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Impact of Trade Costs on Trade: Empirical Evidence from Asian Countries

By

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Executive Summary

Trade costs include all costs incurred in getting a good to a final user other than the marginal cost of producing the good itself, such as transportation costs (both freight costs and time costs), policy barriers (tariffs and non-tariff barriers), information costs, contract enforcement costs, costs associated with the use of different currencies, legal and regulatory costs, and local distribution costs (wholesale and retail). Higher trade costs is an obstacle to trade and it impedes the realization of gains from trade liberalisation.

Considering the increase in trade interdependency in Asia, the need for better enabling environment to trade in Asia is gaining high momentum. On the demand side, the noticeable development is that tariff barrier in Asia has become low as a result of trade liberalisation. However, on the supply side, rising trade costs is having an adverse impact on trade. Freight costs are one of the major components of trade costs. While freight costs for imports in developed countries continue to be lower than those of developing countries, freight costs in developing Asia are on an average 116 percent higher than in developed countries. On one hand, while ocean freight prices have fallen over time for movement of vessels among some selected Asian countries, auxiliary shipping charges have gone up, thereby offsetting the gains arising from technological advancement in shipping and navigation and trade liberalisation. A clear understanding of the role of trade costs in enhancing trade is thus very important in order to promote deeper integration of the economies across the region.

How are the Asian countries doing in reducing trade costs? To answer this, this study has made advancement over earlier studies carried out on this subject in terms of methodology and application. In this study, by estimating an augmented gravity model at 4-digit HS level for the year 2004, the author finds that a number of trade costs components, namely, infrastructure quality, tariffs, and transport costs affect international trade patterns significantly. This paper shows, inter alia, that a reduction in tariffs and transport costs by 10 percent, each would increase bilateral trade by about 2 and 6 percents, respectively. Therefore, propensity to increase the trade is likely to be higher with reduction of transport costs, rather than tariff reduction at the present context. The estimated coefficients of this paper also indicate that the trade in Asia has been benefited from FTAs, and countries that speak the same language also trade more among themselves.

Findings of this paper have important policy implications for Asian countries seeking to expand trade. Addressing rising auxiliary shipping charges as well as the overall rise in shipping costs may require serious consideration by regulators and policymakers that wish to further promote trade in Asia. In addition, if improvements in the quality of infrastructure in LDCs continue to lag behind those in more developed countries, their share in world trade is likely to decline.

1. Introduction

Higher trade costs is an obstacle to trade and it impedes the realization of gains from trade liberalisation. Gains from trade depend not only on the tariff liberalisation but also on the quality of infrastructure and related services. Improved infrastructural and logistics services play an important role in the flow of international trade. In one hand, it generates enormous wealth by reducing costs of trade because of its non-discriminatory and non-rivalry characteristics, and, on the other, it integrates production and trade across countries.

The effective rate of protection provided by the transport costs in many cases is higher than that provided by tariffs (World Bank, 2001). For the majority of Sub-Saharan African countries, Latin America and Caribbean, and a large part of Asia, transport cost incidence for exports is five times higher than tariff cost incidence (World Bank, 2001).[1] Therefore, supply constraints are the primary factors that have limited the ability of many countries to exploit trade opportunities. As a result, complimentary trade policies focusing trade costs have gained immense importance in enhancing international trade.

Trade costs are often cited as an important determinant of the volume of trade. A growing literature in this regard has documented the impact of trade costs on the volume of trade.[2] Most of these studies show that integration is the result of reduced costs of transportation in particular and other infrastructure services in general. The shared objective of economic integration, in general, is to reduce trade barriers – visible and invisible. Direct evidence on border costs shows that tariff barriers are now low in most countries, on average (trade-weighted or arithmetic) less than 5 percent for rich countries, and with a few exceptions are on average between 10 to 20 percent for developing countries (Anderson and van Wincoop, 2004). While the world has witnessed drastic fall in tariffs over last two decades, a whole lot of barriers remain and do penalise trade, among which some 'soft' and 'hard' barriers. One set of such 'soft' barriers are dealt with through trade and business facilitation measures. The 'hard' set of barriers, which are often cited as physical or infrastructure barriers, are dealt with through transport facilitation measures. In a different vein, the costs appearing from these barriers can be clubbed together, and, for the sake of understanding, can be termed as 'trade costs', which is measured as a mark-up between export and import prices, where this mark-up roughly indicates the relative costs of transfer of goods from one country to another.

In recent year, Asia has witnessed a spread of regional and bilateral integration and cooperation initiatives. [3] In one hand, trade volume in Asia has been rising at a very rapid

[1] According to the World Bank (2001), 168 out of 216 US trading partner, transport costs barriers outweighed tariff barriers.

[2] Refer the study Anderson and van Wincoop (2004), which has elaborately covered the major seminal studies carried out on this subject. Also refer De (2006a), for an updated list of studies dealing trade costs.

[3] Regionalism enters into Asia with establishment of ASEAN in 1960s. Since then, several regional and subregional initiatives appeared in Asia, such as Bangkok Agreement, SAARC, etc. However, the East Asia Summit in 2005 involving ASEAN+6 countries indicates the rise of constructive regionalism in Asia. Slow progress in WTO Doha Round and also the pan-Asian integration have encouraged proliferation of bilateral agreements in Asia. In 2005, about 36 bilateral agreements from Asia were notified to WTO, which was only 3 involving developing Asia before 1995, whereas 46 agreements are yet to be notified to WTO, and further 42 agreements are being negotiated (ADB, 2006). Also see, UNESCAP (2005).

pace, and, on the other, the composition of trade within Asia is taking a new shape. Countries in Asia are gradually specialising in trade in intermediate and finished products, where effectiveness of transport infrastructure plays an important role in trade and international integration. With the rise of bilateralism in Asia, any attempt towards deeper integration of the economies of the region thus holds high promise if accompanied by initiatives that help improve trade efficiency and reduce trade costs (ADB, 2006).

Table1: Estimates of Total Freight Costs for Imports*

Year	Developed countries	Developing Countries	Developing Asia
	(%)		
1990	2.9	6.7	6.9
2000	2.9	5.9	6.5
2003	2.9	6.1	6.7
2004	3.0	5.9	6.5

Note: *As a percentage of import value (taken at *cif*).
Source: UNCTAD (2006)

Reduction of trade costs help traders get their goods to market more quickly and cheaply. Considering the increase in trade interdependency in Asia, the need for better enabling environment to trade in Asia has gained high momentum. On the demand side, the noticeable development is that tariff barrier in Asia has become low as a result of trade liberalisation. However, on the supply side, rising trade costs is having an adverse impact on trade. Freight costs are one of the major components of trade costs. While freight costs for imports in developed countries continue to be lower than those of developing countries, the same in the case of developing Asia is hovering around 6.5 percent thereby affecting the comparative advantage of Asian countries. Table 1 shows that freight costs in developing Asia are on an average 116 percent higher than developed countries. According to UNCTAD, this difference is mainly attributable to global trade structures, regional infrastructure facilities, logistics systems, and the more influential distribution strategies of shippers of developed countries.[4]

Table 2: Trends in Freight Costs in Selected Asian Countries[1]

Origin Country	Destination Country	Base Ocean freight		Other charges[2]		Total	
		2003	2005	2003	2005	2003	2005
		(US$ per 20' container)					
Japan	China	250	275	178	223	428	498
Japan	Korea	300	275	238	289	538	564
Japan	Hong Kong	196	200	419	425	615	625
Japan	Malaysia	366	375	244	296	610	671
Japan	Singapore	312	325	307	321	619	646
Japan	India	1546	1600	489	523	2035	2123
Japan	Thailand	312	275	232	258	544	533
China	Japan	900	800	162	366	1062	1166
China	Korea	300	500	190	240	490	740
China	Hong Kong	412	400	331	345	743	745

[4] See, UNCTAD (2006)

China	Malaysia	620	600	213	217	833	817
China	Singapore	410	400	240	241	650	641
China	India	2109	2000	288	302	2397	2302
China	Thailand	608	600	166	180	774	780
Korea	Japan	300	400	218	262	518	662
Korea	China	250	350	203	220	453	570
Korea	Hong Kong	444	450	419	422	863	872
Korea	Malaysia	388	400	267	282	655	682
Korea	Singapore	398	400	309	318	707	718
Korea	India	2010	1950	517	528	2527	2478
Korea	Thailand	395	400	251	255	646	655

Notes: 1. Rates are collected for shipment of a 20' container (TEU) among country's major ports. Rates are averaged for the years 2003 and 2005. 2. Including container handling charges, documentation fees, government taxes and levies, etc. of both the trading partners.
Source: Calculated based on freight rates provided by Maersk Sealand (2006)

Freight costs vary across Asia. Inefficient transport services are reflected in higher freight costs and longer time for delivery. Table 2 indicates that while ocean freight has fallen over time (here, between 2003 and 2005) for movement of vessels among some selected Asian countries, auxiliary (other) charges have gone up, thereby offsetting the gains arising from (i) technological advancement (e.g. bigger vessel) and (ii) trade liberalisation (e.g. lower tariff). Therefore, differences across countries in transport costs are a source of absolute and comparative advantage and affect the volume and composition of trade (WTO, 2004).[5]

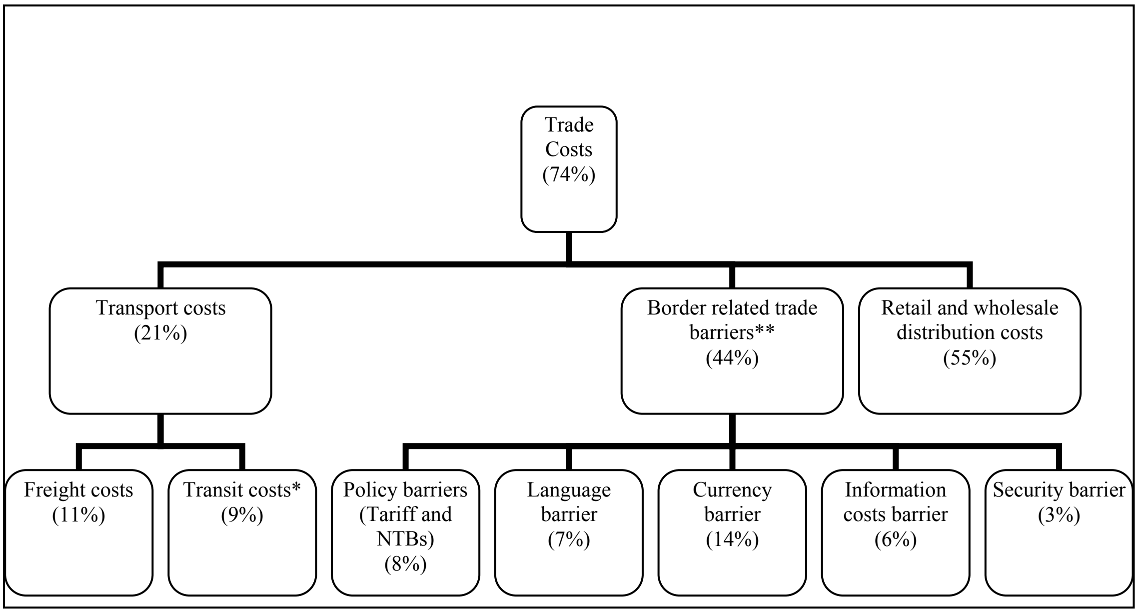
How are the Asian countries doing in reducing trade costs? A clear understanding of the role of trade costs in enhancing trade will help to promote deeper integration of the region. This study therefore seeks to enhance understanding in this area in the context of selected Asian countries. The next section (Section 2) defines trade costs and review studies done so far on the subject. Data and methodology used to evaluate the importance of various trade cost components, as well as some insights on freight cost components as possible trade barriers, are presented in Sections 3 and 4, respectively. Econometric results are presented and discussed in Section 5, followed by conclusions in Section 6.

[5] In another context, while describing East Asia's outward-oriented growth, ADB-JBIC-WB team commented that the efficiency of East Asia's logistics is falling behind, with costs of transportation representing a high proportion of the final price of goods thereby affecting competitiveness of the region. (ADB-JBIC-WB, 2005, pp. 61-64)

2. Trade Costs and Their Relevance

In broad terms, trade costs include all costs incurred in getting a good to a final user other than the marginal cost of producing the good itself, such as transportation costs (both freight costs and time costs), policy barriers (tariffs and non-tariff barriers), information costs, contract enforcement costs, costs associated with the use of different currencies, legal and regulatory costs, and local distribution costs (wholesale and retail). Trade costs are reported in terms of their ad-valorem tax equivalent. In Anderson and van Wincoop's (2004) term: the 170 percent of 'representative' trade costs in industrialized countries breaks down into 21 percent transportation costs, 44 percent border related trade barriers and 55 percent retail and wholesale distribution costs (Figure 1).

Figure 1: Estimated Trade Costs in Industrialized Countries



Notes: *Tax equivalent of the time value of goods in transit. Both are based on estimates for US data. ** The combination of direct observation and inferred costs, which, according to author, is an extremely rough breakdown.
Source: Drawn from Anderson and van Wincoop (2004)

In general, an exporter or importer incurs trade costs in all the phases of the export or import process starting from obtaining information about market conditions in any given foreign market and ending with receipt of final payment. One part of the trade costs is trader specific and depends upon his/her operational efficiency. The magnitude of this trade costs diminishes with an increase in the efficiency level of the trader, under the prevailing framework of any economy.

The other part of trade costs is specific to the trading environment and is incurred by the traders due to in-built inefficiencies in the trading environment. It includes institutional bottlenecks (transport, regulatory and other logistics infrastructure), information asymmetry and administrative power that give rise to rent seeking activities by government officials at various stages of transaction. This may cost traders (or country) time and money including demurrage charges, making transactions more expensive.

Trade costs are large, even aside from trade policy barriers and even between apparently highly integrated economies. In explaining trade costs, Anderson and van Wincoop (2004) referred the example of Mattel's Barbie doll, discussed in Feenstra (1998), indicated that the production costs for the doll were US$ 1, while it sold for about US$ 10 in the United States. The cost of transportation, marketing, wholesaling and retailing represent an ad-valorem tax equivalent of 900 percent. Anderson and van Wincoop (2004) commented: "Tax equivalent of representative trade costs for rich countries is 170 percent. This includes all transport, border-related and local distribution costs from foreign producer to final user in the domestic country. Trade costs are richly linked to economic policy. Direct policy instruments (tariffs, the tariff equivalents of quotas and trade barriers associated with the exchange rate system) are less important than other policies (transport infrastructure investment, law enforcement and related property rights institutions, informational institutions, regulation, language)."

Direct transport costs include freight charges and insurance, which is customarily added to the freight charge. Indirect transport user costs include holding costs for the goods in transit, inventory costs due to buffering the variability of delivery dates, preparation costs associated with shipment size (full container load vs. partial loads) and the like. Indirect costs must be inferred. Alongside tariffs and NTB's, transport costs appear to be comparable in average magnitude and in variability across countries, commodities and time.

Trade costs have large welfare implications. Current policy related costs are often worth more than 10 percent of national income (Anderson and van Wincoop, 2002). Obstfeld and Rogoff (2000) commented that all the major puzzles of international macroeconomics hang on trade costs. Some of the studies, for example, APEC (2002), OECD (2003), and Francois *et al*. (2005) estimate that for each 1 percent reduction of trade transaction costs, world income could increase by US$ 30 to 40 billion.

Many commentators have indicated that the success of trade liberalisation will always be suboptimal if transport costs are not controlled. World Trade Organisation (WTO, 2004) comments: "the effective rate of protection provided by transport costs in many cases higher than that provided by tariffs". According to the World Bank (2001), for 168 out of 216 trading partners of the United States, transport costs barriers outweighed tariff barriers. It is estimated that doubling distance increases overall freight rates between 20 and 30 percent (Hummels, 1999b). Time delays affect international trade. It is estimated that on an average each additional day that a product is delayed prior to being shipped reduces trade by at least 1 percent (Djankov *et al*., 2006).[6] Therefore, what follows is that gains from trade will be more if trade frictions are minimised.

Details of trade costs also matter to economic geography. For example, the home market effect hypothesis (big countries produce more of goods with scale economies) hangs on differentiated goods with scale economies having greater trade costs than homogeneous goods (Davis, 1998). The cross-commodity structure of policy barriers is important to welfare (e.g., Anderson, 1994).

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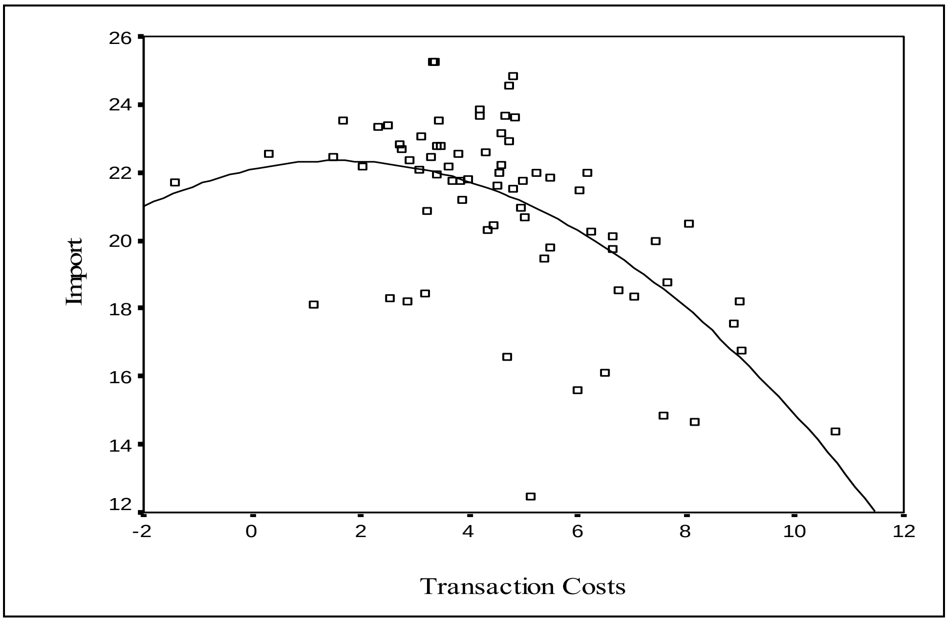
[6] This was estimated by the authors through a structured Gravity model using newly constructed *Doing Business* Database of the World Bank on shipment of cargo from the factory gate to the ship (vessel) in 126 countries.

In dealing with cross-country trade, influenced by *new trade theory*, several studies have explicitly considered transport costs (interchangeably transaction costs) such as Bergstrand (1985, 1989), Davis (1998), Deardorff (1998), Limao and Venables (2001), Fink *et al*., (2002), Clark, Dollar and Miucco (2004), Redding and Venables (2004), Hummels (1999a, 2001), Wilson *et al*, (2003), De (2006a), among others.

Figure 2: Relative Importance of Trade Transaction Costs in Asia



Note: Import and transaction costs are based on pooled bilateral trading pairs for 15 Asian economies (those listed in the paper) for the year 2004.
Source: De (2006b)

Poor institutions and poor infrastructure act as impediments to trade, differentially across countries. While dealing with barriers to trade, there are some studies which have explicitly emphasised on the quality of infrastructure (as a proxy of trade costs), associated with cross-country trade. Country's infrastructure plays a vital role in carrying trade. For example, by incorporating transport infrastructure in a two-country Ricardian framework, Bougheas *et al.* (1999) have shown the circumstances under which it affects trade volumes. According to Francois and Manchin (2006), transport and communication infrastructure and institutional quality are significant determinant not only for a country's export levels but also for the likelihood of exports. Nordås and Piermartini (2004) have shown that quality of infrastructure is an important determinant of trade performance wherein port efficiency alone has the largest impact on trade among all indicators of infrastructure. De (2005, 2006b) provided evidence that transaction costs is statistically significant and important in explaining variations in trade in Asia. In addition, De (2005, 2006b) also found that port efficiency and infrastructure quality are two important determinants of trade costs. Higher the transaction costs, lower is the volume of trade. This is exemplified in Figure 2, which shows a negative non-linear relationship between transaction costs and imports in the context of 15 Asian economies for the year 2004. This relationship clearly points to the fact that trade transaction costs do influence trade.

The infrastructure variables have explanatory power in predicting trade volume. Limao and Venables (2001) emphasized the dependence of trade costs on infrastructure, where infrastructure is measured as an average of the density of the road network, the paved road network, the rail network and the number of telephone main lines per person. A deterioration of infrastructure from the median to the 75th percentile of destinations raises transport costs by 12 percent. The median landlocked country has transport costs which are 55 percent higher than the median coastal economy.[7] Country's comparative advantage also depends upon quality of infrastructure. Yeaple and Golub (2002) found that differences in the quality of public infrastructure between countries can explain differences in total factor productivity.

Some studies have indicated that the cost of trade facilitation, specifically trade documentation and procedures, is high, between 4 to 7 percent of the value of goods shipped. In 1996, APEC conducted a study that highlighted the gain from effective trade facilitation. For example, the gains from streamlining customs procedures exceeded those resulting from trade liberalization, such as tariff reduction. Gains from effective trade facilitation accounted for about 0.26 percent of real GDP of APEC members (about US$ 45 billion), while the gains from trade liberalization would be 0.14 percent of real GDP (about US$ 23 billion).[8] According to the World Bank, raising performance across the region to halfway up to the level of the APEC average could result in a 10 percent increase in intra-APEC exports, worth roughly US$ 280 billion (World Bank, 2002).

Therefore, what follows is that understanding trade costs and their role in determining international trade volumes must incorporate the internal geography of countries and the associated interior trade costs. This study builds upon the literature carried out on this subject earlier and in particular De (2006a), and it has two distinct methodological improvements over De (2006a and 2006b). First, we have estimated the modified gravity model controlling for remoteness and endogeneity. Second, the model is tested at a large cross-section data, taken at 4-digit HS level for 10 Asian countries.[9] The next section deals with the data and methodology.

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[7] Bougheas *et al.* (1999) estimated gravity equations for a sample limited to nine European countries. They included the product of partner's kilometres of motorway in one specification and that of public capital stock in another and found that these have a positive particle correlation with bilateral exports.

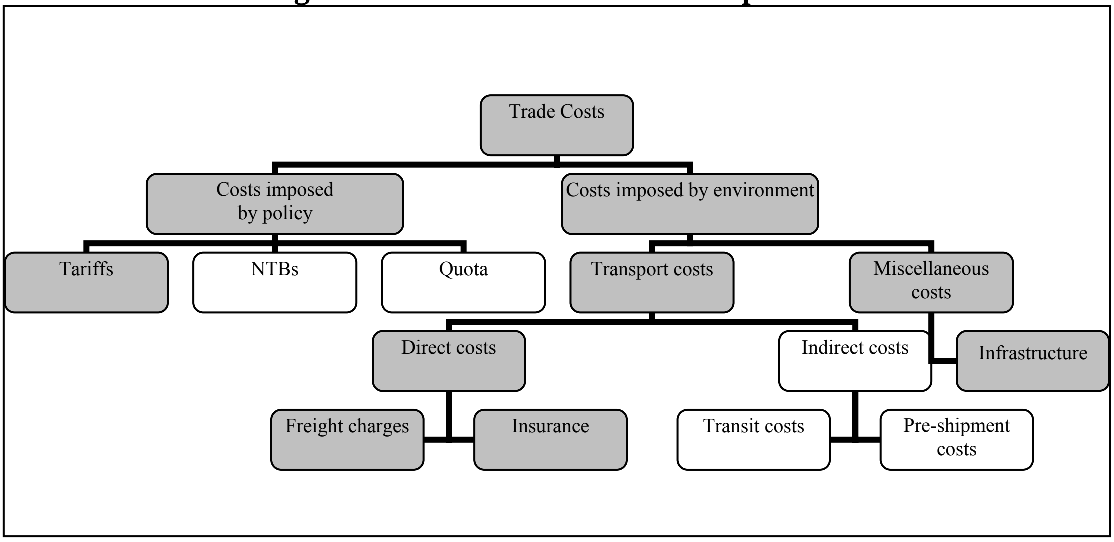
[8] Similar indications were obtained for countries in APEC (Cernat, 2001; World Bank, 2002; Wilson *et al*, 2003).

[9] These two are the new additions to the earlier studies done by the author on similar subject.

3. Data and Methodology

The main objective of this study is to assess the trade costs (barriers to trade) in context of selected Asian countries. As an extension, the study also analyses the impact of trade liberalization and regulatory reforms on trade. To attain this objective, this study is undertaken in two stages. First, we stress that the specification of the gravity equation, together with the choice of the distance measure, is crucial for evaluating the size of the barriers. Second, we estimate the impact of trade costs on regional trade, controlling for endogeneity and remoteness, following which, policy conclusions are drawn.

Figure 3: Trade Costs and Its Components



In this study, we deal with only those components of trade costs which are imposed by both policy (such as tariff) as well as environment (such as transport and others). Shaded boxes of the Figure 3 are the trade costs components considered in this study. Due to lack of compatible quantitative information, NTBs, quotas, and transit and pre-shipment costs were not considered in this study.

To estimate bilateral transport costs, two methods have been used interchangeably: (i) the difference of ad-valorem trade-weighted freight rate,[10] and (ii) the differences in inter-country costs of transportation using shipping rate, collected from shipping agents.[11]

[10] Many measures have been constructed to measure transport cost. The most straightforward measure in international trade is the difference between the *cif* (cost, insurance and freight) and *fob* (free on board) quotations of trade. The difference between these two values is a measure of the cost of getting an item from the exporting country to the importing country. There is another source to obtain data for transport costs from industry or shipping firms. Limao and Venables (2001) obtained quotes from shipping firms for a standard container shipped from Baltimore to various destinations. Hummels (1991a) obtained indices of ocean shipping and air freight rates from trade journals which presumably are averages of such quotes. The most widely available (many countries and years are covered) is average ad-valorem transport costs are the aggregate bilateral *cif/fob* ratios from UN's COMTRADE database, supplemented in some cases with national data sources. Nevertheless, because of their availability and the difficulty of obtaining better estimates for a wide range of countries and years, apparently careful work such as Harrigan (1993) and Baier and Bergstrand (2001) used the IMF (COMTRADE) database.

[11] We use ocean freight rates, collected from Maersk Sealand (2006).

Importing countries report the value of imports from partner countries inclusive of transportation charges, and exporting countries report their value exclusive of transportation charges, which measures the costs of the imports and all charges incurred in placing the merchandise aboard a carrier in the exporting port. Alternatively, using the freight rate, we arrive at variation in transport costs across countries. Let T*ij* denotes the unit cost of shipping a particular good from country *j* to country *i*. We suppose that it is determined by:

$$T_{ij}=f\,(x_{ij}, X_i, X_j, \mu_{ij}) \quad (1)$$

where x_{ij} is a vector of characteristics relating to the journey between *i* and *j*, X_i is a vector of characteristics of country *i*, X_j is a vector of characteristics of country *j*, and μ_{ij} represents all unobservable variables.

Denoting the export price shipped from *j* to *i* by p_{ij}, we define t_{ij}, the ad-valorem transport cost factor, as

$$t_{ij} = (p_{ij} + T_{ij}) / p_{ij} = t\,(x_{ij}, X_i, X_j, \mu_{ij}) \quad (2)$$

where the determinants of T_{ij} are given in equation (1). The ratio of import and export costs provides the measure of transport costs on trade between each pair of countries. Assuming that t_{ij} can be approximated by a log linear function up to some measurement error, the average observed transaction cost rates t_{ij} appears as follows.

$$\ln t_{ij} = \alpha + \beta \ln x_{ij} + \gamma \ln X_i + \delta \ln X_j + \omega_j \qquad (3)$$

Here, the transport costs t_{ij} represent costs of transportation between country *i* and *j*.

In our paper, we use two separate methods to estimate t_{ij}. *Method I* is trade-weighted transport costs, derived from differences of export and import prices, whereas the *Method II* represents weighted costs of transportation, estimated using cross-country shipping rates.[12] While both the methods have been widely used to estimate transport costs, there is a methodological difference between the two. The trade-weighted transport cost in *Method I* for commodity *k* is as follows.

$$t_{ij}^{k} = \left(\frac{IM_{ij}^{\;k}}{EX_{ji}^{k}} - 1 \right) S_i^{\;k} \quad (4)$$

where IM^k_{ij} stands for import price of country *i* from country *j* for the commodity *k*, EX^k_{ji} denotes export price of country *j* to country *i* for the commodity *k*, and S_i^k is the value-share of commodity *k* in country *i* in the bilateral trade (here, at the 4-digit HS). In terms of the data, we use *cif* values to represent IM^k_{ij}, and *fob* values for EX^k_{ji}. As indicated by Limao

[12] Here, methodology follows Limao and Venables (2001), which was adopted from Hummels (1999a).

and Venables (2001), *cif/fob* data does contain information about the cross sectional variation in transport costs, and that results from using this data are quite consistent with those obtained from the shipping costs data.[13]

The trade-weighted transport cost at the 4-digit HS in *Method II* is derived using

$$t_{ij}^{k} = \frac{Q_{ij}^{k} f_{ji}^{k}}{Q_{ij}} \quad (5)$$

where, Q^{k}_{ij} stands for import in quantity of country *i* from country *j* for the commodity *k*, f_{ji}^{k} stands for shipping costs of per unit of import of commodity *k* by country *i* from country *j*, and Q_{ij} is country *i*'s total import from country *j*.

For country characteristics, we have focused on infrastructure measures – the country's ability to enhance the movement of merchandise. Here, we treat infrastructure as a proxy to those costs, which are equally responsible for movement of goods across and within countries. Infrastructure facilities, arising from differential factor endowments within a country, are responsible for movement of goods. To assess impact of infrastructure facilities on bilateral trade, we have constructed an Infrastructure Index (II), comprising nine infrastructure variables for each individual country. II is designed to measure the costs of travel across a country. In theory, the export and import prices are border prices and thus it would seem that own and trading partner infrastructures as defined here should not affect these rates. It is possible that there are interactions between the variables. The simplest example is that an increase in land distance should increase the cost of going through a given infrastructure. The II was constructed based on Principal Component Analysis (PCA),[14] and it measures the relative position of a country considering a set of observables. Briefly, the II is a linear combination of the unit free values of the individual facilities such that

$$II_{ij} = \sum W_{kj} X_{kij} \quad (6)$$

where II_{ij} is infrastructure index of the i-th country in j-th time, W_{kj} is weight of the k-th facility in j-th time, and X_{kij} = unit free value of the k-th facility for the i-th country in j-th time point.

While indexing the infrastructure stocks of the countries, we have considered following nine variables which are directly involved in moving the merchandise between countries: (i) railway length density (km per 1000 sq. km of surface area), (ii) road length

[13] However, *cif/fob* ratio has several drawbacks. The first is measurement error; the *cif/fob* factor is calculated for those countries that report the total value of imports at *cif* and *fob* values, both of which involve some measurement error. The second concern is that the measure aggregates over all commodities imported, so it is biased if high transport cost countries systematically import lower transport cost goods. This would be particularly important if we were using exports, which tend to be concentrated in a few specific goods. It is less so for imports which are generally more diversified and vary less in composition across countries (Limao and Venables, 2001)

[14] Refer, Fructure (1967)

density (km per 1000 sq. km of surface area), (iii) air transport freight (million tons per km), (iv) air transport, passengers carried (percentage of population), (v) aircraft departures (percentage of population), (vi) country's percentage share in world fleet (percent), (vii) container port traffic (TEUs per terminal) (viii) fixed line and mobile phone subscribers (per 1,000 people), and (ix) electric power consumption (kwh per capita). The weights of these variables, and the index, derived from the PCA, are given in Appendix 1.

The Augmented Gravity Model

In order to explore the impact of trade costs on trade flows, our empirical analysis has considered an augmented gravity model, since it is one of the popular partial equilibrium models known in explaining the variation of trade flows. The gravity model provides the main link between trade barriers and trade flows. The gravity equation proposed here is a sort of reduced form of an intra-industry trade model. Following Anderson and van Wincoop (2003), the baseline equation is as follows.

$$X_{ij} = \frac{Y_i Y_j}{Y_w} \left(T_{ij} \big/ P_i P_j \right)^{1-\sigma} \quad (7)$$

where, Y_i Y_j and Y_w denote the aggregate size of countries *i*, *j* and the world, respectively; T_{ij} accounts for trade costs and other trade barriers; P_i and P_j reflect the implicit aggregate equilibrium prices; and σ is the constant elasticity of substitution (CES) between all goods in the consumption utility function.[15]

We assume from equation (7) that T_{ij} may be divided into several components, namely, infrastructure quality, tariff barriers, transport costs, distance, difference in language, and other border effects. Assuming monopolistically competitive market, the term (1- σ) should be negatively related to volume of trade.

In order to carry out the estimations, following Head (2003), and Anderson and van Wincoop (2003), we assume the implicit aggregate equilibrium prices P_i and P_j are basically resistance term or remoteness (trade weighted average distances from rest of the world).[16] Here, we derive remoteness (R_i), as a proxy of implicit aggregate equilibrium prices, through following equation.

$$R_i = \sum_{m \neq j} \left(d_{im} \big/ Y_m \right) \quad (8)$$

[15] See, Anderson and van Wincoop (2003) for compete derivation of the model. We assume, as shown in Anderson (1979) and Anderson and van Wincoop (2003), all goods are differentiated by place of origin and each country is specialized in the production of only one good. Therefore, supply of each good is fixed (n_i = 1), but it allows preferences to vary across countries subject to the constraint of market clearing (CES).

[16] In fact, some authors tentatively estimated model with price index variables (Baier and Bergstrand, 2001).

where R_i reflects the average distance of country *i* from all trading partners other than *j*, d_{im} is the distance between countries *i* and *m*, Y_m is the GDP of country *m*.

Therefore, final estimable gravity equation takes following shape.

$$\ln IM_{ij} = \alpha_0 + \alpha_i + \beta_1 \ln Y_iY_j + \beta_2 \ln II_i + \beta_3 \ln II_j + \beta_4 \ln TC_{ij} + \beta_5 \ln T_{ij} + \beta_6 \ln R_i + \beta_7 \ln R_j + \beta_8 \ln D_{ij} + \beta_9 d_1 + \beta_{10} d_2 + \beta_{11} d_3 + \varepsilon_{ij} \quad (9)$$

where *i* and *j* are importing and exporting country respectively, IM_{ij} represents import by country *i* from country *j*, taken at constant US\$, Y_i and Y_j denote gross domestic products, taken at constant US\$, of countries *i* and *j*, respectively, II represents country's infrastructure quality, measured through an index, TC_{ij} stands for transport costs for bilateral trade between countries *i* and *j*, T_{ij} stands for bilateral tariff (weighted average) between country *i* and *j*, R_i and R_j denote average remoteness of countries *i* and *j*, D_{ij} is the distance between countries *i* and *j*. Dummies 1, 2 and 3 refer to PTA/FTA in force, adjacency, and language, respectively. To capture country effects, we use country specific dummy, α_i. The parameters to be estimated are denoted by β, and ε_{ij} is the error term.

The gravity model explains bilateral trade flows as a function of the trading partners' market sizes and their bilateral barriers to trade. As indicated in Nordås and Piermartini (2004), a number of them are standard variables in the empirical literature to capture trade barriers: (i) transport costs are generally captured by distance and island, landlocked and border dummies to reflect that transport costs increase with distance. They are higher for landlocked countries and islands and are lower for neighbouring countries; (ii) information costs are generally captured by a dummy for common language; (iii) tariff barriers are generally neglected. However, data on tariff barriers show that there is a high degree of variability in cross-country bilateral applied tariffs. Since neglecting tariffs may be a source of an omitted variable bias, we, therefore, include bilateral tariffs in our estimations.

There are few important reasons for considering the equation (9). First, we estimate a modified gravity equation, controlling for endogeneity and remoteness. Second, an alternative method to obtain unbiased estimates of the impact of distance and other bilateral variables on bilateral trade flows is to replace the multilateral resistance indexes with importer and exporter dummies (Anderson and van Wincoop, 2003). We therefore estimate a gravity equation including country specific effects. Third, the variables are identified keeping in mind their importance in influencing bilateral trade. Fourth, we can estimate elasticity of trade flows with respect to exogenous variables. Fifth, a country's trade with any given partner is dependent upon its average remoteness to the rest of the world (Anderson and van Wincoop, 2003). Studies that do not control for remoteness produce biased estimates of the impact of transaction costs on trade. Finally, in an attempt to minimize the possibility of endogeneity bias we also estimate equation (9) instrumenting country's import. We use the number of ports in bilateral pairs as instrument mainly for two reasons: (i) countries in Asia rely more on seaports for merchandise trade, rather than overland, and (ii) due to spatial distribution, number of seaports are unlikely to be affected by the total volume of import in a given pair.

The augmented gravity model considered here uses data for the year 2004 at 4-digit HS for 10 Asian countries, namely, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Singapore, Taiwan and Thailand. By taking tariffs, transport costs and infrastructure quality, we cover a major portion of trade costs. Bilateral trade, transport costs, and tariffs are taken at 4-digit HS for the year 2004.[17] Since the gravity equation is the standard analytical framework for the prediction of bilateral trade flows, we use it as a policy simulation technique rather than extending it for forecasting purposes.

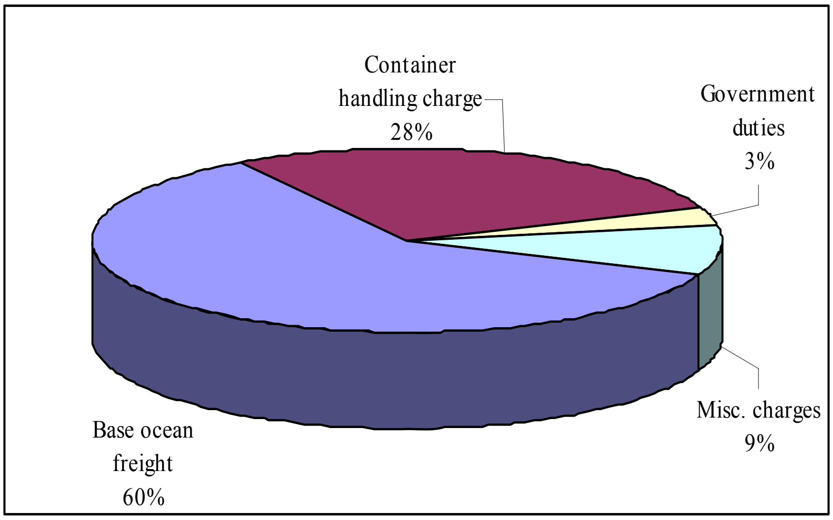
The major sources of secondary data are collected from International Monetary Fund (IMF), United Nations Statistical Division (UNSD), United Nations Conference on Trade and Development (UNCTAD), and the World Bank (WB). Appendix 3 provides the data specific sources.

[17] The model also suffers from data limitation when we consider equation (4) to estimate transport costs. On average 56 percent of total observations for all sectors are found to be either zero or negative or missing. Theoretically, t_{ij} can not be negative or zero. Due to poor quality of data compilation, we face discrepancy in transport costs estimation. However, we get better results when we consider equation (5) and use freight rates. Appendix 2 shows the country-wise observations collected and those with errors.

4. Barriers to Trade: Ocean Freight and Auxiliary Shipping Charges

Despite technological advancement, cost of movement of goods across countries has not fallen in Asia. As an indication of the relative importance of lower, simplified and transparent ocean freight for trade, Figure 4 and Table 3 provide the composition and structure of ocean freight in Asia for the year 2004. About 60 percent of total shipping costs for movement of cargo between origin and destination countries is charged by shipping lines as base ocean freight, whereas 28 percent is container handling charges, recovered by the terminal or port operators. Government duties are also not negligible; about 3 percent of total shipping costs is imposed by governments as taxes and levies for using the port and navigation facilities.

Figure 4: Broad Overview of Total Ocean Freights in Asia



Notes: Calculated based on Table 3.

However, the extent of auxiliary shipping charges[18] is very wide and cover several components, such as peak season surcharge, congestion surcharge, Bunker Adjustment Factor (BAF), Yen Appreciation Surcharge (YAS), Fuel Adjustment Factor (FAF), and delivery order, etc., which often make the shipping between the countries costlier. For example, exporters had to pay on an average US$ 35 per 20' container towards BAF in 2004, which was imposed by the shipping lines as fuel surcharge, and on an average US$ 30 per 20' container as YAS for cargoes going to Japan.

[18] By auxiliary shipping charges we mean all shipping charges other than basic ocean freight in this study. In Figure 4, auxiliary shipping charges include container handling charge, government duties and miscellaneous charges (40 percent of total ocean freights).

Table 3: Components of Total Ocean Freight in Asia

Freight components	Collected by	Rate (%)*
(a) Mandatory charges		
Base ocean freight between origin and destination	Shipping company	60.00
Container handling charge at origin	Terminal or port operator	16.00
Container handling charge at destination	Terminal or port operator	12.00
Carrier security charge	Shipping company	0.80
Documentation fee at origin	Shipping company	2.25
Documentation fee at destination	Shipping company	1.60
Government and port duties	Terminal or port operator	2.20
(b) Optional charges		
Wharfage	Terminal or port operator	0.60
Container cleaning charge	Shipping company	0.25
Peak season surcharge	Shipping company	0.65
Congestion surcharge	Shipping company	0.85
Bunker Adjustment Factor (BAF)	Shipping company	0.70
Yen Appreciation Surcharge (YAS)	Shipping company	0.60
Fuel Adjustment Factors (FAF)	Shipping company	0.50
Delivery order	Shipping company	0.70
EDI charge	Terminal or port operator	0.30
	Total	100.00

Notes: *Average charges, calculated based on shipping rates provided by the Maersk Sealand for the year 2004 for movement of a container vessel among 10 countries as listed in this paper.

In many cases the volume of auxiliary shipping charges often overtakes base ocean freight. This is clearly captured in Table 4. Cargo originating from Japan going to Hong Kong had to pay on an average US$ 425 per 20’ container towards auxiliary charges in 2004, where the base ocean freight was only US$ 200, thus making container transportation between the two countries effectively costlier than that between Japan and India. The sea trade between Japan and Korea follows the same direction. Because of the close proximity and advanced maritime and shipping facilities, we expected auxiliary charges should be low. However, what we found was that the charges between the two countries were higher than the base ocean freight. Quite contrary to popular belief, the volume of auxiliary shipping charges in South Asian countries is found to be relatively low. For example, cargo originating at Japan destined to Sri Lanka had to pay about US$ 231 (11.94 percent of the total shipping costs) as auxiliary charges, and the same originating at China destined to India incurred US$ 302 (13.11 percent of the total shipping costs) towards auxiliary charges in 2004.

Table 4: Ocean Freight and Auxiliary Charges in Asia in 2004

Origin country	Destination country	Base ocean freight*	Auxiliary charges*	BOF-AC ratio#	Origin country	Destination country	Base ocean freight*	Auxiliary Charges*	BOF-AC ratio#
		(%)					(%)		
Hong Kong	Singapore	52.71	47.29	89.70	Thailand	China	79.80	20.20	25.32
Hong Kong	Sri Lanka	71.08	28.92	40.68	Thailand	Singapore	71.27	28.73	40.32
Hong Kong	India	71.57	28.43	39.72	Thailand	Sri Lanka	77.36	22.64	29.27
Hong Kong	Malaysia	35.74	64.26	179.80	Thailand	Japan	75.23	24.77	32.93
Hong Kong	Indonesia	64.44	35.56	55.18	Thailand	Malaysia	73.28	26.72	36.46
Hong Kong	Thailand	62.28	37.72	60.56	Thailand	Indonesia	69.32	30.68	44.27
Hong Kong	Japan	46.88	53.12	113.30	Thailand	India	76.23	23.77	31.18
Hong Kong	Korea	40.27	59.73	148.30	Thailand	Hong Kong	63.97	36.03	56.33
Hong Kong	Philippines	43.15	56.85	131.72	Thailand	Korea	69.87	30.13	43.12
Hong Kong	Vietnam	48.08	51.92	107.99	Thailand	Philippines	76.72	23.28	30.34
Hong Kong	Taiwan	63.62	36.38	57.18	Thailand	Vietnam	86.08	13.92	16.17
Japan	China	55.21	44.79	81.13	Thailand	Taiwan	61.88	38.12	61.60
Japan	Singapore	50.34	49.66	98.63	Singapore	China	60.57	39.43	65.10
Japan	Sri Lanka	88.06	11.94	13.56	Singapore	Malaysia	48.70	51.30	105.35
Japan	India	75.37	24.63	32.68	Singapore	Sri Lanka	73.16	26.84	36.68
Japan	Malaysia	55.93	44.07	78.80	Singapore	Japan	70.74	29.26	41.36
Japan	Indonesia	53.57	46.43	86.68	Singapore	Thailand	46.12	53.88	116.84
Japan	Thailand	51.58	48.42	93.87	Singapore	Indonesia	34.89	65.11	186.58
Japan	Hong Kong	32.01	67.99	212.44	Singapore	India	68.18	31.82	46.68
Japan	Korea	48.79	51.21	104.97	Singapore	Hong Kong	36.79	63.21	171.84
Japan	Philippines	62.41	37.59	60.24	Singapore	Korea	50.12	49.88	99.51
Japan	Vietnam	71.65	28.35	39.56	Singapore	Philippines	73.93	26.07	35.26
Japan	Taiwan	35.15	64.85	184.52	Singapore	Vietnam	67.50	32.50	48.16
Indonesia	Shanghai	64.51	35.49	55.01	Singapore	Taiwan	34.86	65.14	186.89
Indonesia	Singapore	52.35	47.65	91.02	Korea	China	61.37	38.63	62.95
Indonesia	Colombo	76.99	23.01	29.89	Korea	Malaysia	58.63	41.37	70.55
Indonesia	Tokyo	72.07	27.93	38.75	Korea	Sri Lanka	79.72	20.28	25.44
Indonesia	Thailand	58.67	41.33	70.45	Korea	Japan	59.86	40.14	67.06
Indonesia	Malaysia	52.84	47.16	89.26	Korea	Thailand	61.04	38.96	63.84
Indonesia	India	77.90	22.10	28.38	Korea	Indonesia	57.76	42.24	73.13
Indonesia	Hong Kong	53.37	46.63	87.38	Korea	India	78.68	21.32	27.09
Indonesia	Korea	51.33	48.67	94.82	Korea	Hong Kong	51.60	48.40	93.80
Indonesia	Philippines	71.38	28.62	40.09	Korea	Singapore	55.73	44.27	79.45
Indonesia	Vietnam	75.88	24.12	31.79	Korea	Philippines	71.19	28.81	40.48
Indonesia	Taiwan	47.34	52.66	111.25	Korea	Vietnam	80.20	19.80	24.69
Malaysia	China	64.54	35.46	54.94	Korea	Taiwan	40.57	59.43	146.50
Malaysia	Singapore	54.75	45.25	82.66	China	Japan	68.78	31.22	45.39
Malaysia	Sri Lanka	80.80	19.20	23.76	China	Singapore	62.37	37.63	60.33
Malaysia	Japan	82.63	17.37	21.02	China	Sri Lanka	86.89	13.11	15.09
Malaysia	Thailand	56.82	43.18	76.00	China	India	86.89	13.11	15.09
Malaysia	Indonesia	53.50	46.50	86.90	China	Malaysia	73.46	26.54	36.12
Malaysia	India	82.06	17.94	21.87	China	Indonesia	62.53	37.47	59.92
Malaysia	Hong Kong	33.72	66.28	196.55	China	Thailand	76.92	23.08	30.00
Malaysia	Korea	54.77	45.23	82.58	China	Hong Kong	53.68	46.32	86.27
Malaysia	Philippines	74.50	25.50	34.23	China	Korea	67.47	32.53	48.21
Malaysia	Vietnam	65.63	34.37	52.37	China	Philippines	81.18	18.82	23.19
Malaysia	Taiwan	50.90	49.10	96.47	China	Vietnam	87.30	12.70	14.55
					China	Taiwan	58.00	42.00	72.41

Notes: * As percentage of total freight in bilateral pairs. Other charges include all shipping charges except ocean freight as indicated in Table 2. Calculated based on shipping rates provided by the Maersk Sealand for the year 2004 for movement of a container vessel among 10 countries as listed in this paper. # Ratio between base ocean freight and auxiliary charges.

Therefore, as shown in Table 2, the auxiliary shipping charges have witnessed steep rise in recent years, which is likely to be offsetting the gains arising from tariff liberalisation, and making the entire trade costlier. A major part of these charges like documentation fees, government taxes and levies, etc. are the 'soft' barriers to trade and very much explicit in the system, on which traders (exporters and importers) have less control. While some auxiliary charges, such as terminal handling charges, are market driven, government duties and levies (similar to tariffs) is very much *ad hoc* and offers less 'economic rationale'. Apparently, the auxiliary charges are relatively higher among the ports of Hong Kong, Japan and most of the countries located in Northeast and Southeast Asia, where the volume of two-way trade is also very high. Therefore, what follows is that auxiliary shipping charges are increasingly becoming critical to trade in Asia, which should be seen unambiguously as explicit barriers to merchandise trade.

5. OLS and 2SLS Estimation Results

Tables 5 shows the estimation results of equation (9) for two scenarios of transport costs: one using equation (4) and another using equation (5). The explanatory variables of interest are II, TC and T in equation (9). We expect that the TC, T and II are negatively correlated with the volume of imports, respectively.[19] The gravity model performs well and most of the variables do have expected signs. The results show that the volume of import is inversely proportional to the II, TC, and T. Variables being in natural logarithms, estimated coefficients capture their elasticity. Given large cross-section nature of the data at 4-digit HS for the year 2004, estimated gravity model explains 13 percent of the variation in direction of trade flows, when equation (4) is considered to measure transport costs, and about 55 percent of the variation in direction of trade flows, when we use equation (5).

The volume of imports is increasing in GDP and deceasing in the distance. But this is a rather common phenomenon as we are dealing with aggregate behaviour. The most interesting result is the strong influence of components of trade costs on trade. The higher the transport costs, and tariffs between each pair of countries, the less they trade. Significance of transport costs using equation (5) always found to be higher than that estimated by equation (4). Coefficient of transport costs is statistically significant at 1 percent level in Model 2 and they are also negative. It also indicates that trade-weighted transport costs using ocean freight through equation (5) seems to be a better method compared to conventional way to estimate transport costs using equation (4) in our case.

With 12,051 observations at 4-figit HS (Model 2 in Table 5), we found variables representing trade costs such as tariff, infrastructure, and transport costs are significant, and carry usual sign thereby showing appropriate relationship between trade and trade costs components. Estimated coefficients indicate that a reduction in tariff and transport costs by 10 percent, each would increase bilateral trade by about 1.6 and 5.7 percents, respectively. Therefore, propensity to increase the trade will be higher with reduction of transport costs, rather than tariff reduction.

Table 5: OLS Results at 4-digit HS for the Year 2004

	Model 1[#]		**Model 2[$]**	
	Coefficient	**t-value**	**Coefficient**	**t-value**
GDP of importing countries	0.107***	3.720	0.059**	2.350
GDP of exporting countries	0.488***	20.440	0.394***	21.230
Infrastructure of importing countries	-0.421***	-7.500	-0.586***	-12.090
Infrastructure of exporting countries	-0.054*	-1.990	-0.148***	-5.930
Weighted tariff	-0.276***	-13.830	-0.161***	-9.450
Trade-weighted transport costs[$]			-0.571***	-11.620
Trade-weighted transport costs[#]	-0.021*	-1.940		
Remoteness of importing countries	-0.001	-0.010	-0.680***	-8.260
Remoteness of exporting countries	-0.638***	-8.720	-0.929***	-15.150
Distance	-0.420***	-9.970	-0.573***	-15.570
FTA Dummy	0.323***	5.900	0.179***	3.970
Adjacency Dummy	0.163**	2.260	0.072	1.290

[19] The usual caveat is that in our particular case, we took an inverse measure of II in the regression so that an increase in II is expected to be associated with an increase in the TC, and vice versa.

Language Dummy	0.114	1.570	0.117*	2.000
Country effect				
China	0.693***	4.940	0.579***	9.580
Hong Kong	Insignificant		Insignificant	
India	Insignificant		Insignificant	
Indonesia	0.087	1.080	-0.212**	-2.810
Japan	Insignificant		Insignificant	
Korea	-0.488***	-6.340	-0.964***	-13.750
Malaysia	Insignificant		Insignificant	
Singapore	Insignificant		Insignificant	
Thailand	0.119*	1.940	0.241***	4.570
No of observations	20533		12051	
Adjusted R^2	0.130		0.555	

Notes: #Estimated using equation (4). $Estimated using equation (5). *Significant at 10 percent level. ** Significant at 5 percent level. ***Significant at 1 percent level.

Infrastructure quality is also an important determinant of trade flows. We found that the quality of infrastructure has a strong impact on trade. In our case, we found infrastructure qualities of both importing and exporting countries are statistically significant. Further deterioration of infrastructure quality will hamper trade flows. In other words, an improvement of current state of infrastructure by 10 percent in both exporting and importing countries will lead to rise in imports by 5.9 percent in importing countries and exports by 1.5 percent in exporting countries.

What is interesting is that preferential and/or free trade arrangement among the Asian countries has positively influenced the trade. The significant coefficient of FTA dummy tells that trade in Asia has benefited from the PTA/FTA environment. The estimated coefficient also indicates that trade in the present context is not much influenced by geographical contiguity as adjacency dummy appears with positive sign but statistically insignificant, whereas language similarity does influence trade as reflected in estimated positive and statistically significant coefficient. Therefore, countries that speak the same language would trade more, does hold in this case.

Models 1 and 2 in Table 5 report the results including remoteness of both exporting and importing countries. Coefficients of remoteness and distance are significant with unchanged negative signs, thereby indicating a country's distance from its trading partner and relative remoteness from rest of the world which have clear negative effect on imports. Therefore, the importance of distance is not diminished, even if we include quality of infrastructure. Since distance is a proxy for trade costs where trade costs, according to several studies quoted in this paper, are largely determined by the quality of infrastructure, this is somewhat surprising. It is likely that better infrastructure and lower transport costs first and foremost increase the trade volume, while the distance is as important as before for the distribution of trade on individual trading partners.

The sign of country effects is a reflection of current trade situation. Country effects have also appeared significantly in case of China, Indonesia, Korea and Thailand. China and Thailand show positive and significant country effects, while the same in case Indonesia and Korea are negative and significant. The reason is large or medium sized countries like China and Thailand, which are major producers and exporters, have much to influence the trade in Asia, thus showing positive and significant country effects. On the other hand, countries like Indonesia and Korea are still not able to get adequate benefits due to the presence of comparatively higher trade barriers such as higher tariffs and transport costs. It may also be inferred that countries with negative and significant country effect (here, for example, Indonesia and Korea) indicate low exploitation of trade potentiality and high presence of trade barriers.[20]

Next, we deal with the 2-stage least square estimates (2SLS) which addresses more precisely the potential problem of omitted variable bias and endogeneity. The results are reported in Table 6. In fact robustness of trade costs components has gone up, even though marginally, as can be observed in Table 6. The results differ from those presented in Table 5, and the explanatory power of the model has also improved, though marginally. This result holds when we deal with the potential endogeneity of the variable transport costs by using a number of ports engaged in trade in bilateral pair as instrument.

Table 6: 2SLS Results at 4-digit HS for the Year 2004

	Model 1[#]		**Model 2[$]**	
	Coefficient	**t-value**	**Coefficient**	**t-value**
GDP of importing countries	0.014	0.410	0.150***	4.950
GDP of exporting countries	0.325***	9.390	0.112***	3.800
Infrastructure of importing countries	-0.279***	-4.640	-0.341***	-6.550
Infrastructure of exporting countries	-0.008	-0.290	-0.170***	-6.830
Weighted tariff	-0.276***	-13.830	-0.159***	-9.360
Trade-weighted transport costs[$]			-0.574***	-7.700
Trade-weighted transport costs[#]	-0.024**	-2.210		
Remoteness of importing countries	-0.056	-0.600	-0.727***	-8.880
Remoteness of exporting countries	-0.504***	-6.640	-0.726***	-11.500
Distance	-0.530***	-11.680	-0.786***	-19.460
FTA Dummy	0.292***	5.310	0.014	0.300
Adjacency Dummy	-0.006	-0.080	-0.036	-0.640
Language Dummy	0.171**	2.330	0.066	1.130
Country effect				
China	0.738***	5.260	0.470***	7.750
Hong Kong	Insignificant		Insignificant	
India	Insignificant		Insignificant	
Indonesia	-0.015	-0.190	-0.378***	-4.970
Japan	Insignificant		Insignificant	
Korea	-0.555***	-7.160	-1.029***	-14.720
Malaysia	Insignificant		Insignificant	
Singapore	Insignificant		Insignificant	
Thailand	0.300***	4.450	0.548***	9.460
Instrument: No of seaports for exports and imports in bilateral pair	0.572***	6.460	1.063***	12.410
No of observations	20533		12051	
Adjusted R^2	0.132		0.560	

Notes: # Estimated using equation (4). $ Estimated using equation (5). *Significant at 10 percent level. ** Significant at 5 percent level. ***Significant at 1 percent level.

[20] However, one can not refute the problems of multicolinearity associated with the results.

The 2SLS estimates indicate that trade costs components, namely, infrastructure quality, transport costs, and tariffs, have statistically significant negative impact on the volume of imports. The coefficients of these trade costs components increase marginally, compared with the OLS results. Therefore, 2SLS estimates imply that 10 percent saving in transport costs and 10 percent reduction in tariffs will likely to increase imports by about 6 and 2 percents, respectively. At the same time, 10 percent improvement in infrastructure quality will increase exports by 2 percent (in exporting countries) and imports by 3 percent (in importing countries). Number of ports being the instrument variable has appeared with significant and positive sign. This lead to conclude that the problems of omitted variable bias and the endogeneity is taken care, to some extent, in the model.

Therefore, a country's infrastructure quality and transport costs are the two main determinants of cross-country variations of trade flows in the present context. Interestingly, these two barriers are explicitly related with environment, where the rise in transport costs is an outcome of the environment and policy constraints on the regional trade and infrastructure system. Nevertheless, these findings provide sufficient indications of presence of trade costs in Asia.

To summarize, there is strong empirical evidence that trade costs components, namely, infrastructure quality, tariffs, and transport costs are important for international trade patterns. Indeed, as product differentiation, vertical specialization and international outsourcing have become more prominent in world trade, the relative importance of these costs as a determinant of international trade has thus increased in Asia.

6. Summary and Conclusions

Considering earlier studies, findings of this paper too provide sufficient indications of the presence of trade costs particularly in context of Asian trade. This paper has provided additional measures of bilateral trade restrictions and empirical estimates using the gravity model. First, we introduce infrastructure quality of the trading partners that we believe have an impact on trade. Second, we introduce bilateral tariffs, which are largely ignored in the empirical gravity literature in context of Asia. Third, in order to ensure unbiased estimates, we used resistance parameters. Fourth, in order to find out the relative robustness of the transport costs, we used trade-weighted transport costs considering cross-country shipping rates, which is also a new entry in the gravity literature. Fifth, in order to check the potential problem of omitted variable bias and endogeneity, we use simultaneous equation modelling.

The analysis carried out in this paper provides sufficient evidences to ascertain that variations in transport costs along with infrastructure facilities have significant influence on regional trade flows in Asia. A 10 percent saving in transport costs is likely to increase trade by about 6 percent. Further, we found that tariffs have a relatively large and negative impact on trade. We also found that the importance of distance is not diminished, even if we include quality of infrastructure and transport costs. The findings of this paper indicate that the trade in Asia has been benefited from FTAs, whereas the trade in present context is not much influenced by geographical contiguity. Further, countries that speak the same language would trade more does hold in our case in this study. Countries like China, Indonesia, Korea and Thailand being major regional producers and exporters, influence the Asian trade more than others in recent years. However, countries such as Indonesia and Korea are yet to reap much benefit from freer trade environment due to low exploitation of trade potentiality and high presence of trade barriers. We also highlighted that a country's infrastructure quality and transport costs are the two main determinants of cross-country variations of trade flows in the present context. Interestingly, these two barriers are explicitly related to environment where the rise in transport costs is an outcome of the environment and policy constraints on the regional trade and infrastructure system.
Tariffs tend to be lower not only in Asia but also across most of the economies in the world. Attention is being paid towards trade and transport facilitation, to a varied extent, across the world. Asia is moving progressively into more complex and higher-value manufacturing, and greater integration into global production chains, logistics requirement have to be more sophisticated. The challenge for Asian countries is thus to identify improvements in logistics services and related infrastructure that can be achieved in the short-to-medium term and that would have a significant impact on competitiveness of these countries. Our results have important policy implications for Asian countries seeking to expand trade. These findings also have important policy implications for least developed countries too. If improvements in the quality of infrastructure in LDCs continue to lag behind the more developed countries, their share of world trade is likely to continue to decline.

In order to better inform policy-making process, future studies should attempt to establish the technological relationship between transportation costs and distance as we now have bigger vessels plying across Asian ports, and the region is witnessing more liberal trade environment. This study has considered some direct and indirect trade costs components but omitted infrastructure costs and also wholesale and distribution costs. Impact of infrastructure costs along with the wholesale and distribution costs thus need to be captured more accurately in the model. One of the supposed objectives of technological development and improved trade facilitation measures at ports and borders is to reduce costs of movement of goods across countries. In this paper, a plausible explanation has been given why ocean freight costs are penalising merchandise trade. However, due to limitation, individual components of ocean freight costs were not considered in the model. Therefore, future studies should be attempted to understand how the components of ocean freight costs (such as base ocean freight and auxiliary shipping charges) along with other trade barriers are affecting trade.

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Appendix 1

Estimated Weights

Infrastructure Indicator	**Factor Loadings 1**	**Factor Loadings 2**
Air transport freight (million tons per km)	0.81	0.57
Air transport, passengers carried (percentage of population)	0.88	-0.38
Aircraft departures (percentage of population)	0.91	-0.36
Country's percentage share in world fleet (percent)	0.36	0.69
Container port traffic (TEUs per terminal)	0.53	0.69
Electric power consumption (kwh per capita)	0.90	0.10
Fixed line and mobile phone subscribers (per 1,000 people)	0.93	0.02
Railway length density (km per 1000 sq. km of surface area)	0.92	-0.31
Road length density (km per 1000 sq. km of surface area)	0.90	-0.26
Expl.Var (% of total)	0.67	0.19

Note: Factor Loadings (Unrotated)

Infrastructure Index and Ranks in 2004

Country	**Score**	**Rank**
Singapore	6.01	1
Hong Kong	5.60	2
Japan	4.23	3
Korea	3.22	4
China	1.92	5
Malaysia	1.74	6
Thailand	0.99	7
India	0.59	8
Philippines	0.59	9
Indonesia	0.46	10
Vietnam	0.40	11

Appendix 2

Discrepancy in Transport Costs Estimation at 4-digit HS

Importer	Total number of observations at HS 4	Total number of observations with positive transport costs at HS 4	Total number of observations with zero/negative/missing transport costs at HS4
China	6380	2847	3533
Hong Kong	5734	2626	3108
India	5652	2566	3086
Indonesia	6213	2916	3297
Japan	5582	2548	3034
Korea	5705	2599	3106
Malaysia	6736	2924	3812
Singapore	6937	2755	4182
Taiwan	5517	2266	3251
Thailand	6463	2584	3879
Grand Total	60919	26631	34288

Data Classification

Sector	Corresponding 2-digit HS	Remarks
Food	16 - 23	Taken all at HS 4
Chemical	28 - 40	
Textile and clothing	41 - 67	
Machinery	84	Excluding HS 8415, 8418, 8471, 8473
Electronics	85, 90, 91, 92, 95	Including HS 8415, 8418, 8471, 8473
Auto components	87	Taken all at HS 4
Steel and metal	72 - 83	
Transport equipment	86, 88, 89	

Appendix 3

Sources of Data

Particular	**Source**
Bilateral trade	UN COMTRADE, UNSD
Bilateral tariff	WB WITS, UNCTAD TRAINS
GDP, GDP per capita, surface area, population, openness, exchange rate, etc.	WB WDI 2006
Distance	Great circle distance, http://www.wcrl.ars.usda.gov/cec/java/lat-long.htm
Infrastructure variables: (i) railway length, (ii) road length, (iii) air transport freight, (iv) air transport passengers carried, (v) aircraft departures, (vi) container traffic, (vii) fixed line and mobile phone subscribers, (viii) internet users, and (ix) electric power consumption	WB WDI 2006
Shipping rates	Maersk Sealand, Denmark, http://www.maerskline.com