Enhancing Asia's Trade:
Price and Non-Price Barriers Revisited*[$]

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Abstract

In a supply-constrained region like Asia, promoting exports has always been a challenge particularly at a time when Asia's trade has been severely affected by lack of external demand. This study argues that price barriers have now taken a new shape which may likely to generate differential impacts on trade flows. The size and shape of price barriers would be higher if NTBs, applied by the countries in ongoing crisis period, were counted. One of the conclusions of this study is that 'price' barrier is still more important than 'non-price' barrier in enhancing Asia's trade and regional integration. The higher the price barrier between countries in a pair, the less they trade. In other words, a 10 percent increase in the ad-valorem price (transport and tariff) lowered trade by 6 percent. Tariff and transport costs, each considered separately, also influence the trade flow in the same direction, to more or less the same extent. Another conclusion of this study is that incidence of inland transportation cost is much higher than international transportation cost. Costlier inland transportation limits and taxes trade in the way tariffs do. There are indications of huge domestic infrastructure bottlenecks in countries in Asia. Based on direct and indirect evidence related to trade barriers, this study concludes that complementary trade policies focusing on price and non-price barriers have immense importance in enhancing international trade and integration in the post-crisis period.

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1. Introduction

The ongoing global economic crisis has put enormous pressure on exporters to increase their productivity and reduce costs so as to secure their share of a shrinking global market (UNESCAP, 2009). Enormous current account deficits in the US, which have facilitated export-led growth in Asia in past, would likely to fall.[1] At the same time, rapid economic growth in China and India will continue, continuing the re-orientation of trade toward Asia.[2] Critiques argue that regional trade in such a situation will eventually rise in Asia and there is thus need for regional demand driven growth rebalancing.[3] In past, Asia's growing international and regional economic networks through exchange of goods, services and capital has been fostered by the development and efficient uses of supporting infrastructure, both hard (physical) and soft (institutional). The importance of tariffs as barriers to trade has therefore gradually declined; however, high tariffs still exist for certain sensitive products, and there is a strong presence of non-tariff barriers (NTBs) including high transaction costs in the region. Therefore, the regional demand from a rebalancing of growth might be suboptimal if not supported by lower trade costs in Asia.

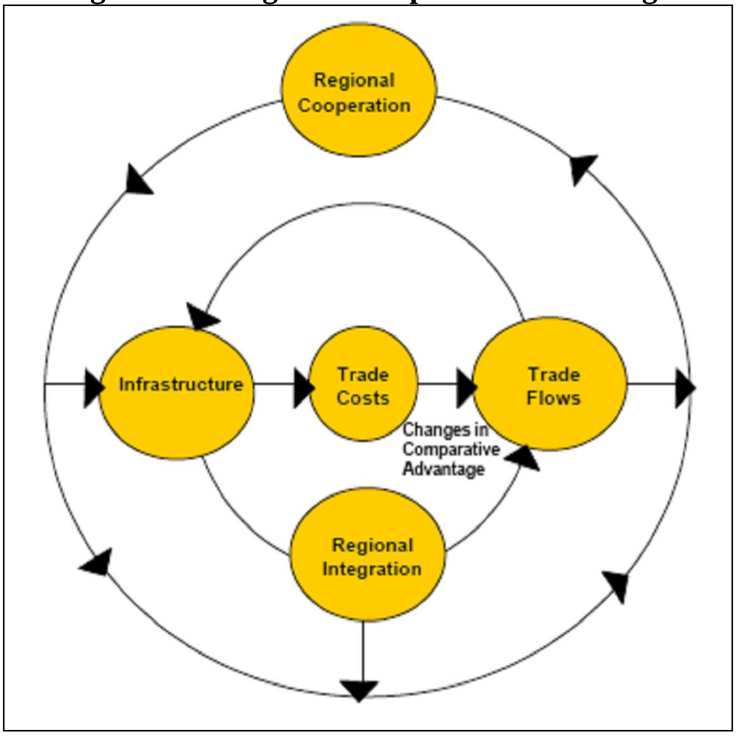
In a supply-constrained region like Asia, promoting exports has always been a challenge particularly at a time when trade has been severely affected by lack of external demand. Although the current export slowdown is a temporary phenomenon, it surely has some long-term trade (and regional integration) policy implications. Any slowdown in trade might influence trade costs differently across countries due to volume, price and scale effects of trade. More importantly, 'price' barriers become stronger in post-crisis period, thus having the tendency to negate the benefits of trade liberalization initiated in the pre-crisis period, to bring the trade cost in countries to the pre-crisis level, and to encourage further external distortions. In this paper, we attempt to understand the impact of 'price' and 'non-price' barriers on Asia's trade.

There is also another important point for which the study on trade costs is very important. Brooks (2008) argued that as production services become increasingly fragmented and traded internationally, cooperation among the economies participating in those production networks becomes more crucial to maintain or raise an individual host country industry's competitiveness in supplying those services. Infrastructure investment that reduces trade costs facilitates regional economic integration through trade and investment expansion, which motivates regional cooperation, including cooperation in infrastructure development, generating a virtuous cycle. A simple depiction of the relationships, adapted from Brooks (2008), is presented in Figure 1. The infrastructure investment (which many countries have undertaken as stimulus package in the crisis period) may not lead to facilitate trade flows if it is not supported by lower trade costs. Countries eventually will loose their journey in gaining comparative advantages due to rise in trade costs – price and otherwise. Besides, rising trade procedures and processes would ruin

[1] Refer, Hummels (2008), according to whom it was led to major cargo imbalances across the world.
[2] This would push up the demand for and prices of oil in coming days. These oil price rises will continue to disadvantage air shipping as they have done since 2000 (Hummels, 2000).
[3] Refer, for example, Kawai (2009), Park (2009).

trade transaction.[4] Importantly, inefficient trade procedures may lead to the *de facto* exclusion of a country from regional and global production networks and value chains, significantly affecting that country's trade and investment prospects as well as opportunities for its enterprises to climb up the value chain. Asia's trade-supporting infrastructure therefore needs massive improvements to maintain the competitiveness of existing production networks and widen their benefits, notably to inland parts of Asia (Brooks, 2009; ADB-ADBI, 2009).[5]

Figure 1. Changes in Comparative Advantage



Source: Brooks (2008)

Rest part of the paper is organized as follows. Section 2 presents the motivation of the study. Data and methodology are briefed in Section 3. Which barriers important – price or non-price? We answer this question in Section 4. Conclusions are briefed in Section 5.

2. Why revisiting price and non-price barriers to trade?

A set of literature devoted examined the direct evidences on border costs shows that tariff barriers are now low in most countries.[6] On average (trade-weighted), they are less than 5 per cent for rich countries and, with a few exceptions, between 10 and 20 per cent for

[4] Although estimates vary widely, it is generally found that trade transaction costs (TTC) associated with import and export procedures (excluding tariffs) amount to 7 to 10 percent of the value of goods traded (Engman, 2009).

[5] The whole set of empirical studies show that Asia has been suffering more due to high costs of transportation, and countries in Asia with better trade-supporting infrastructure trade more than those lack in it (Brooks and Hummels, 2009; Brooks and Menon, 2008).

[6] See, for example, Anderson and van Wincoop (2004).

developing countries.[7] While the world has experienced a drastic fall in tariffs over the last two decades, several barriers that penalize trade remain. Some are referred to as "soft" barriers, others as "hard" barriers. While "soft" barriers are addressed through trade and business facilitation, and institutional measures, "hard" barriers which are considered to comprise physical or infrastructure barriers, are addressed through transport facilitation measures. The costs arising from these two broad types of trade barriers can be clubbed together and referred to collectively as trade costs.

Trade costs are often cited as an important determinant of trade volume. High trade costs create obstacles to trade and impede the realization of gains from trade liberalization.[8] Most of the studies on trade costs show that integration is the result of reduced costs of transportation in particular and other infrastructure services in general. Supply constraints are the primary factors that have limited the capacity of many developing and least developed countries to exploit the trade opportunities arising from trade liberalization. An optimal gain from trade, therefore, depends not only on tariff liberalization but also on the quality of infrastructure and related services associated with cross-border trading.

Trade costs have large welfare implications. Current policy-related costs are often valued at more than 10 per cent 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 studies, for example Francois and others (2005), have estimated that for each 1 percent reduction of trade transaction costs, world income could increase by $30 billion to $40 billion.[9] The gains from streamlining customs procedures have exceeded those resulting from trade liberalization, such as tariff reduction. An APEC Study (2002) indicated that gains from effective trade facilitation accounted for about 0.26 percent of real gross domestic product (GDP) of APEC members (about $45 billion) for the year 2006, while the gains from trade liberalization for 2006 would be 0.14 percent of real GDP (about $23 billion).[10] The same study also indicated that efforts to achieve APEC's commitment to reduce trade-related transaction costs by 5 percent by 2006 could raise APEC's GDP by 0.9 percent (US$154 billion a year in 1997 prices) and lift real consumption to 5.5 percent above what it would otherwise be. Wilson and others (2002) estimated that raising trade facilitation performance across the region to half the level of the APEC average could result in a 10 percent increase—worth roughly $280 billion— in intra-APEC exports.

The cost of international trade is a crucial determinant of a country's trade competitiveness. The doubling of a country's transport costs leads to a drop in its trade of 80 per cent or even higher (Limão and Venables 2001). In many cases, the effective rate

[7] Refer, Anderson and van Wincoop (2004). WTO (2006a), WTO (2007), and ITC (2007)

[8] A growing literature in this regard has documented the impact of trade costs on the volume of trade (see, Duval 2007; Duval and Uttapam, 2009). Seminal studies carried out on this topic in recent years include: Hummels (1999, 2007), Limão and Venables (2001), Anderson and van Wincoop (2004), and Brooks (2008).

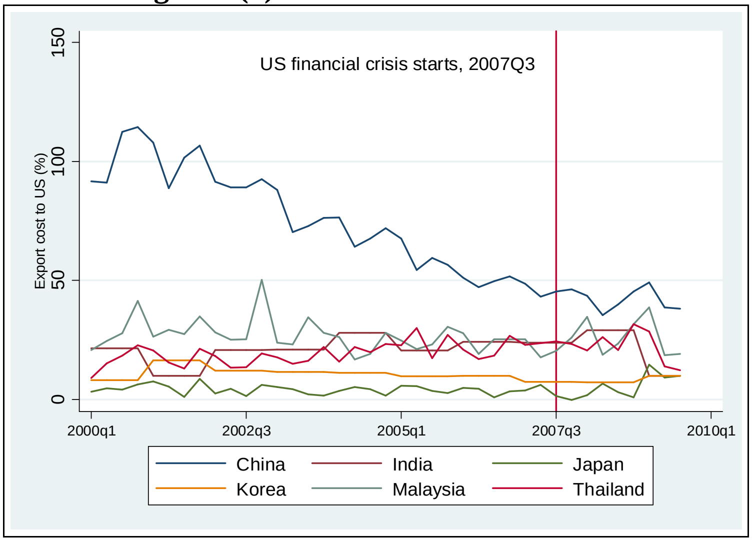
[9] See also APEC (2002), Walkenhorst and Yasui (2003).

[10] Refer, APEC (2002).

of protection provided by the international transport costs[11] was found to be higher than that provided by tariffs. Thus, international transportation costs represent a greater barrier than tariffs, and, in turn, a more binding constraint to greater participation in international trade.[12] However, progress has been made in reducing international transport costs. Among the Asian countries, international transport costs vary widely from less than 5 percent for most of the Southeast Asian countries to over 20 percent for Bhutan (UNESCAP, 2009). The most progress was achieved in Southeast Asia, the only subregion to outperform the world average (UNESCAP, 2009).

The difference between import price (*cif*) and export price (*fob*) has been used as an indicator of trade costs, capturing broadly defined international transport costs. A progressive reduction in the *cif* to *fob* price gap can be interpreted as an increase in international trade and transport efficiency, particularly if this is achieved through improved port and related international transport infrastructure and services available in the exporting country. However, slowdown in import demand in US during the crisis years has made the exports to US more expensive in relative terms (Figure 1). Changes in slope (pre-crisis negative to post-crisis positive) and the corresponding intercepts in Figure 1(b) confirm this.

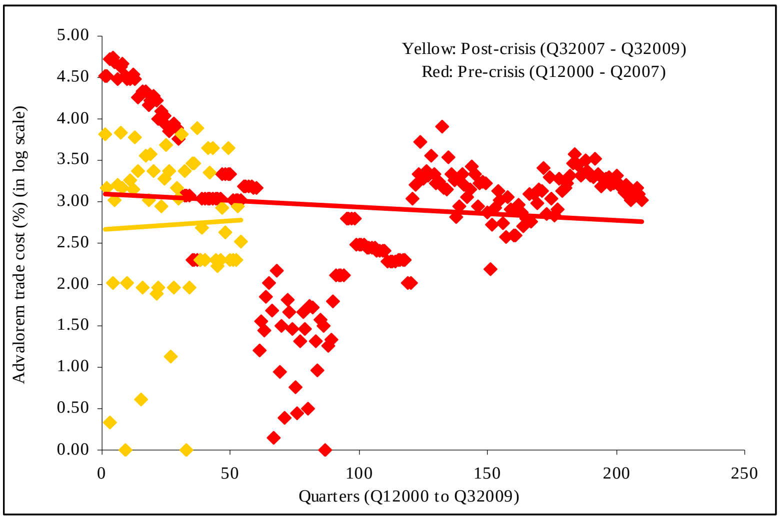
Figure 1(a): Advalorem Trade Costs*



Note: *For exports to US
Source: Quarterly data collected from IMF (2010)

[11] In the case of a cross-border shipment of goods, transport costs comprise two major elements: (a) international transport costs, which include costs associated with the shipment of goods from one country to another; and (b) the inland (domestic) transport costs, which include the costs of inland transportation of merchandise in both exporting and importing countries.
[12] According to the World Bank (2001), for 168 of 216 trading partners of the United States of America, transport costs barriers outweighed tariff barriers. For the majority of countries in sub-Saharan Africa, Latin America and the Caribbean, and a large part of Asia, the transport cost incidence for exports is five times higher than the tariff cost incidence.

Figure 1(b): Global Crisis Making Asian Exports to US Expensive



Note: Advalorem trade costs = [(Import price – Export price)/Export price]*100, where *cif* and *fob* prices represent import and export prices of trade, respectively, taken at current price. Figure 1(b) considers 6 Asian countries of Figure 1(a).
Source: Quarterly data collected from IMF (2010)

What follows is that the price barriers have now taken a new shape which may likely to generate differential impacts on trade flows. The size and shape of price barriers would be higher if NTBs, applied by the countries in the crisis period, were counted. Therefore, complementary trade policies focusing on price and non-price barriers have immense importance in enhancing international trade and integration.

In view of the above, the purpose of this study, which is based on direct and indirect evidences related to trade barriers, is to explore responses to these questions, thereby enhancing the understanding of the role trade costs play in enhancing Asia's trade competitiveness. Such an understanding could facilitate initiatives to integrate production across Asia as well as those aimed at promoting deeper trade integration in the region.

3. Data and methodology

We attempt to assess the impact of trade costs (barriers to trade) on trade flows in the context of six Asian countries, namely, China, India, Japan, Malaysia, Korea and Thailand. In other words, we test how changes in trade cost components affect import demand. We estimate the impact of transport costs and other barriers on regional trade and competitiveness, controlling for other variables, in the framework of a gravity model. We deal with those barriers (components of trade costs) which are both imposed by price (e.g. freight and tariff rates) and non-price (infrastructure) factors.

Of all the components of trade transaction, transport cost has been studied the most extensively. Generally, there are two approaches to transport modeling in trade: (a) one in which transport is modeled implicitly with the traded goods;[13] and (b) one which involves explicit transport sector modeling. The former relates to price factors, while the latter deals predominantly with non-price factors. As trade costs are heavily dependent on both types of factors, we explore both approaches here.

Here, a world of *N* countries and a continuum of differentiated goods are considered. It is assumed that countries specialize in a range of goods and that consumers have constant elasticity of substitution (CES) preferences.[14] Following Anderson and van Wincoop (2003 and 2004), a theoretically consistent gravity model is then applied for export between country *i* and country *j* in sector *k* (X^k_{ij}).[15] It takes the following shape:

$$X_{ij} = \frac{Y_i Y_j}{Y^w}\left(\frac{t_{ij}}{\prod_i P_j}\right)^{1-\sigma} \qquad (1)$$

where Y_i and Y_j are the income levels of countries *i* and *j*,[16] Y^w is total world income and $\sigma > 1$ is the elasticity of substitution. Precisely, σ is the elasticity of substitution parameter between all goods in the consumption utility function. The trade cost factor, $t_{ij} \geq 1$, is defined as the gross bilateral cost of importing a good (one plus the tariff equivalent), so that if p_i is the supply price of a good produced in country *i*, then $p_{ij} = t_{ij}p_i$ is the price faced by consumers in country *j*. $\prod_i$ and P_j are country *i*'s outward and country *j*'s inward multilateral resistance variables, respectively. These capture the countries' average international trade barriers. The important insight of the model is that bilateral trade flows X_{ij} depend on the bilateral trade barrier t_{ij} relative to average international trade barriers. Therefore, trade is a product of the scale and structure of partner economies, their geographic, political and institutional proximity, and openness of their economies to trade, and trade barriers.

As discussed, we introduce both price and non-price components of t_{ij} in equation (1). We assume from equation (1) that t_{ij} can be divided into several components, namely, infrastructure quality, tariff barriers, transport costs, and other border effects. Assuming monopolistically competitive market, the term (1- σ) should be negatively related to the volume of trade. We assume that the shipment of a container from country *i* to country *j* incurs three major costs: (i) inland transportation costs at exporting country *i* (t_i^{Inl}); (ii) international transportation costs (port to port) between *j* and *i* (t_{ij}^{Int}); and (iii) inland transportation costs at importing country *j* (t_j^{Inl}). Therefore, equation (1) can be rewritten as:

[13] Transport is implicit in the "iceberg" model (Samuelson, 1954)—the most widely used. That model assumes that a part of the transported good is consumed in transportation.

[14] It is assumed that all goods are differentiated by place of origin and that each country is specialized in the production of only one good. Therefore, the 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).

[15] It follows Helble and others (2007).

[16] Aggregate sizes of import demand and export supply of countries *i* and *j* respectively. These terms are used to represent the supply capability of the exporter and the demand availability of the importer for a given period of time in a static sense.

$$X_{ij} = \frac{Y_i Y_j}{Y^w}\left(\frac{t_j^{Inl} + t_{ij}^{Int} + t_i^{Inl}}{\prod_i P_j}\right)^{1-\sigma} \quad (2)$$

In terms of the demand side trade, the final estimable equation is therefore expressed as follows:[17]

$$\ln X_{ij} = \sum_{i \neq j} \alpha_{ij} + \beta_1 \ln Y_i + \beta_2 \ln TII_i + \beta_3 \ln TII_j + \beta_4 \ln Port_i + \beta_5 \ln Port_j + \beta_6 \ln T_j^{Inl} + \beta_7 T_{ij}^{Int} + \beta_8 T_i^{Inl} + \beta_9 \ln TR_{ij} + \beta_{10} \ln ER_j + \beta_{11} \ln Distance + \beta_{12} Adj + \beta_{13} Lan + \beta_{13} RTA + \varepsilon_{ij} \quad (3)$$

On the impact of ***non-price*** barriers to trade, we have

$$\ln X_{ij} = \sum_{i \neq j} \alpha_{ij} + \beta_1 \ln Y_i + \beta_2 \ln TII_i + \beta_3 \ln TII_j + \beta_4 \ln Port_i + \beta_5 \ln Port_j + \beta_6 \ln Distance + \beta_7 Adj + \beta_8 Lan + \beta_9 RTA + \varepsilon_{ij} \quad (4)$$

whereas, on ***price*** barriers to trade, we consider

$$\ln X_{ij} = \sum_{i \neq j} \alpha_{ij} + \beta_1 \ln Y_i + \beta_2 \ln T_j^{Inl} + \beta_3 \ln T_{ij}^{Int} + \beta_4 \ln T_i^{Inl} + \beta_5 \ln TR_{ij} + \beta_6 \ln ER_j + \beta_7 \ln Distance + \beta_8 Adj + \beta_9 Lan + \beta_{10} RTA + \varepsilon_{ij} \quad (5)$$

With explicit ***tariff*** and ***freight rates***, we revise the equation (5) as follows:

$$\ln X_{ij} = \sum_{i \neq j} \alpha_{ij} + \beta_1 \ln Y_i + \beta_2 \ln (T_{ij} + TR_{ij}) + \beta_3 \ln ER_j + \beta_4 \ln Distance + \beta_5 Adj + \beta_6 Lan + \beta_7 RTA + \varepsilon_{ij} \quad (6)$$

To understand the variability of ***inland and international transport costs***, we use:

$$\ln X_{ij} = \sum_{i \neq j} \alpha_{ij} + \beta_1 \ln Y_i + \beta_2 \ln(T_j^{Int} + T_i^{Inl}) + \beta_3 \ln TR_{ij} + \beta_4 \ln ER_j + \beta_5 \ln Distance + \beta_6 Adj + \beta_7 Lan + \beta_8 RTA + \varepsilon_{ij} \quad (7)$$

, and

$$\ln X_{ij} = \sum_{i \neq j} \alpha_{ij} + \beta_1 \ln Y_i + \beta_2 \ln (T_{ij}^{Int}) + \beta_3 \ln (TR_{ij}) + \beta_4 \ln ER_j + \beta_5 \ln Distance + \beta_6 Adj + \beta_7 Lan + \beta_8 RTA\ \varepsilon_{ij} \quad (8)$$

where i and j are importing and exporting countries, respectively; X_{ij} represents the bilateral import of country i from country j of commodity k; Y_i denotes the total import of country i from country j; *TII* represents the country's trade infrastructure, measured

[17] This equation closely follows equation (18) of Hummels (1999). Here, export supply capability (Y_j) is not included since we are considering imports in bilateral pair.

through an index; Port represents performance of a country's port; T_{ij} stands for transport costs (ad-valorem) for bilateral trade between countries *i* and *j*; TR_{ij} stands for the bilateral average (ad-valorem) tariff by country *i* for imports from country *j*; and ER_i represents the annual average exchange rate in exporting country ***i***. *Distance* is capital-to-capital distance between bilateral trading pairs. The parameters to be estimated are denoted byβ, and ε_{ij} is the error term.

The model considered here uses data for the years 2000 and 2008 at 4-digit HS for imports of six Asian countries, namely, China, India, Japan, Malaysia, Korea and Thailand. The model considers data at a bilateral level for all the variables for each country's individual partners. Appendix 1 presents commodity classifications. We use Maersk Sealand's freight rates to calculate inland and international transportation costs at bilateral level (see Appendix 2). By focusing on tariffs and transport costs, we cover a major portion of trade costs. Bilateral trade, transport costs, and tariffs are taken at 4-digit HS for the years 2000 and 2008. The pooled data set comprises about 61,290 observations, 16 identical commodity groups for each year and seven countries all through.[18] Appendix 3 provides the data sources, and Appendix 4 provides the note on *TII* and *Port*.

In this study, the decision to use either a fixed or random effects model was based on the Hausman χ^2 test.[19] For the fixed-effect specifications, we used the least squares dummy variable (LSDV) model, while the random-effect models are estimated using the generalized least squares (GLS) method, correcting for possible heteroscedastic errors and panel-specific serial correlation. Of the two models, the fixed-effect model (two-way) has appeared most significant. Before estimating the models, we have obtained a matrix of correlation coefficients among the explanatory variables to rule out any possibility of multicollinearity problems. Where such problems were detected, we excluded some of the variables.[20] The following regression diagnostics were carried out for both the models:[21] (i) linearity assumption between response variable and predictors was checked; (ii) statutory hypothesis tests were carried out on the parameter estimates; (iii) Ramsey tests were done to check model specification; (iv) normality of residuals was tracked through Kernel density plot; (v) all estimates were checked for heteroscedasticity through the Breusch-Pagan/Cook-Weisberg test for heteroscedasticity. Cameron and Trivedi's decomposition of IM-test was also used as an alternative; (vi) multicollinearity problems were checked by looking at partial correlations (see Appendix 6) and then by

[18] About 8.36 per cent of the total observations in the pooled framework show illogical values (missing, negative or extremely high); most such values (27 per cent) were observed in the category of fuels, mining and forest products.

[19] The Hausman test examines the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. If they are the same (insignificant P-value, Prob>chi2 larger than 0.05), it is safe to use random effects (Hausman, 1978).

[20] Appendix 5 presents partial correlations among dependent and independent variables (in natural logs).

[21] These text book-type diagnostics have been done through Stata 10. We ignore placing the results due to space constraints. However, the same can be made available to interested readers on request.

using variance inflation factor (VIF);[22], and (vii) the presence of serial correlation, if any, was detected through the Durbin-Watson (DW) test.

4. Barriers affecting trade flows in Asia: Estimated results

Tables 1 and 2 present estimation results for the two combined years (2000 and 2008) for two scenarios (price and non-price). We expect that the price (barrier) variables will be negatively correlated with the volume of imports, and non-price (barrier) variables will be positively related to imports, respectively. The estimated coefficients show elasticity, which is useful as an indicator of the effect of trade barriers on trade volumes. The model performs well, as most of the variables had the expected signs. Given large cross-section nature of the data at 4-digit HS for the years 2000 and 2008, estimated models (Table 1) explained about 81 per cent of the variations in the direction of trade flows when price variables were considered, and 85 per cent when non-price variables were analyzed (Table 2).

Table 1. Log-linear least squares estimates of import demand: non-price effects

Variables	Coefficient	t-value
$Port_i$ (Performance of importers' port)	0.121**	3.71
$Port_j$ (Performance of exporters' port)	0.410***	13.24
TII_i (Trade infrastructure of importer)	0.391***	17.62
TII_j (Trade infrastructure of exporter)	0.579***	32.13
Y_j (Importer market size)	0.348***	53.70
$Distance_{ij}$	-0.477***	17.237
Adjacency dummy	0.337***	14.56
Language dummy	0.210***	18.98
RTA dummy	0.193**	11.02
Number of observations	61,290	
Adj. R^2	0.810	

Notes: Dependent variable is log of import of goods (at 4-digit HS) in bilateral pair. Cross-section pooled for the years 2000 and 2008. Country fixed effect included in the model. *Significant at the 10 per cent level; **significant at the 5 per cent level; ***significant at the 1 per cent level.

The size of importers market has a positive impact on the volume of imports while the barriers, price as well as non-price, impede imports. The most interesting result is the strong influence that the ad-valorem price factor ($T_{ij} + TR_{ij}$) had on trade: the higher the price barriers between each pair of partners, the less they trade. In other words, a 10 per cent rise in ad-valorem price (transport and tariff) decreases trade by 6.17 per cent. Tariff and transport costs, considered separately, also influence the trade flow in the same direction, with more or less same magnitude, and the coefficients of price variables are

[22] As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation. Tolerance, defined as 1/VIF, is used by many researchers to check on the degree of collinearity. A tolerance value lower than 0.1 is comparable to a VIF of 10. It means that the variable could be considered as a linear combination of other independent variables (refer to Stata 10)

statistically significant. Thus, it may be said that 'price' barriers are still relatively higher than 'non-price' barriers of trade costs.

Table 2. Log-linear least squares estimates of import demand: price effects

Variables	Model 1		Model 2	
	Coefficient	t-value	Coefficient	t-value
T_{ij} (Transport)				
TR_{ij} (Tariff)			-0.276***	-16.190
T_{ij} +TR_{ij} (Transport + Tariff)	-0.617***	-24.390		
T_{ij}^{Int} +T_i^{Inl} (International transport + Inland transport of importer)			-0.225***	-32.920
T_{ij}^{Int} (International transport)				
ER_j (Exchange rate)	0.010*	2.360	0.005	1.680
Y_j (Importer market size)	0.417***	576.090	0.484***	396.870
$Distance_{ij}$	-0.601***	-12.883	-0.710***	-14.128
Adjacency dummy	0.235***	10.570	0.277***	10.490
Language dummy	0.487***	11.451	0.510***	10.459
RTA dummy	0.302**	5.432	0.343**	5.672
Number of observations	61,290		61,290	
Adj. R^2	0.851		0.851	
Variables	**Model 3**		**Model 4**	
	Coefficient	**t-value**	**Coefficient**	**t-value**
T_{ij} (Transport)			-0.075**	4.840
TR_{ij} (Tariff)	-0.251***	-15.550	-0.240***	-15.120
T_{ij} +TR_{ij} (Transport + Tariff)				
T_{ij}^{Int} +T_i^{Inl} (International transport + Inland transport of importer)				
T_{ij}^{Int} (International transport)	0.053**	4.790		
ER_j (Exchange rate)	0.011*	2.820	0.011*	2.800
Y_j (Importer market size)	0.485***	362.820	0.486***	361.320
$Distance_{ij}$	-0.573***	16.809	-0.519***	-15.187
Adjacency dummy	0.241***	9.000	0.235***	8.900
Language dummy	0.530***	11.091	0.558***	10.856
RTA dummy	0.337**	5.431	0.301**	5.80
Number of observations	61,290		61,290	
Adj. R^2	0.853		0.850	

Notes: Dependent variable is log of import of goods (at 4-digit HS) in bilateral pair. Cross-section pooled for the years 2000 and 2008. Country fixed effect included in the model. *Significant at the 10 percent level; **significant at the 5 per cent level; ***significant at the 1 per cent level.

International transport cost, when considered separately, had a positive sign and was significant at the 5 per cent level, thereby indicating that it is more important to address inland rather than international transportation costs. With given conditions, it may be said that when intra-Asian trade is becoming high[23], trade within Asian countries will grow further even if there is marginal rise in international transport costs. This also suggests that there are huge infrastructure bottlenecks inside countries in Asia (barring perhaps

[23] In 2008, about 56 per cent of Asia's exports were conducted within the region, and about 29 per cent of world exports came from Asia (ADB ARIC Database, 2009).

Japan) that call for urgent measures for infrastructure improvement. Costlier inland transportation prohibits and taxes trade as much as tariffs do. Therefore, trade facilitation has a strong role to play in reducing trade costs and raising competitiveness in Asia.

Contrary to expectations, in all models, the exchange rate in the exporting appeared with positive coefficient. Possible explanations include: (a) currency depreciation had little effect on aggregate trade flow during the period of our study; or (b) there was appreciation against the United States dollar. US dollar weakened in the crisis period. In all models, distance had the correct sign, and was statistically significant. The adjacency, language and RTA dummies, which are proxies of indirectly measured barrier, have positive signs in all the models, which indicate that sharing a border, speaking in same language and free trade (regional and bilateral) environment do matter in trade in Asia.

In the case of non-price variables, the estimated results indicate that the trading infrastructure of exporting countries is much more important than that of importing countries; this coefficient is statistically significant at the 1 per cent level. Similarly, the port performance of exporting countries has a comparatively higher positive effect on trade flow than does the port performance of importing countries. The adjacency, language and RTA dummies have the expected signs and also significant.

The direction of the influence of price and non-price factors on trade flow has been researched extensively. However, the combined effect of explicit barriers, such as transport and tariffs, on Asian trade was unknown. As mentioned above, estimated coefficients indicated that a 10 per cent increase in price barriers such as tariffs and transport costs would lower Asian aggregate trade by 6 per cent. We would expect an analysis of disaggregated data to reveal variations in the effects of barriers. To this end, we examined estimates at the commodity levels for the effects of price and non-price factors on trade flows.

Tariffs were shown to be highly significant (negative) barriers in 10 of the 16 commodity groups included in the study. Tariffs are no longer a barrier to trade flow in some commodity groups, such as fuels, mining and forest products; metal and paper and pulp, which have statistically significant coefficients. These commodity groups are “all weather” and demand driven, and feed the manufacturing sector in Asia. The category of automobiles and components also had a positive coefficient, but it was not statistically significant. The extensive production network of the automobile sector in Asia had forced tariffs down, thus they were gradually losing significance as a barrier; however, high tariffs still existed on certain automobile parts (e.g. the gear box in 1000cc four-wheelers). Tariffs were still penalizing trade in the office and telecom sector in Asia. Overall, estimated coefficient indicates that a 10 per cent fall in tariffs would lead to a 2 to 6 per cent rise in trade in 10 commodity groups in Asia.

Among the price factors, the estimated coefficients of transport costs are significant and negative in most of the sectors: electrical and electronics, pharmaceuticals, leather, machinery and mechanical appliances, metal, paper and pulp, chemicals, textiles and clothing, food, and office and telecom equipment. In the remaining sectors, namely, automobiles and components; transport equipment; and fuels, mining and forest products, the estimated coefficients of transport costs components have a positive sign but are not always significant. A careful scrutiny of the differentials of the estimated coefficients in the former group of commodities clearly indicates that inland transportation costs are more significant than international transport costs, except perhaps in the automobiles and components sector. Therefore, larger or medium-sized countries, such as China, Japan, India, Malaysia, Korea and Thailand, which are producers and/or exporters of manufactures such as electrical and electronics, pharmaceuticals, leather, machinery and mechanical appliances, or office and telecom equipment, still had not been able to reap many benefits from trade due to the presence of comparatively higher price barriers, such as higher tariffs and transport costs.

The ad-valorem combined effect of tariffs and transport is highly significant and negative in the cases of textile and clothing, office and telecom equipment, machinery and mechanical appliances, electrical and electronics, and leather. Of the significant estimates, the size of the effects varies widely. The estimated coefficients show that a 10 per cent reduction in ad -valorem tariffs and transport costs would lead to a rise of about 2 to 9 per cent in bilateral trade flows of manufactures (except automobiles and transport equipment) in Asia. The usual caveat is that adjusted R^2 explains only a small part (a third or less) of the variation in trade flows.[24] Perhaps the inappropriateness of the structural model or omitted variable bias could be the plausible reasons for poor fit.

When we consider non-price effects on trade flows, we get comparatively better results in all sectors except transport equipment. There is strong empirical evidence that non-price components, namely, a country’s infrastructure quality and the performance of its ports, are important for international trade patterns of 15 prominent sectors in Asia. The importing country’s infrastructure quality is the most important determinant of cross-country variations of trade flows.

This is also not to deny that models also suffer from endogeneity as highly correlated exogenous variables are used in some cases in the gravity equations. Alternative estimations such as the maximum likelihood estimation (MLE) and frontier maximum likelihood estimation (FMLE) may also be used in order to check the relative robustness of the models.

5. Conclusions and Policy Implications

Over the past decades of globalization, economies in Asia had grown rapidly till the financial crisis appeared in mid 2007. This acceleration of growth, in which international trade has played an important role, has helped Asian economies make impressive strides in economic development. The globalization process has resulted in an increase in international trade in goods and services in both extensive and intensive margins in Asia. Asia has experienced a sharp increase in merchandise trade and has been showing greater trade interdependence on a large variety of goods, particularly in intermediate and capital

[24] Due to limitation of space, the results were not reported here. Interested readers may contact author for the same.

goods. However, rising trade costs (attributable to higher tariffs and freight rates) continued to impede trade in Asia. The main conclusion of this paper is that ‘price’ barrier is still more important than ‘non-price’ barriers, *ceteris paribus*, in enhancing Asia’s trade. The higher the price barriers between countries in a pair, the less they traded. In other words, a 10 per cent increase in the ad valorem price (transport and tariff) lowered trade by 6 per cent. Tariff and transport costs, each considered separately, also influence the trade flow in the same direction, to more or less the same extent. The analysis carried out in this study provides sufficient evidence to ascertain that variations in tariffs and transport costs have significant influence on regional trade flows in Asia.

The estimated coefficient of international transportation costs indicated that it is more important to address inland rather than international transportation cost if the goal is to enhance Asian trade in the post-crisis period. There were indications of huge domestic infrastructure bottlenecks in countries in Asia that call for immediate attention in order to enhance trade flows in Asia. Costlier inland transportation limits and taxes trade in the way tariffs do. Therefore, infrastructure has an important role to play in reducing trade costs in Asia.

Tariffs were shown to have a relatively large and negative impact on trade when we considered individual sectors. Trade in all sectors, with the exception of transport equipment, is influenced by tariffs, transport costs and infrastructure quality. In the case of transport equipment, bilateral tariffs had a less significant role, as trade in that sector is more demand driven in Asia.

The ad-valorem combined effect of tariff and transport is highly significant and negative in the cases of textiles and clothing, office and telecom equipment, machinery and mechanical appliances, electrical and electronics, and leather. The size of the effects varies widely. Estimated coefficients show that a 10 per cent reduction in ad-valorem tariffs and transport costs would lead to an increase of about 2 to 9 per cent in bilateral trade flows of manufactures (except automobiles and transport equipment) in Asia.

Larger or medium-sized countries, such as China, Japan, India, Malaysia, Korea and Thailand, which are producers and exporters of manufactures such as electrical and electronics, pharmaceuticals, leather, machinery and mechanical appliances, and office and telecom equipments, still had not been able to reap benefits due to presence of comparatively higher ‘price’ barriers such as higher tariffs and transport costs.

Given these broad findings, we can say that with the rise of regionalism (and also bilateralism) in Asia, any attempt towards regional demand driven growth rebalancing of the region holds high promise only if accompanied by initiatives that help improve trade efficiency and reduce trade costs. Reductions in inland transportation costs should be a priority in any new policy for Asia’s infrastructure development, since a decrease in inland transportation costs, as an outcome of improved infrastructure, will stimulate trade. 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 the competitiveness of Asian countries.

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Appendix 1. Classification of commodity groups

	Corresponding 2/4 - digit HS (2002)	Remarks
Agriculture products	01 - 24, 50 - 53	Taken at 4-digit HS excluding HS 01 and HS 06
Food	16 - 23	
Fuels, mining and forest products	25 - 27, 44	Taken at 4-digit HS, excluding HS 45
Manufactures	28 - 43, 45 - 49, 54 - 70, 72 - 92, 94 - 96	Taken at 4-digit HS, excluding HS 44, 50 - 53, 71, 93
Chemical	28 - 36, 38	Taken at 4-digit HS, excluding HS 37
Pharmaceuticals	30	
Rubber and plastics	39 - 40	
Leather	41 - 43, 64	
Paper and pulp	47 - 48	
Textile and clothing	54 - 63	Taken at 4-digit HS, excluding HS 64 - 67, 71
Iron and steel	72 - 73	
Metal	68 - 70, 74 - 81	
Machinery and mechanical appliances	82 - 84	Taken at 4-digit HS, excluding HS 8415, 8418, 8471, 8473
Electrical and electronics	85, 90, 91, 92, 95	Taken at 4-digit HS, including HS 8415, 8418, 8471, 8473
Office and telecom equipment	8517 - 8548	
Electronic integrated circuits	8542	
Transport equipment	86 - 89	
Automobiles and components	87	

Appendix 2. Components of international transport cost (US$ /Twenty-foot equivalent unit)

	Terminal handling charges[a]		Ocean freight charges[b]	
	2000	2008	2000	2008
China	223	537	338	570
India	374	820	729	1389
Indonesia	235	466	416	643
Japan	339	526	556	720
Malaysia	245	401	409	503
Korea	238	332	456	531
Thailand	184	324	310	389

Notes: [a] Average (weighted) over all commodities. [b] Other than terminal handling charges.
Source: Calculated based on date from Maersk Sealand (2009).

Appendix 3. Sources of data

Particular	Source
Bilateral trade	United Nations Commodity Trade Statistics Database International Monetary Fund, Direction of Trade Statistics Database
Bilateral tariff	World Bank, World Integrated Trade Solution; United Nations Conference on Trade and Development, Trade Analysis and Information System
Gross domestic product, gross domestic product per capita, surface area, population	World Bank, World Development Indicators 2009
Infrastructure variables: (a) railway length; (b) road length; (c) air transport freight; (d) air transport passengers carried; (e) aircraft departures; (f) container traffic; (g) fixed-line and mobile phone subscribers; (h) Internet users; and (i) electric power consumption	World Bank, World Development Indicators 2009; CIA International
Freight	Maersk Sealand, Denmark

Appendix 4. Trade Infrastructure Index (TII) and Port

To assess country characteristics and domestic (inland) transport costs, we focus on infrastructure measures—the country's ability to enhance the merchandise trade. Infrastructure is treated here as a proxy for those costs, because it responsible for movement of goods across and within countries. We have used principal component Analysis (PCA) for indexing the trade infrastructure. While indexing the infrastructure stocks of the countries, we considered the following nine variables, which are directly involved in moving merchandise between countries: (a) railway length density (km per 1,000 km^2 of surface area); (b) road length density (km per 1,000 km^2 of surface area); (c) air transport freight (million tons per km); (d) air transport, passengers carried (percentage of population); (e) aircraft departures (percentage of population); (f) country's percentage share in world fleet; (g) container port traffic (twenty-foot equivalent units per terminal); (h) fixed-line and mobile phone subscribers (per 1,000 people); and (i) electric power consumption (kwh per capita).

Estimated weights: principal component analysis

	Factor loadings (1)	
Infrastructure Indicator	2000	2008
Air transport freight (million tons per km)	0.73	0.78
Air transport, passengers carried (percentage of population)	0.80	0.82
Aircraft departures (percentage of population)	0.80	0.96
Country's percentage share in world fleet	0.31	0.36
Container port traffic (TEUs per terminal)	0.45	0.53
Electric power consumption (kwh per capita)	0.77	0.97
Fixed-line and mobile phone subscribers (per 1 000 people)	0.89	0.91
Railway length density (km per 1000 sq. km of surface area)	0.83	0.94
Road length density (km per 1000 sq. km of surface area)	0.84	0.89
Expl.Var (% of total)	0.64	0.67

Note: Factor loadings (Unrotated)

Estimated trade infrastructure index, 2000 and 2008

	2000	2008
China	1.65	1.88
India	0.49	0.57
Indonesia	0.45	0.48
Japan	4.02	4.08
Malaysia	1.69	1.73
Korea	3.11	3.23
Thailand	0.84	0.93

Performance of ports: number of containers (TEUs) handled per hour, 2000 and 2008

	2000	2008
China	21	41
India	12	29
Indonesia	11	21
Japan	27	37
Malaysia	39	44
Korea	31	45
Thailand	12	29

Note: Average of country's top three largest container ports.
Source: Calculated based on International Association of Ports and Harbours.

Appendix 5. Pair-wise correlation coefficients

	X_{ij}	Y_i	TR_{ij}	T_{ij}^{Int}	T_{ij}	T_i^{Inl}	ER_j	$Port_i$	$Port_j$	TII_i	TII_j
X_{ij}	1										
Y_i	0.726*	1									
TR_{ij}	-0.527*	-0.546*	1								
T_{ij}^{Int}	0.361*	0.405*	-0.151*	1							
T_{ij}	-0.460*	0.411*	-0.272*	0.708*	1						
T_i^{Inl}	-0.062*	-0.011*	-0.003	0.350*	0.414*	1					
ER_j	0.022*	0.021*	0.03*	0.021*	0.005*	-0.037*	1				
$Port_i$	-0.681*	-0.706*	0.550*	-0.411*	-0.311*	0.030*	0.021*	1			
$Port_j$	-0.400*	-0.451*	0.295*	-0.313*	-0.318*	-0.011*	-0.422*	0.430*	1		
TII_i	-0.619*	-0.715*	0.550*	-0.426*	-0.408*	0.052*	-0.021*	0.970*	0.453*	1	
TII_j	-0.041*	0.001	0.020*	-0.135*	-0.078*	-0.099*	-0.173*	-0.000	0.701*	0.006	1

Notes: Taken in log scale. * Significant at the 5 per cent level