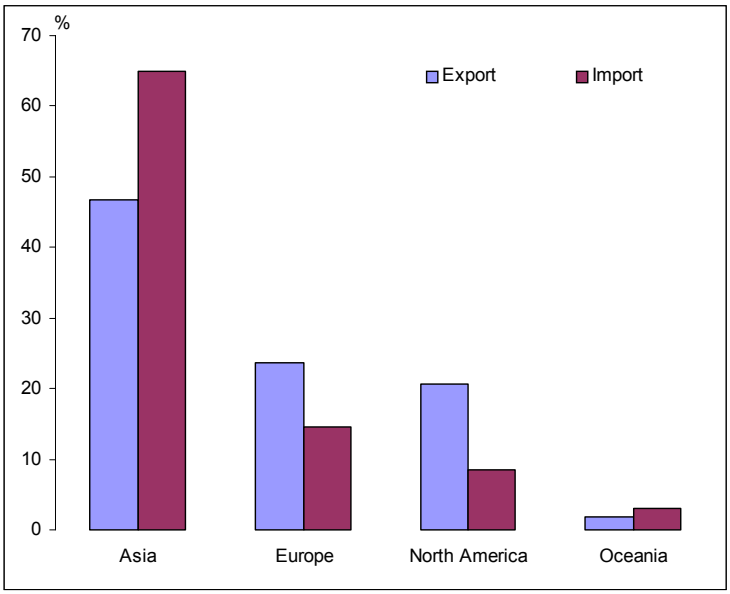
An important feature of Asia's trade pattern is its increasing intra-regional trade. According to the World Trade Organization (WTO),[1] intra-regional merchandise trade in Asia accounts for almost half (49.7%) of Asia's total exports in 2007 while Asia's exports to North America and Europe accounts for 19.9 percent and 18.8 percent respectively. More importantly, trade within Asia has experienced a significant shift from traditional inter-industry trade to intra-industry trade in finished goods, and more recently, to intra-industry trade in parts and components, in particular in "machinery and transport equipment" industries where a large number of multi-layered vertical production process is involved. China's trade pattern mirrors that of Asia. As shown in Figure 1, exports to Asia accounts for nearly half of China's total exports. In contrast, China's exports to the United State and Europe accounts for about 20 percent of its total exports respectively. China's imports from Asia represent an even bigger share of its total imports (about 65 percent), suggesting China has engaged intensively in intra-industry trade in parts and components with economies in the Asian region while exporting finished goods to markets in the developed West.

This changing trade pattern in Asia in general and, China in particular, reflects changes in the nature of international production from traditional pattern of producing a good "all under one roof in one country" to production 'fragmentation' where the whole production process is carried out in a dispersed manner across multiple economies. Stories of production 'fragmentation' abound. For example, to meet an order for 10,000 shirts from a retailer in the United States, a trading company will source for the yarn required for making shirts, which may be a factory in South Korea. It may then decide to do the dying and the weaving to make the fabric in two

[1] http://www.wto.org/english/res_e/statis_e/its2008_e/its08_world_trade_dev_e.htm

factories in Taiwan. Finally, the cutting, making and trimming may be done in Thailand for labor, capacity and skill reasons (Fung 2005). The story of making iPod is now well-known. Who makes the Apple iPod? It is not Apple (Varian 2007). The 451 parts that go into iPod is made in many countries, most of them Asia. iPod's hard drive is manufactured by Toshiba in the Philippines and China. Its display module, video/multimedia processor chip and the controller chip are made in Taiwan while the final assembly is done in China.

Figure 1 Mainland China's Trade Profile: 2007



Source: China Customs' Statistics.
Note: "North America" refers to the United States and Canada; "Oceania" refers to Australia and New Zealand.

The formation of production fragmentation network within Asia has led to new international division of labor. East Asia economies are now integrating more tightly than ever and there is a growing trend of trade liberalization within the region. Against this backdrop of growing economic integration among Asian economies, restrictions on trade across the Taiwan Strait have received increasing attention. The Cross-strait Economic Cooperation Framework Agreement (hereafter ECFA) has recently been put forward with an aim to "normalize" trade

relationship between Mainland China and Taiwan. In this paper, we seek to examine what the trade potential will be across the Taiwan Strait if not for political consideration. This issue is important because trade across the Straits has not been "normal", with many restrictions imposed on the importation of goods from Mainland China. This "abnormal' trade relationship across the Taiwan Strait has implications for both Taiwan and Mainland China as it greatly restricts Taiwan's participation in the 'division of labor' in East Asia.

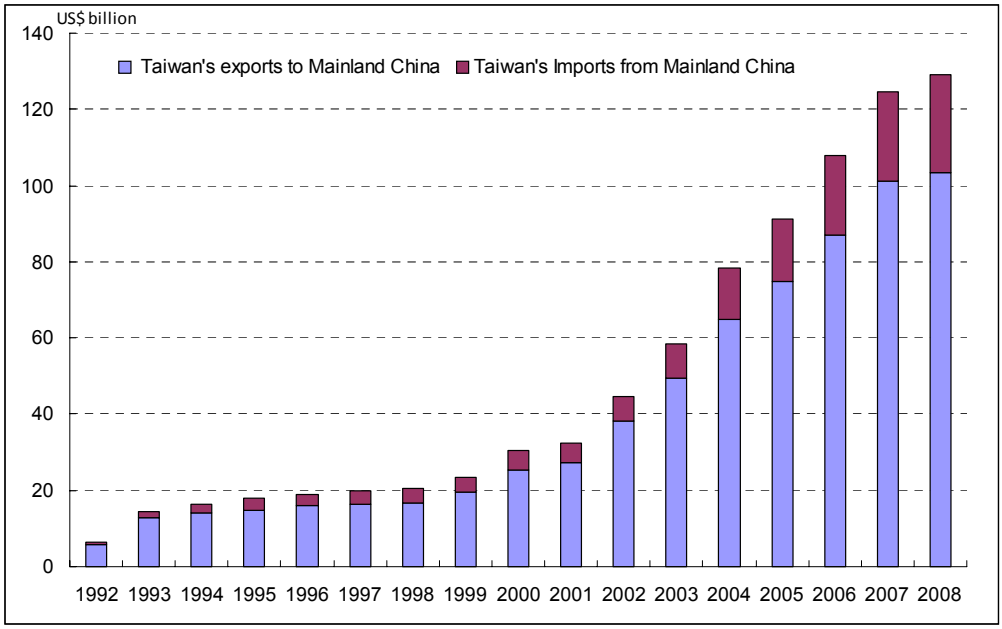
We use a standard gravity equation approach in our preliminary investigation. Gravity equation modeling is appropriate in examining the issue as it can be justified by a variety of theories, including monopolistic competition (Helpman and Krugman, 1985) and a Heckscher–Ohlin model with specialization (Anderson, 1979; Deardorff, 1998; Anderson and van Wincoop, 2003). It has been used to analyze empirically the effects of regional trade blocs (see Frankel et al., 1997 among others), currency unions (Rose, 2000), WTO membership (Rose, 2004, Subramanian and Wei, 2007). We note that there may be limitations of gravity equation, in particular in capturing bilateral trade arising from intra-firms' trade or intra-industry trade in parts and components. However, we see our exercise as the first step in understanding the potential trade across the Taiwan Strait.

The paper is organized as follows. The next section provides an overview of trade between Mainland China and Taiwan. In section 3, we attempt to estimate the trade potential across the Taiwan Strait, using a standard gravity modeling technique. We ask what the trade between Mainland China and Taiwan will be like based on conventional variables that have been documented to be reliable determinants of trade flows. The value of potential trade is then predicted and discussed. The final section provides concluding remarks.

2. **Trade across the Strait**

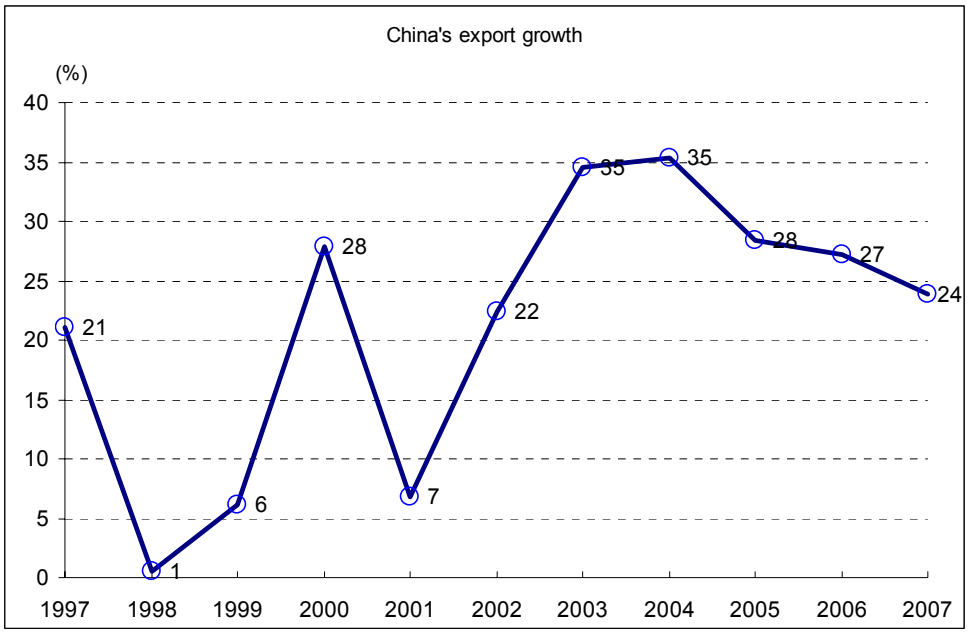
As shown in Figure 2, trade between Mainland China and Taiwan has increased substantially in the past decade, from less than US$ 20 billion in 1997 to US$ 129 billion, with average annual growth rate of nearly 20 percent. Mainland China has become Taiwan's biggest export market in 2008, accounting for 28.9 percent of Taiwan's total exports (UNCTAD 2009). Trade with Mainland China accounts for about one-fifth of Taiwan's total foreign trade (Table 1). The rapid growth of cross-trade occurs when Mainland China experienced phenomenal growth of exports (and imports) after its entry into the World Trade Organization (WTO) in 2001 (see Figure 3).

Figure 2 Trade across the Taiwan Strait: 1992-2008



Source: Data are from UNCTAD (code: 490).

Figure 3 China's Export Growth: 1997-2007



Source: China Customs Statistics.

In terms of trade structure, inter-industry trade has been the dominant feature of bilateral trade between Mainland China and Taiwan, yet intra-industry trade has growing in importance. As shown in Table 2, in the early 2000, the share of intra-industry trade accounts for about 30 percent of total bilateral trade. In 2008, it accounts for 39 percent. The increasing intra-industry trade reflects the fact that Mainland China has been actively involved in the international division of labor, in particular within East Asia after China's entry to WTO. As production fragmentation deepens, East Asian economies as a group are more strongly dependent on fragmentation-based trade than any other region in the world. In 2004, components accounted for 33.5 per cent of the total manufacturing export of East Asian countries, especially Malaysia, the Philippine, Singapore and Thailand, while only 20.9 per cent for EU, and 30.7 per cent for NAFTA countries (Athukorala and Nobuaki 2006). Trade in "machinery and transport equipment" industries accounts for 46.5 percent of total bilateral trade between Mainland China

and Taiwan in 2008, suggesting that trading in parts and components is important (UNCTAD 2009).

Table 1 Share of Cross-Strait Trade in Total Trade (%)

	1985	1990	1995	2000	2005	2008
Mainland China						
Exports to Taiwan	0.4	1.2	2.1	2.5	2.6	2.2
Imports from Taiwan	2.3	8.2	14.7	11.1	8.5	6.5
Share of Total	1.6	4.5	8.0	6.6	5.4	4.1
Taiwan						
Exports to Mainland	3.2	6.5	17.2	16.5	28.4	28.9
Imports from Mainland	0.6	1.4	3.0	4.4	11.0	13.1
Share of Total	2.2	4.2	10.4	10.7	20.0	21.2

Source: Cross-Strait Economic Statistics Monthly (No. 196), Mainland Affairs Council, Taiwan.

Table 2 Trade Flows and Trade Pattern across the Taiwan Strait: 1992-2008 (unit: million US dollars, current price)

Year	Total Trade Flows	Taiwan's export to Mainland China	Taiwan's Import from Mainland China	Inter-industry Trade	Intra-industry Trade	IIT share (%)
1992	6,560	5,866	695	5,380	1,180	18
1993	14,400	12,932	1,469	11,600	2,800	19
1994	16,300	14,086	2,247	12,200	4,100	25
1995	17,900	14,784	3,098	12,100	5,800	32
1996	19,000	16,180	2,802	13,800	5,200	27
1997	19,800	16,441	3,399	13,600	6,200	31
1998	20,500	16,631	3,869	13,200	7,300	36
1999	23,500	19,527	3,950	15,900	7,600	32
2000	30,500	25,494	5,039	20,800	9,700	32
2001	32,300	27,339	5,001	23,000	9,300	29
2002	44,600	38,061	6,586	32,100	12,500	28
2003	58,400	49,361	9,004	40,900	17,500	30
2004	78,300	64,759	13,545	51,800	26,500	34
2005	91,200	74,680	16,550	59,000	32,200	35
2006	108,000	87,099	20,733	67,000	41,000	38
2007	124,000	101,027	23,460	78,400	45,600	37
2008	129,000	103,307	25,883	78,400	50,600	39

Source: Data are from UNCTAD (code: 490). Inter-industry trade is calculated as the Sum of (X(i) -M(i)) where X(i) and M(i) are exports and imports of good i respectively, while inter-industry trade is calculated as the sum of (X(i)+M(i))-sum(X(i)-M(i))), both at the two-digit level of HS.

However, trade between Mainland China and Taiwan has been asymmetric with the value of Taiwan's exports to Mainland China (US$ 103 billion) being almost four times that of Taiwan's

imports from Mainland China (US$ 25.9 billion). Although Mainland China has become Taiwan's biggest export market, Taiwan's imports from Mainland China accounts for only 13 percent of Taiwan's total imports. This asymmetric feature of bilateral trade across the Strait is mainly due to restrictions imposed by Taiwan on imports from Mainland China.

3. **The Gravity Model and Estimation Strategy**

3.1 The Gravity Model and Empirical Specification

To examine the potential trade flow between Mainland China and Taiwan, we apply the gravity model to estimate bilateral trade flows and their determinants. The gravity model was developed independently, by Dutch economists Tinbergen (1962) and his collaborator Linnemann (1966) and Finnish economists Pöyhönen (1963) and Pulliainen (1963). It has been used extensively in empirical studies of international trade since then. As Anderson put it, gravity equation is '[p]robably the most successful empirical trade device of the last twenty-five years' and 'usually produces a good fit' (1979: 106). The theoretical foundations of the gravity model can be found in Anderson (1979), Helpman and Krugman (1985) and Bergstrand (1985).

Specifically, we set up two gravity models to estimate the relationship between bilateral trade flow and their determinants. The first was initiated by Ross (2004) that considers the aggregate impact of WTO, while the second is initiated by Subramanian and Wei (2007), which further distinguishes the differential impacts of WTO on developed and developing countries. Since both are widely used specifications, we use the first as the basic model and the second as a comparison model.

The basic version of gravity equation, following Ross (2004) and Subramanian and Wei (2007), is given by:

$$\ln import_{jkt} = \theta_0 + \sum_h \alpha_{ht} M_{jt} + \sum_m \beta_{mt} X_{jt} + \sum_n \gamma_n Z_{jkt} + \theta_1 FTA_{jkt} + \theta_2 GSP_{jkt} + \theta_3 WTO\_M_{jt} + \theta_4 WTO\_X_{kt} + \sum_t \phi_t DT_t + \varepsilon_{ijt} \quad (1)$$

where M_{jt}'s are a list of time-varying importer variables while X_{jt}'s are a list of time-varying exporter variables. These variables include GDP and GDP per capita, which are used to capture importers' and exporters' specific characteristics (Wincoop, 2003).

Z_{jkt}'s are a list of variables, including greater circle distance between j and k, dummies for common language, colonial links, shared borders, common currencies and so on. They are used to proxy for "multilateral resistance". Essentially, the variable list and data are from Ross (2004) and Subramanian and Wei (2007).

FTA_{jkt} is a dummy variable that takes on a value of 1 if j and k belong to a common free trade areas or common market in year t. GSP_{jkt} is a dumy variable that takes on a value of 1 if the importing industrial country grants preferences under the generalized scheme of preferences (GSP) to exporting country k in year t and where j and k are not members of a free trade area or common market in year t.

WTO_M_{jt} is a dummy variable for importer j to be a WTO member, while WTO_X_{kt} is a dummy variable for exporter k to be a WTO member. Also, DT_t is a year dummy for the control of each time-specific effects (or macro-economic shocks).

Since Subramanian and Wei (2007) argued that WTO's impact on bilateral trade depends on whether trading partners are developing or developed countries, we estimate an alternative model which includes a dummy for developed versus developing country to further differentiate the WTO dummies.

$$\begin{aligned}\ln import_{jkt} = {} & \theta_0 + \sum_h \alpha_{ht} M_{jt} + \sum_m \beta_{mt} X_{jt} + \sum_n \gamma_n Z_{jkt} \\ & + \theta_3 WTO\_DVE\_M_{jt} + \theta_4 WTO\_DVE\_X_{kt} \\ & + \theta_5 WTO\_DING\_M_{jt} + \theta_6 WTO\_DING\_X_{kt} \\ & + \theta_1 FTA_{jkt} + \theta_2 GSP_{jkt} + \sum_t \phi_t DT_t + \varepsilon_{ijt}\end{aligned} \tag{2}$$

where $WTO\_DVE\_M_{jt}$ and $WTO\_DING\_M_{jt}$ are dummy variables for importer j that is a developed or developing country WTO member, while $WTO\_DVE\_X_{kt}$ and $WTO\_DING\_X_{kt}$ are dummy variables for exporter k that is a developed or developing country WTO member. All other variables are the same as those defined in equation (1).

Although (1) and (2) can be used to examine the bilateral trade flows, they are not useful in examining changes in trade structure, i.e., whether the increase of trade flow is due to inter-industry or intra-industry trade growth. To answer this question, we use the intra-industry trade index (calculated at the 3-digit level, SITC Rev. 1) as the dependent variable and re-estimate the above two gravity models. The purpose is to examine how the characteristics of trading partners can affect their intra-industry trade, so that we can make use of the relationship to predict the potential intra-industry trade between economies.

$$\begin{aligned}Intra\_Index_{jkt} = {} & \theta_0 + \sum_h \alpha_{ht} M_{jt} + \sum_m \beta_{mt} X_{jt} + \sum_n \gamma_n Z_{jkt} \\ & + \theta_1 FTA_{jkt} + \theta_2 GSP_{jkt} + \theta_3 WTO\_M_{jt} + \theta_4 WTO\_X_{kt} + \sum_t \phi_t DT_t + \varepsilon_{ijt}\end{aligned} \tag{3}$$

$$
\begin{aligned}
Intra\_Index_{jkt} = {} & \theta_0 + \sum_h \alpha_{ht} M_{jt} + \sum_m \beta_{mt} X_{jt} + \sum_n \gamma_n Z_{jkt} \\
& + \theta_3 WTO\_DVE\_M_{jt} + \theta_4 WTO\_DVE\_X_{kt} \\
& + \theta_5 WTO\_DING\_M_{jt} + \theta_6 WTO\_DING\_X_{kt} \\
& + \theta_1 FTA_{jkt} + \theta_2 GSP_{jkt} + \sum_t \phi_t DT_t + \varepsilon_{ijt}
\end{aligned} \tag{4}
$$

where $Intra\_Index_{jkt}$ are intra-industry index between country j and k at time t. Table 2A in the Appendix provides a summary of definitions for the list of the variables in (1) to (4).

To estimate (1) and (2), we first adopt the pooled OLS regression technique with the adjustment of heteroschasticity and then use the panel data regression with the assumption of random effects as a comparison. Since the panel regression technique has the advantage of eliminate the trade-pair specific effect, our prediction is based on this estimation.

To check for robustness of our estimation on potential trade between Mainland China and Taiwan, we estimate (1)-(4) with two data sample. The first is a complete dataset that covers all 177 countries with data available. Estimation based on this sample provides average estimates of bilateral trade volume, given the characteristics of these countries. As the purpose of our study is to examine trade potential between Mainland China and Taiwan, our prediction will be more reliable if some East-Asian-specific characteristics can be controlled for. We thus provide estimation based on a small sample dataset that covers only 10 East Asian economies.[2] Nonetheless, the exercises using these two samples may help provide robustness tests for our estimation results.

3.2 Data Collection

The data in this study is an unbalanced panel data of bilateral trade, income, population, distance,

[2] The ten East Asian economies are Mainland China, Japan, South Korea, Hong Kong SAR, Singapore, Thailand, Malaysia, the Philippines, Indonesia and Vietnam.

geographical, cultural and historical information and a few other group-specific measures. Our data set is built upon that of Subramanian and Wei (2007) which is available at the website (http://www.nber.org/~wei/data.html), with data for new variable or updated data collected from the following sources: (1) the International Monetary Fund (IMF)'s Direction of Trade Statistics (DTS) and (2) the World Bank's World Development Indicator (WDI) and (3) the Australian National University (ANU)'s International Economic and Trade Databank (IEDB).

Our dataset consists of 82, 541 observation s, which covers 177 countries during the five-year period from 1980 to 2008 (except for the last one).[3] For data before 2000, we obtained them directly from Subramanian and Wei (2007), whereas for observations after 2000, we obtain from the IMF's DTS (for trade data) and WDI (for income and population data) with the same definitions. As one of the most important dependent variable, bilateral imports (c.i.f price) are defined as those reported by the importing country, measured in U.S. dollars and deflated by US CPI (1982 price) for urban areas (available from the website: www.freelunch.com). Geographical variables, dummies for WTO and FTA membership and other dummies are taken from Subramanian and Wei (2007) with updates to incorporate China's access to WTO.

The intra-industry indexes for each bilateral trade relationship are extracted from ANU's IEDB and matched with the basic database. The indexes are estimated following Loyld and Grubel (1977) with the 3-digit (SITC Rev. 1) data from United Nation's COMTrade Database. Due to data availability, the matched dataset only consists of 49, 181 observations, covering 164 countries during the five-year period of 1980 to 2005. The latest data available for intra-industry index is for 2004.

[3] A list of country code and names are shown in Appendix A.

Finally, trade data for Taiwan is from IMF's DOT and UN's COMTRADE, where Taiwan is classified as "n.e. Asian countries and regions" (with subclass of 490). Data on income and population for Taiwan (China) is obtained from Taiwan's National Statistics website (http://eng.stat.gov.tw/ct.asp?xItem=12700&CtNode=1561).

3.3 Regression Results

Table 3 presents regression results from the gravity model of bilateral trade flow using data for 1980 to 2008. We provide results from two sets of data, one with data for all 177 economies while the other with data for 10 East Asian economies. For each dataset, we experiment with two models ((1) and (2)) using pooled OLS and panel random effect techniques. As can be seen, regression coefficients for almost all variables have the expected signs and are statistically significant. The value of R-square is from 0.51 to 0.61, suggesting that overall the model provides a good fit. The size variable, GDP, is positive and significant. So is the stage of economic development, GDP per capita. The longer the geographic distance, the less trade occurred between the economies, which are as what is expected. Economies with common language and border trade more with each other. So do economies within the same free trade area.

Regression results from the gravity model of intra-industry trade are presented in Table 4. Again, we provide results from two sets of data, one with data for all 177 economies while the other with data for 10 East Asian economies. For all economies, regression coefficients for almost all variables are similar to those using bilateral trade flows as dependent variable. However, for the East Asian sample, it seems that the size and the stage of development of trading partners do not necessarily imply a higher bilateral intra-industry trade. Yet, economies with common language and border have more intra-industry trade with each other. So do economies within the same free trade area.

Table 3 Estimation results for the gravity model of bilateral trade flows: 1980-2008

Dependent variable:	All Countries				East Asian Economies			
Bilateral trade flows	Basic Model		Alternative Model		Basic Model		Alternative Model	
	Pooled OLS	Panel_RE	Pooled OLS	Panel_RE	Pooled OLS	Panel_RE	Pooled OLS	Panel_RE
lrgdp1	0.868***	0.306***	0.874***	0.315***	0.016	-0.099**	0.118**	-0.120***
	(0.007)	(0.009)	(0.007)	(0.009)	(0.059)	(0.045)	(0.055)	(0.043)
lrgdppc1	0.428***	0.677***	0.353***	0.564***	1.462***	1.052***	1.114***	1.057***
	(0.011)	(0.017)	(0.013)	(0.019)	(0.111)	(0.115)	(0.119)	(0.117)
lrgdp2	0.979***	0.320***	0.985***	0.317***	0.204***	-0.057	0.209***	-0.098**
	(0.007)	(0.009)	(0.007)	(0.009)	(0.066)	(0.045)	(0.062)	(0.040)
lrgdppc2	0.673***	0.869***	0.514***	0.596***	1.211***	0.929***	0.836***	0.823***
	(0.011)	(0.018)	(0.014)	(0.020)	(0.095)	(0.108)	(0.122)	(0.098)
ldist	-1.009***	-1.021***	-0.966***	-0.921***	-0.147*	0.136	-0.171**	0.001
	(0.012)	(0.023)	(0.012)	(0.023)	(0.086)	(0.167)	(0.085)	(0.161)
landl	-0.578***	-0.904***	-0.650***	-1.026***	-	-	-	-
	(0.017)	(0.034)	(0.017)	(0.034)	-	-	-	-
island	-0.074***	-0.298***	-0.119***	-0.444***	0.315***	0.300**	0.038	-0.057
	(0.019)	(0.038)	(0.019)	(0.038)	(0.076)	(0.148)	(0.096)	(0.185)
lareap	0.038***	0.258***	0.021***	0.231***	0.290***	0.232***	0.206***	0.229***
	(0.004)	(0.007)	(0.004)	(0.007)	(0.035)	(0.039)	(0.036)	(0.040)
comlang	0.416***	0.237***	0.460***	0.307***	0.528***	0.306	0.634***	0.711***
	(0.023)	(0.048)	(0.023)	(0.047)	(0.131)	(0.217)	(0.139)	(0.238)
border	0.860***	0.953***	0.925***	1.126***	0.691***	0.734**	0.703***	0.682**
	(0.052)	(0.105)	(0.052)	(0.103)	(0.197)	(0.358)	(0.200)	(0.337)
comcol	0.471***	0.004	0.576***	0.382***	0.960***	0.852***	1.111***	1.094***
	(0.037)	(0.069)	(0.038)	(0.070)	(0.191)	(0.299)	(0.200)	(0.330)
curcol	1.116***	0.558**	1.159***	0.562**	-	-	-	-
	(0.228)	(0.283)	(0.217)	(0.282)	-	-	-	-
colony	1.402***	2.320***	1.253***	1.806***	-	-	-	-
	(0.042)	(0.084)	(0.042)	(0.083)	-	-	-	-
comctry	-0.856**	0.219	-0.738**	0.533	-	-	-	-
	(0.352)	(0.705)	(0.325)	(0.687)	-	-	-	-
custrict	0.918***	0.293**	0.893***	0.269*	-	-	-	-
	(0.093)	(0.146)	(0.092)	(0.142)	-	-	-	-
fta	1.119***	0.814***	1.056***	0.679***	0.067	0.350***	0.094	0.364***
	(0.039)	(0.036)	(0.040)	(0.035)	(0.159)	(0.107)	(0.156)	(0.105)
Industrial country importer granting GSP	0.474***	0.521***	0.370***	0.310***	-0.118	0.256	0.161	0.173
	(0.027)	(0.046)	(0.032)	(0.051)	(0.221)	(0.305)	(0.415)	(0.444)
Importer WTO member	0.065***	0.317***	-	-	-0.543***	0.249**	-	-
	(0.022)	(0.025)	-	-	(0.153)	(0.121)	-	-
Exporter WTO member	0.400***	0.380***	-	-	-0.117	0.078	-	-
	(0.025)	(0.027)	-	-	(0.142)	(0.131)	-	-
Industrial country importer dummy	-	-	0.316***	-	-	-	0.225	-
	-	-	(0.031)	-	-	-	(0.423)	-
Developing country importer dummy	-	-	-	-0.859***	-	-	-	-0.820
	-	-	-	(0.053)	-	-	-	(0.528)
Industrial country exporter dummy	-	-	0.606***	1.636***	-	-	0.976***	1.644***
	-	-	(0.025)	(0.043)	-	-	(0.258)	(0.375)
Developing country exporter dummy	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	(Sig.)	(Sig.)	(Sig.)	(Sig.)	(Sig.)	(Sig.)	(Sig.)	(Sig.)
constant	-24.293***	-12.324***	-22.365***	-8.547***	-17.103***	-5.477***	-11.335***	-1.513
	(0.194)	(0.313)	(0.214)	(0.335)	(2.055)	(2.007)	(2.681)	(2.252)
Number of observations	75,791	75,791	75,791	75,791	515	515	515	515
R2	0.607	0.544	0.608	0.537	0.630	0.537	0.629	0.511

Note: *** p<0.01, ** p<0.05, * p<0.1

Table 4 Estimation results for the gravity model of intra-industry trade: 1980-2008

Dependent variable:	All Countries				East Asian Countries			
Intra-industry index	Basic Model		Alternative Model		Basic Model		Alternative Model	
	Pooled OLS	Panel_RE	Pooled OLS	Panel_RE	Pooled OLS	Panel_RE	Pooled OLS	Panel_RE
lrgdp1	0.041***	0.032***	0.041***	0.032***	-0.027**	0.000	-0.036**	-0.005
	(0.001)	(0.001)	(0.001)	(0.001)	(0.014)	(0.014)	(0.014)	(0.015)
lrgdppc1	0.029***	0.031***	0.019***	0.018***	0.102***	0.060**	0.163***	0.082**
	(0.002)	(0.003)	(0.002)	(0.003)	(0.027)	(0.030)	(0.035)	(0.034)
lrgdp2	0.036***	0.028***	0.034***	0.026***	-0.062***	-0.041***	-0.055***	-0.037**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.013)	(0.014)	(0.015)	(0.015)
lrgdppc2	0.032***	0.031***	0.015***	0.014***	0.097***	0.078***	0.180***	0.114***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.023)	(0.027)	(0.038)	(0.038)
ldist	-0.049***	-0.049***	-0.046***	-0.045***	0.023	0.029	0.026	0.034
	(0.002)	(0.003)	(0.002)	(0.003)	(0.023)	(0.033)	(0.022)	(0.033)
landl	0.014***	0.009**	0.005	-0.000	-	-	-	-
	(0.003)	(0.004)	(0.003)	(0.004)	-	-	-	-
island	-0.005	-0.003	-0.010***	-0.009**	0.102***	0.107***	0.156***	0.141***
	(0.003)	(0.005)	(0.003)	(0.005)	(0.020)	(0.030)	(0.028)	(0.039)
lareap	0.000	0.003***	-0.001	0.002*	0.065***	0.051***	0.081***	0.058***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.008)	(0.009)	(0.010)	(0.011)
comlang	0.014***	0.010*	0.016***	0.013**	0.089***	0.079*	0.066**	0.057
	(0.004)	(0.005)	(0.004)	(0.005)	(0.031)	(0.047)	(0.030)	(0.048)
border	0.045***	0.047***	0.055***	0.056***	0.026	0.041	0.024	0.042
	(0.008)	(0.012)	(0.008)	(0.012)	(0.039)	(0.062)	(0.039)	(0.062)
comcol	0.036***	0.030***	0.049***	0.047***	0.160***	0.170**	0.131***	0.150**
	(0.006)	(0.009)	(0.006)	(0.009)	(0.047)	(0.069)	(0.046)	(0.068)
curcol	0.189***	0.237***	0.209***	0.247***	-	-	-	-
	(0.054)	(0.060)	(0.052)	(0.059)	-	-	-	-
colony	0.089***	0.098***	0.073***	0.075***	-	-	-	-
	(0.008)	(0.012)	(0.008)	(0.012)	-	-	-	-
comctr	-0.411***	-0.443***	-0.423***	-0.445***	-	-	-	-
	(0.066)	(0.107)	(0.064)	(0.103)	-	-	-	-
custrict	0.011	0.009	-0.000	-0.002	-	-	-	-
	(0.018)	(0.023)	(0.018)	(0.023)	-	-	-	-
fta	0.125***	0.082***	0.107***	0.066***	0.068*	0.073**	0.072*	0.070**
	(0.006)	(0.007)	(0.006)	(0.007)	(0.037)	(0.032)	(0.038)	(0.033)
Industrial country importer granting GSP	0.042***	0.043***	0.016***	0.009	-0.161***	-0.161***	-0.259***	-0.236***
	(0.004)	(0.006)	(0.005)	(0.007)	(0.049)	(0.052)	(0.045)	(0.036)
Importer WTO member	0.051***	0.034***	0.043***	0.027***	0.056*	0.033	0.022	0.021
	(0.004)	(0.005)	(0.004)	(0.005)	(0.034)	(0.036)	(0.035)	(0.037)
Exporter WTO member	-	-	0.040***	0.030***	-	-	-0.034	-0.015
	-	-	(0.004)	(0.004)	-	-	(0.038)	(0.040)
Industrial country importer dummy	-	-	0.055***	-	-	-	-	-
	-	-	(0.005)	-	-	-	-	-
Developing country importer dummy	-	-	-	-0.074***	-	-	0.025	-0.014
	-	-	-	(0.007)	-	-	(0.067)	(0.068)
Industrial country exporter dummy	-	-	0.053***	-	-	-	-	-
	-	-	(0.004)	-	-	-	-	-
Developing country exporter dummy	-	-	-	-0.064***	-	-	0.222***	0.146*
	-	-	-	(0.006)	-	-	(0.073)	(0.086)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	(Sig.)	(Sig.)	(Sig.)	(Sig.)	(Sig.)	(Sig.)	(Sig.)	(Sig.)
constant	-1.136***	-0.888***	-0.903***	-0.512***	-1.210**	-1.301**	-2.974***	-2.069**
	(0.031)	(0.043)	(0.035)	(0.051)	(0.490)	(0.535)	(0.834)	(0.807)
Number of observations	45,867	45,867	45,867	45,867	422	422	422	422
R2	0.144	0.105	0.152	0.107	0.248	0.270	0.267	0.285

Note:*** p<0.01, ** p<0.05, * p<0.1

3.4 Trade Potential across the Taiwan Strait

With regression results in hand, we are now ready to estimate the trade potential between Mainland China and Taiwan, given their conventional trade determinants such as GDP, GDP per capita, distance, etc, but without political consideration. We provide major economic and social indicators for Mainland China and Taiwan in the Appendix (Table 1A). Our predicted results are provided in Table 5 and 6.

Table 5 shows the predicted trade potential between Mainland China and Taiwan. Results are based on regressions on two sample datasets, one covering all 177 countries while the other for East Asian economies only. For each sample, regressions are carried out based on Model (1) (basic model) and (2) (alternative model). The actual trade value is provided in the last column.

For both models, predicted trade values based on regression results from East Asian economies yields higher values than those based on all countries. This is understandable as the more "irrelevant" countries (countries that trade less with each other) are involved, the lower the estimated coefficients, and hence the lower the predicted trade value. Since Subramanian and Wei (2007) provides a finer differentiation of WTO status than Ross (2003), the "Alternative Model" is supposed to give a better fit. We thus focus our discussion on the predicted values from Model (2) for East Asian economies. Since the panel regression technique has the advantage of eliminate the trade-pair specific effect, our prediction is based on this estimation.

As shown in the last second column of Table 5, the predicted value of Taiwan's imports from Mainland China is US$ 52.2 billion in 2007,[4] which is about twice that of Taiwan's actual import

[4] The predicted values for 2008 in the table, in fact, should be for 2007 as values for the RHS variables in 2008 has not been available and we have to use data for 2007 instead.

value of US$ 25.8 billion in 2007. The implication is clear: given their sizes, the stages of their economic development, bilateral distance as well as other characteristics, if Taiwan can import freely from Mainland China, as other East Asian economies do, Taiwan's imports from Mainland China should be more than double that of the current value. Interestingly, our predicted value of Taiwan's exports to Mainland China is US$ 53.9 billion in 2007, much lower than the actual value of Taiwan's exports to Mainland China (US$ 101 billion in 2007).

Table 5 Predicted Trade Flows between Mainland China and Taiwan: 1980-2008
(unit: million US dollars, current price)

	All Countries		East Asian Countries		
Year	Basic Model	Alternative Model	Basic Model	Alternative Model	Actual Trade Flow
Total Trade Flow (Export + Import)					
1980	32	27	945	1,655	-
1985	58	46	1,513	2,567	-
1990	196	132	4,182	6,612	-
1995	536	313	9,610	14,194	17,882
2000	831	462	13,634	19,559	30,533
2005	3,848	1,555	68,596	88,689	91,230
2008	4,761	1,881	82,719	106,096	129,191
Taiwan's exports to Mainland China					
1980	16	14	388	646	-
1985	28	23	634	1,053	-
1990	99	67	1,707	2,535	-
1995	267	157	3,951	5,556	14,784
2000	400	231	5,691	7,964	25,494
2005	1,542	757	31,667	44,364	74,680
2008	1,872	914	38,440	53,921	103,308
Taiwan's Imports from Mainland China					
1980	16	14	557	1,009	-
1985	30	23	879	1,514	-
1990	97	65	2,475	4,076	-
1995	269	155	5,658	8,639	3,098
2000	431	231	7,943	11,595	5,039
2005	2,306	797	36,930	44,325	16,550
2008	2,888	967	44,279	52,175	25,883

Note: East Asian economies are Mainland China, Japan, South Korea, Hong Kong SAR, Singapore, Thailand, Malaysia, the Philippines, Indonesia and Vietnam.

The lower predicted value of Taiwan's exports to Mainland China deserves more attention. As Mainland China maintains a more or less similar trade regime against other East Asian

economies including Taiwan, why is the value of Taiwan's exports to Mainland China under-estimated by the model? The model may have left out more important determinant of exports than those conventional variables such as GDP, GDP per capita, geographical distance, common language etc, in particular for Taiwan. We suggest that perhaps a lot of Taiwan's exports to Mainland China are driven by Taiwan's foreign direct investment (FDI) in China or arms-length trade by Taiwanese firms in Mainland China. If this is the case, then exports will be under-predicted. We are not able to test this conjecture as data for detailed bilateral FDI is generally not available for developing countries. Nevertheless, thanks to a relatively open market in Mainland China, Taiwan's exports to Mainland China "outperforms" what are predicted by its conventional determinants.

Table 6 Predicted IIT Index between Mainland China and Taiwan: 1980-2008 (unit: %)

	All Countries		East Asian Countries		
year	Basic Model	Alternative Model	Basic Model	Alternative Model	Actual IIT Index
1980	40.0	36.9	71.2	66.9	-
1985	40.7	37.2	70.7	66.8	-
1990	46.3	41.6	74.8	72.3	-
1995	51.1	45.4	73.0	71.4	32.4
2000	50.3	44.4	76.5	75.2	31.8
2005	56.1	48.6	81.1	78.0	35.3
2008	61.9	52.8	-	-	-

Table 6 shows the predicted potential IIT index between Mainland China and Taiwan. The actual IIT index between Mainland China and Taiwan is about 35 percent in 2005, which is the latest data available. Based on regression results from the gravity model for East Asian economies, the IIT index could have been much higher, for example standing at 78 percent in 2005, given the conventional determinants of trade. This suggests a huge potential for more integration between economies at both sides of the Strait which would benefit enormously from finer 'division of labor'.

4. **Conclusion**

In the past decade or so, East Asian economies have increasingly participated in finer 'division of labor' within the region— specializing in one or more stages of a good's production process. This feature of production fragmentation has changed the landscape of trade in Asia with increasing trade in "parts and components". Yet, Taiwan has not been able to participate fully in the 'division of labor' in Asia thanks to restrictions of cross-Strait trade in general and imports from Mainland China in particular. As integration deepens, Taiwan's restrictions on trade with Mainland have received more attention. The recently proposed Cross-strait Economic Cooperation Framework Agreement highlights the dilemma that Taiwan faces.

In this paper, we ask what the value and pattern of trade across the Taiwan Strait should be if not for political consideration. To this end, we estimate a gravity equation model and try to provide an estimate of trade potential between Mainland China and Taiwan, given the conventional determinants of trade. Our results suggest that given their sizes, the stages of their economic development, bilateral distance as well as other characteristics, if Taiwan can import freely from Mainland China, as other East Asian economies do, Taiwan's imports from Mainland China should be more than double that of the current value. Interestingly, Taiwan's actual exports outperforms what the model predicts, suggesting that Mainland market is more open to Taiwan than Taiwan's market to Mainland. Results from intra-industry trade estimation suggest that without political consideration, there is a huge potential for both sides of the Strait to participate in a finer division of labor so that the IIT index could have been more than double its current value.

Reference

Anderson, J.E., 1979. A theoretical foundation for the gravity equation. American Economic Review 69 (1), 106–116.

Anderson, J.E., van Wincoop, E., 2003. Gravity with gravitas: a solution to the border puzzle. American Economic Review. 93 (1), 170–192.

Athukorala, Prema-chandra & Yamashita, Nobuaki, 2006. Production fragmentation and trade integration: East Asia in a global context, The North American Journal of Economics and Finance, Elsevier, 17(3): 233-256.

Bergstrand, J. H. (1985), The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence. Review of Economics and Statistics 67(3): 474-481.

Deardorff, A.V., 1998. Determinants of bilateral trade: does gravity work in a neoclassical world? In: Frankel, J. (Ed.), The Regionalization of the World Economy. Univ of Chicago Press, Chicago, pp. 7–22.

Frankel, J., Stein, E., Wei, S.J., 1997. Regional Trading Blocs in the World Economic System. Institute for International Economics, Washington.

Fung, Victor (2005), Business perceptions and expectations regarding the WTO Doha negotiations. APEC Economies Newsletter, Asia Pacific School of Economics and Government Australian National University, 9(12), Dec. 2005.

Helpman, E., Krugman, P., 1985. Market Structure and Foreign Trade. MIT Press, Cambridge MA.

Jones, R. W. and H. Kierzkowski (1990) "The Role of Services in Production and International Trade: a Theoretical Framework", in R. W. Jones and A. O. Krueger, eds., The Political Economy of International Trade: Essays in Honor of R. E. Baldwin, Oxford: Basil Blackwell.

Linnemann, H. (1966), An Econometric Study of International Trade Flows Netherlands: North-Holland Publishing Company.

Martin, Will., Kym Anderson and Cong S. Pham (2008), Effects of GATT/WTO on Asia's Trade Performance, revised version of paper prepared for the PAFTAD Conference, Hanoi, 17-19 December 2007.

Poyhonen, P. (1963), 'A Tentative Model for the Volume of Trade between Countries', Weltwirtschaftliches Archiv Band 90 (Heft 1): 93-99.

Pulliainen, K. (1963), 'A World Trade Study: an Econometric Model of the Pattern of the Commodity Flows in International Trade in 1948-1960', Ekonomiska Samfundets Tidskrif, (2): 78-91.

Rose, A.K., 2000. One money one market: the effect of common currencies on trade. Economic Policy 30, 9–45.

Rose, A.K., 2004. Do we really know that the WTO increases trade? American Economic Review 94 (1), 98–114.

Subramanian, A., Wei, S.-J., 2007. “The WTO Promotes Trade, Strongly but Unevenly," Journal of International Economics 72: 151–175.

Tinbergen, J. (1962) Shaping the World Economy: Suggestions for an International Economic Policy, New York: The Twentieth Century Fund.

Varian, Hal (2007), An iPod Has Global Value. Ask the (Many) Countries That Make It. New York Times, June 28, 2007.

Appendix

Table A1 Major Economic Indicator of Mainland China and Taiwan: 1980-2007

	1980	1985	1990	1995	2000	2005	2007
GDP Mainland China (million US dollars, current price)	189,400	306,667	356,937	728,007	1,198,480	2,235,914	3,205,507
GDP Per Capita China Mainland (US dollar, current price)	193	292	314	604	949	1,715	2,432
GDP Taiwan (million US dollar, current price)	49,025	64,444	168,416	277,990	325,698	364,997	394,901
GDP Per Capita Taiwan (US dollar, current price)	2,486	3,041	7,556	11,868	13,090	14,075	15,122
Land Area: Mainland China (sq km)							9,326,410
Land Area Taiwan (sq km)							32,261
Distance Mainland China-Taipei (km)							675

Source: Data for GDP and GDP per capita for Mainland China are from IFS WDI database while those for Taiwan are from Statistics Bureau of Taiwan.

Table A2 Definition of major variables in the model

Variable Name	Defition of Each Variable
ltrade_rose	log real bilateral trade in hundredths of million US dollars (c.i.f price)
lrgdp1	log real GDP of importer (cty1)
lrgdppc1	log real GDP per capita of importer (cty1)
lrgdp2	log real GDP of exporter (cty2)
lrgdppc2	log real GDP per capita of exporter (cty2)
ldist	log of distance
landl	landlocked variable, taking the value of 0/1/2
island	Islands variable, taking the value of 0/1/2
lareap	log of product of land areas
comlang	dummy for common language (1 for common language)
border	dummy for land border (1 for having land border)
comcol	dummy for common colonizer post 1945
curcol	dummy for pairs currently in colonial relationship
colony	dummy for pairs ever in colonial relationship
comctry	dummy for same nation/perennial colonies
custrict	dummy for strict currency union, taking value of 1 if trading partners belong to the same strict currency union
fta	FTA dummy, taking value of 1 if they are in same FTA
gsp	GSP dummy, taking value of 1 if industrial country importer granting GSP to exporter
WTO_M	dummy for importer to be WTO member
WTO_X	dummy for exporter to be WTO member
WTO_DEV_M	dummy for importer to be industraial countries and WTO member
WTO_DING_M	dummy for importer to be developing countries and WTO member
WTO_DEV_X	dummy for exporter to be industraial countries and WTO member
WTO_DING_X	dummy for exporter to be developing countries and WTO member