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Differential impacts of trade facilitation on homogeneous and differentiated products in East Asia

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Executive summary

East Asia is an interesting group of countries to study the impacts of trade facilitation. The majority of the economies in the region have shared similarities in terms of the apparent pursuit of export-lead growth policies. These similarities would partially reduce the impacts of unobservable factors such as economy specific policies, endowments and result in a more precise picture of trade facilitation effects on trade.

A number of papers have explored the effects of various trade facilitation factors, both at-the-border and behind-the-border, on trade flows among East Asian economies. Those studies have found that factors such as transport costs, infrastructure and some elements of domestic regulation have had significant impacts on the intra-regional trade of the East Asian economies.

This paper also studies impacts of trade facilitation dimensions including cross-border transport infrastructure, communication infrastructure and domestic regulation on exports of East Asian economies. However, this paper is different from other studies in the region, in three aspects. Firstly, it covers exports to all economies in the World instead of looking at only intra-regional trade as other analyses have done. Secondly, homogenous products and differentiated products are investigated separately. Thirdly, time-importer fixed effects and time-variant approximation as proposed in Baier and Bergstrand (2009) are employed to control for "multilateral resistances" of importers and exporters, respectively.

Some efforts are made to find fairly well representative measures of the three above-mention dimensions of trade facilitation to include in empirical models. Estimation results show that all factors under study have significant impacts on both product groups. Cross-border transport infrastructure has larger impacts on differentiated products. Meanwhile, communication infrastructure is found surprisingly to have larger impacts on homogenous products. Impacts of domestic regulation are insignificantly different for the two product groups. This paper puts forward three distinguishable features of East Asian economies that could attribute partially to this "abnormal" result of communication infrastructure as well as other counter-intuitive results: (a) the popularity of industrial policy among the economies (in contrast to perceived adoption of export-led i.e. outward-oriented strategies); (b) the critical role of multinational corporations in manufactured exports of some economies in the region; and (c) the relatively high proportion of parts and components in exports of the region.

The counterfactual analysis illustrates that export gains would be remarkable if the trade facilitation factors are improved. However, these results should only be regarded as indicative, other factors such as costs of implementation and possible changes in export behavior due to policy changes, must also be taken into account when any initiatives are considered in practice. Taking into account general export evolution of the economies, cross-border infrastructure should be given priority as it would not only result in the highest export gains but also improvement in export structure. However, attention to improved communication infrastructure for homogenous products should also be considered, at least in the short run.

Introduction

Along with tariff reduction under the growing number of bilateral and multilateral trade agreements, trade facilitation has been increasingly documented as an important factor affecting national trade performance, especially in the case of developing countries[1] where firms still face significant obstacles to participating in international trade activities. Empirically, studies have shown that improvements in some elements of trade facilitation, both at-the-border and behind-the-border, have had positive impacts on trade activities. For example, Wilson and others (2002) reported that improvements of trade facilitation could increase trade between Asia-Pacific Economic Cooperation countries (APEC) by around 10 per cent.

East Asian countries/territories[2] (hereafter referred to as economies) are an interesting group with regard to studying the impacts of trade facilitation. The majority of these economies have been pursuing, to varying degrees, export-led economic growth policies. In fact, some have been frequently cited as successors of this policy, such as the Republic of Korea and the Taiwan Province of China. Exports by the region increased more than 13-fold from 1980 to 2007; in other words, the share of these economies in the total merchandise exports of the world increased from 13.8 per cent to 27.2 per cent during that period.[3] According to the United Nations Conference on Trade and Development (UNCTAD) (2008), the region has 8 out of 12 of the world's major exporters of manufactured goods. Furthermore, 8 of these economies are regarded as newly industrialized economies (NICs); all are in the East Asian region (UNCTAD, 2008). These similarities of economies provide a good platform for evaluating the effects of improved trade facilitation. The study of factors linked to trade facilitation would improve our understanding of the impacts on trade, since the role of unobservable economic trade specifics on policies, endowments, etc., would be (at least partially) reduced.

A number of papers have explored the effects of various trade facilitation factors on trade flows among East Asian economies. De (2007) analyzed the impacts of infrastructure facilities, cross-country transport costs and tariffs on trade among nine East Asian economies and India. He found that all three components of trade costs had significant impacts on trade flows. If cross-country transport costs were reduced by 10 per cent, trade among the economies would increase by 6 per cent, which was the largest impact among the three components. However, the estimation at the 4-digit HS level appeared to smooth the impacts as well as economy-fixed effects, and the remoteness was not sufficient for controlling "multilateral resistance" as it needs control at the corresponding level of study (e.g., if the study is at the 4-digit HS level, control of "multilateral resistance" at 4-digit HS is also needed). Shepherd and Wilson (2009) reported that at-the-border infrastructure and communication technology had significant impacts on trade flows among selected East Asian economies during 2000-2005. Employing the same approach, Hernandez and Taningco (2010) also estimated the effects of various factors on intra-trade flows in the region during 2006-2008. Port infrastructure and communication services were again found to be significantly affecting intraregional

[1] A Google scholar search on 26 November 2009, revealed more than 10,000 results for "trade facilitation" and about 6,000 results for "trade facilitation" and "developing countries".
[2] The East Asian region includes East Asian and South-East Asian countries. A list of the economies in each region is provided in Annex I.
[3] The authors' calculation based on UNCTAD, 2008.

trade. In addition, their results showed that the depth of credit information available also had significant effects. However, these studies only looked at intra-trade between the economies being reviewed. Two later studies, by Shepherd and Wilson, and Hernandez and Taningco, looked at aggregate bilateral exports and the BEC 1-digit level of product classification. Studying at the BEC 1-digit level made it possible to account for heterogeneity among product groups but the underlying characteristics of the product groups were unclear. This makes it difficult to draw distinctive conclusions from the various results among the product groups. In addition, the two studies had to compromise on the separate impacts of trade facilitation on exporters and importers in order to take into account "multilateral resistance".

For the current study, an alternative product classification was employed with clearer distinguishing characteristics and evaluation of exports by East Asian economies to all destinations in order to establish a more complete picture of export gains from trade facilitation as well as differences in the impacts of trade facilitation factors on various products. By employing the product classification method of Rauch (1999) the authors attempted first to assess the effects of selected trade facilitation factors, both at-the-border and behind-the-border on the exports of two East Asian economy's product groups; these groups were identified as homogenous and differentiated products. These trade facilitation factors included cross-border transport infrastructure, communications infrastructure and domestic regulation of exports. They then estimated export gains for the product groups under the individual improvement of these trade facilitation elements. To control for effects of "multilateral resistances", time-importer fixed effects and time-variant-approximation proposed in Baier and Bergstrand (2009) were used for importers and exporters, respectively. Fixed effect is one of the best estimators of "multilateral resistances", while the time-variant-approximation of Baier and Bergstrand was carefully and reliably derived.

The econometric results show that trade facilitation has significant impacts on trade in the two product groups. Transport infrastructure has significantly higher impact on exports of differentiated products. Although domestic regulation also has a higher impact on the differentiated group, it is not significant. The positive impact of communications infrastructure is significantly higher on exports of homogenous products. Although this runs counter to existing theories as well as the results of other empirical studies, it could be partially attributed to some distinguishable features of the economies in the East Asian region. Simulation results imply that economies in the region would gain significantly in terms of export increases if the trade facilitation factors are improved; however, the gain varies among factors as well as economies.

This paper is organized as follows. Specific theoretical issues of trade facilitation and its impacts on different products are presented in section 1, while section 2 discusses the performances of exports of the two product groups as well as trade facilitation of selected economies in the region. Section 3 is devoted to econometric models, and estimation and simulation results. Section 4 provides the conclusion.

1. Trade facilitation: Definition, measurement and potentially different impacts on different products

A. Definition of trade facilitation and product classification

Although research on trade facilitation has been rapidly growing, there is still no generally accepted definition(s) of trade facilitation. As Anderson and van Wincoop (2004) argued, "both domestic and international trade costs are included because it is arbitrary to stop counting trade costs once goods cross a border". Thus, in a broad sense, trade facilitation could refer to measures or factors contributing to the reduction of the costs of moving goods when crossing borders. However, experts often define specific domains in the routine of goods movements from a producer in one country to consumers in another country. Some may only concern procedures required for the cross-border movement of goods. For example, Persson's (2008) definition "might be summarized as measures to decrease the transaction costs arising from 'moving [of] goods through ports or customs' (as cited in Roy and Bagai, 2005)". Meanwhile, definitions in a number of papers cover more factors in broader domains, both at-the-border (such as customs valuation and port efficiency) and behind-the-border (such as service efficiency), and business regulation. (For example, Wilson, Catherine and Otsuki, [2005] noted that "the definition has been broadened to include the environment in which trade transactions take place with the focus of trade facilitation efforts 'inside-the-border' on domestic policies and institutional and governance structures").

This paper considers trade facilitation from the broad perspective, which includes both border and behind-the-border measures. Domestic business regulation, communications infrastructure and cross-border transport infrastructure are investigated. Although trade facilitation studies frequently include another indicator called "custom environment" or "cross-border regulation", this indicator has been excluded by the authors as it is more relevant to imports than exports (Wilson, Catherine and Otsuki, 2005). This exclusion is even more practical for the East Asian economies as the majority of which have more or less been pursuing export-led economic growth policies and it is believed that those economies have made great efforts to improve the regulatory environment for exports.

With regard to product classification, the approach by Rauch (1999) is followed in this paper. Under this approach, 4-digit products are classified as homogeneous and differentiated. Homogeneous products are further divided into commodities traded in organized markets such as crude oil, basic metals and coffee. Price referenced products for which prices are available but for which there are no organized markets, could include raw silk, cotton for the textile industry or several types of acids for the chemical industry. The remainder comprises differentiated products (almost all products of the electric industry belong to this group). In this paper, the first level of classification – i.e., product groups that are homogeneous and differentiated – is used. There are two versions of this classification, "conservative" and "liberal". The former minimizes the number of products overlapping between trade in organized markets and referenced prices, while the latter version maximizes it. Since the first level of classification is used here, either version would produce the same results.

B. Specific measures of trade facilitation factors

The World Bank's "Doing Business" surveys cover 10 aspects of the business environment, in which the overall country ranking is a good indicator of the quality of the business environment in general. This can be used as a measure for the domestic regulation element of the study discussed in this paper. However, a more informative and absolute measure is required for policy discussion, but this indicator is needed to represent the overall ranking as closely as possible. Thus, the focus is on the number of documents required to complete a deal in some economic activities. Specifically, documents for starting a business, registering a property and enforcing contracts are regarded as appropriate examples. The criterion for selecting these categories of documents is the correlation between them and the overall ranking; the higher the correlation, the higher the representativeness of the indicator. Table 1 presents correlations of the document numbers and the ranking of East Asian economies studied during 2005-2009[4] and 2006-2007. It is clear that the number of documents needed for starting a business outperforms the other indicators. Thus, this number was used as the measure for the domestic regulation dimension in the analysis.

Table 1. Correlation between overall ranking and selected indicators in East Asian economies

	2005-2009	2006-2007[a]
Documents for starting a business	0.829	0.885
Documents of registering property	0.389	0.389
Documents for enforcing a contract	0.548	0.557

Source: Authors' calculation based on the World Bank's "Doing Business" database.
[a] This study and further justification is discussed later in this paper.

Two indicators – airport and seaport efficiency – are considered as the measure of cross-border transport infrastructure. Airport efficiency was captured by responses by interviewees to the question of "Passenger air transport in your country is…", with the answer being given on a scale of 1 (underdeveloped) to 7 (extensive and efficient by international standards). Seaport efficiency was captured by responses to the question of "Port facilities and inland waterways in your country are:" on a similar scale to that for airport infrastructure. These questions are used in the annual surveys of the World Economic Forum and the aggregated data at national level are sourced from the *Travel and Tourism Competitiveness Reports* prepared by the World Economic Forum. A very high correlation between the two indicators[5] allows the selection of seaport efficiency as the measure for cross-border transport infrastructure.

Wilson, Catherine and Otsuki (2005) put together an index from the two indicators of "speed and cost of Internet access" and "the effect of the Internet on business". Shepherd and Wilson (2009) used the "ISP sector competition index" for the service sector infrastructure. However, the former information is not available in recent *Global Competitiveness Reports* while the latter is only available as raw data which the

[4] During this period, some new economies were included in the "Doing Business" surveys, which meant that ranking for this period was not fully comparable. Thus, the economies that were covered for every year in this period were re-ranked before estimating the correlations. The number of economies for which data were available for the complete period was 175.
[5] The correlation between these indicators is about 96 per cent for the studied East Asian economies in 2006-2007.

authors were unable to access. Furthermore, the authors focused more on communications infrastructure. Thus, the "number of Internet users per 100 population" was used, as given in the *Global Competitiveness Reports* and the *Travel and Tourism Competitiveness Reports.*

The number of mobile phones or fixed landline telephones per 100 head of a population can be used to measure the development of the communications infrastructure; however, the authors argue that these indicators may be misleading in terms of the true situation. For mobile phone subscribers, the number per 100 persons may not reflect the actual ratio of population using this service as it depends on service providers who often provide pre-paid sim-cards included in promotions as a marketing policy; some people just use a new sim-card for a short time in order to utilize the promotion, yet a significant amount of these sim-card numbers are still counted when calculating the number of mobile phone subscribers. It is clear that this marketing policy varies between economies and this indicator may thus fail to reflect the actual development of the communications infrastructure of individual economies.

Fixed landline telephones are a different story since they have been competing with, or have even been replaced by, mobile phones in recent years. Economies that developed their communications infrastructure before the mobile phone 'era' often have an abnormally high number of this type of phone compared with more recently developed economies because people in the former economies often use mobile phones as a replacement for fixed landline telephones. Thus, this data may also fail to reflect the relative extension of the communications infrastructure among economies. Meanwhile, as the Internet has only been developed in the past two decades and because it is no direct replacement, the number of internet users is less affected by the above issue of telephone user numbers and can therefore more correctly reflect development of the communications infrastructure.

C. Potential variation in impacts of trade facilitation on different product groups

This subsection briefly summarizes the potential differences in the impacts of trade facilitation factors on the product groups as well as empirical evidence. Rather than present a full survey, this paper just notes some of the differences as justification for product classification.

Communication infrastructure directly relates to search cost. Unlike homogeneous products that are traded in organized markets, or were arbitrage can be undertaken "solely on the basis of prices prevailing at the ports" (Rauch, 1999), traders of differentiated goods have to follow a search process taking into account the multidimensional characteristics of products in order to match sellers and buyers. That makes the search cost is much higher for differentiated goods (Rauch, 1999). Other features of differentiated products that may be affected by the communication infrastructure are "idea" content and fashionability. Differentiated products vary in terms of characteristics required to meet consumer requirements, and producers as well as traders have to communicate with markets on a more frequent and timely basis. Insufficient communication with consumers may make the "idea" content of a competitor's product better in meeting consumer preferences; even if there is no competing producer,

insufficient reflection information may result in mismatching consumer requirements.[6] Thus, it can be seen that communication infrastructure could affect differentiated products more than homogeneous products, both in the extensive and intensive dimensions of trade. Empirical works by Fink, Mattoo and Neagu (2005) and Tang (2006) found differences in the effects of communication costs on trading of product groups that reduction in communication costs has positive effects on trade of differentiated and reference-priced products but not on the products traded in organized markets.

It is clear that cross-border transport infrastructure correlates highly with transport costs in terms of payment, and it appears to affect trade of homogeneous and differentiated goods in the same way. However, the period of movement – another aspect of trade costs – can potentially have different impacts on the two product groups. Time taken for cross-border movement apparently depends on several factors, one of which is the efficiency of the port. Hummels (2001) extensively studied time as an aspect of trade costs. He pointed out several elements of costs stemming from times of goods movements. Among those elements, he noted that the depreciation cost "captures any reason that a newly produced good might be preferable to an older good" and therefore has the potential to have a great impact on differentiated goods. In the case of homogeneous goods, e.g., crude oil or copper, there is less probability of a big difference and even the possibility of no difference between new and older goods.[7] Meanwhile, many differentiated products suffer not only from depreciation cost in terms of decreasing quality but also "fashion" changes in that current products may not meet customers' requirements later. Moreover, Hummels noted that damage of goods in transit was an aspect of depreciation and that longer movement times increased the cumulative probability of damage. The possibility exists for differences in the impacts of this aspect of depreciation cost. Homogeneous products are often simple items, and damage of a part of such products means only the loss of that part. In contrast, because of the complexity and connection of different parts of a differentiated product, any damage to parts of such a product may result in the loss of the product as a whole. From these analyses, then, it can be seen that variations can be expected in the impact of transport infrastructure on different groups of products. Hummels (2001) showed that an additional day in transit resulted in a 1 per cent decrease in the probability of a country exporting to the United States for all goods and 1.5 per cent for manufactured goods.

The potential impacts of the behind-the-border factors are less clear, as regulations are imposed on economic entities in the same way. Following Sadikov (2007), the authors assumed that improvements of the behind-the-border factors would lead to a decrease in business costs and an increase in productivity. Furthermore, while production of homogeneous products does not need a fixed cost (setting-up cost) but the production of differentiated products does. A lower setting-up cost may increase the establishment of new businesses producing differentiated products relative to those producing homogeneous products. Directly related to trade, lower marginal production costs also increase the propensity for exporting by existing domestic firms, but the magnitude of this effect is not known for different products. Therefore, it is not possible to make accurate predictions of exports when behind-the-border regulations are improved.

[6] Idea of this argument borrows from analyses of Hummels (2001) on cost of time in trading.

[7] In fact, some food commodities also suffer from depreciation cost in terms of decreasing quality, but they do not suffer from "fashionability" changes.

Empirically, the study by Sadikov (2007) reported that improvements in behind-the-border business barriers, which were measured by the number of documents required to start a business, had significant impacts on exports of differentiated products but no effect on exports of homogeneous products.

2. Export and trade facilitation performances of East Asian economies

This section analyzes the trade patterns of the two product groups as well as the performance of dimensions of trade facilitation by selected East Asian economies in recent years.

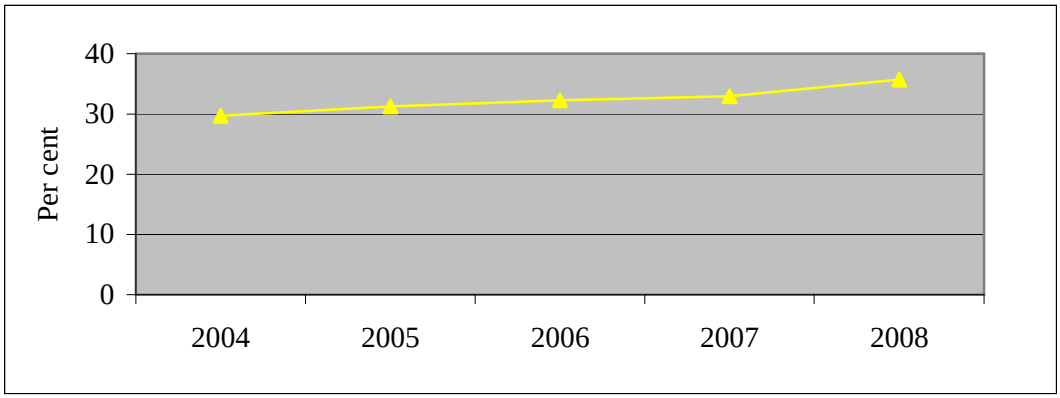
A. Relative performance of export of the differentiated versus homogeneous products

The share of homogenous products in world imports and in total exports by selected East Asian economies' since 2004 are given in figure 1 and figure 3, respectively. The export values used in figures 1 and 3 are from 129 observed economies (however a number of economies are missing for 2008). Justification for the selection of these economies are discussed later in this paper, but it should be noted that those economies not included in the analysis accounted for only 1.23 per cent of total imports by all data-available economies in 2006.

Figure 1 shows a constant upward trend in the share of homogenous products over time, having increased remarkably from 29.7 per cent in 2004 to 35.7 per cent in 2008. However, this increase does not imply that the share of homogeneous goods has increased absolutely in physical terms. As shown in figure 2, the price index of non-manufactured products[8] – which accounts for a significant share of homogeneous products –increased and varied significantly during 2005-2008. In 2007, when the price index of non-manufactured products increased by 9.9 per cent – the smallest increase in 2005-2008 – the share of homogeneous products in total trade also increased by the smallest rate, at about 0.6 per cent. Meanwhile, the increase in the price index for manufactured products, which coincide with differentiated products, was much smaller as well as stable over time. The smaller increase in the share of homogenous products implies that the share of differentiated products increased in terms of the physical amount but decreased in terms of value due to the relative increase in prices of homogenous products.

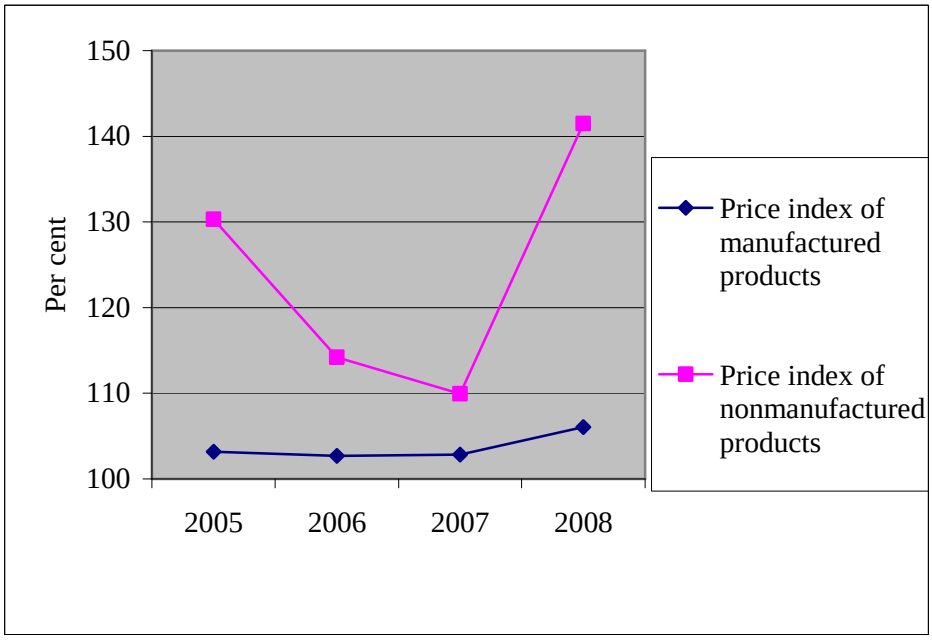
[8] These are import price indexes of the United States. The relative index of any particular month in a year to the same month in the previous year is calculated first, and the indexes for 12 months are then averaged to get the average index of the year. The indexes are simple averages of the indexes for industrialized and other countries. Data is sourced from the Bureau of Labour Statistics, United States Department of Labour.

Figure 1. Share of homogeneous products in world imports



Source: Authors' calculations basing on import data of WITS-COMTRADE.

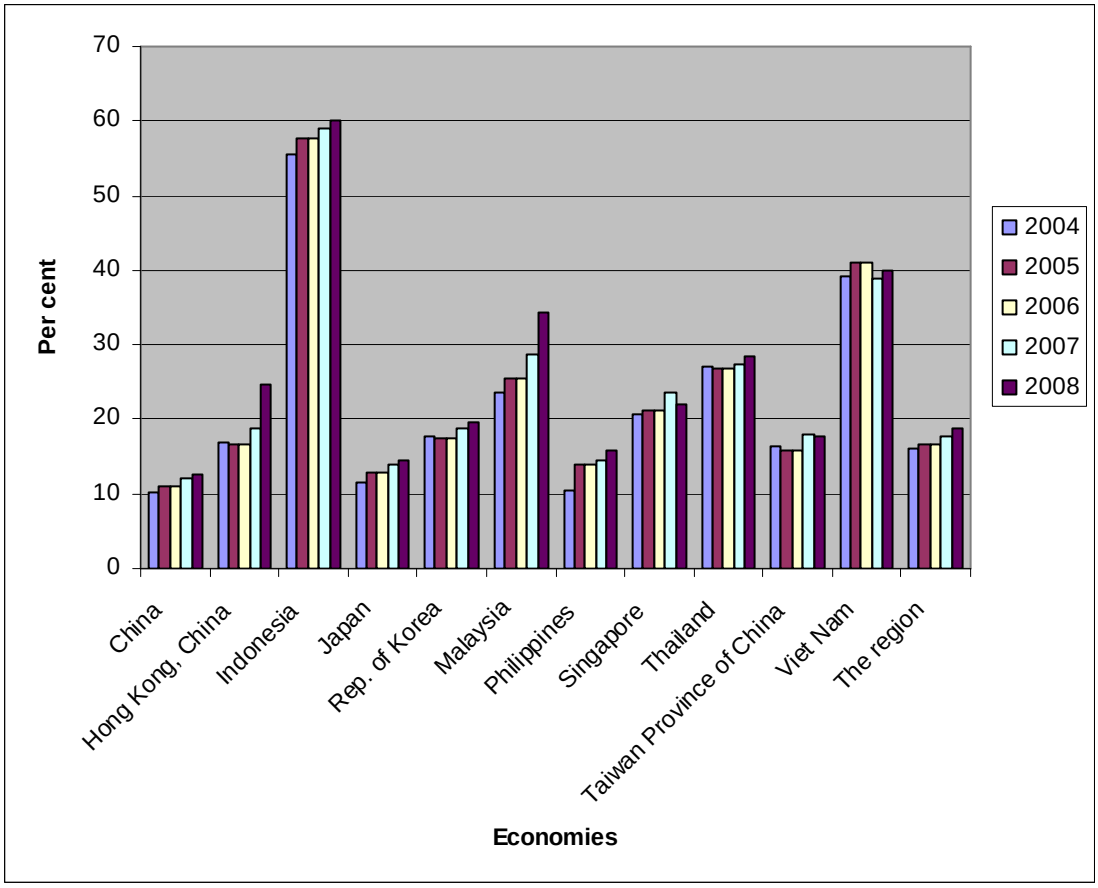
Figure 2. Price indexes of manufactured versus non-manufactured products



Source: Authors' calculations based on import price indexes of the United States**.**

Turning to shares of the region and selected economies, the share of homogeneous products in total exports of the region was slightly higher than one half of the world average. This is consistent with the fact that 8 of the 12 major exporters of manufactured goods are in the region. Only Indonesia and Viet Nam among the economies shown in figure 3 had higher shares of homogeneous products than the world average. Actually, if all economies in the region are included, there are some extreme cases; for example, homogeneous products accounted for about 98.6 per cent of Brunei Darussalam's exports in 2008 but the ratio of those products only accounted for about 4.4 per cent of exports from Macau, China in 2004. These numbers indicate that although there are significant similarities among a number of economies in the region, there are also some "outliers" that must be considered. Another trend seen in figure 3 is that the more developed economies, with the exception of China and the Philippines, tended to export fewer homogenous products.

Figure 3. Share of homogeneous products in total exports by East Asian economies



Source: Authors' calculations based on import data from WITS-COMTRADE.

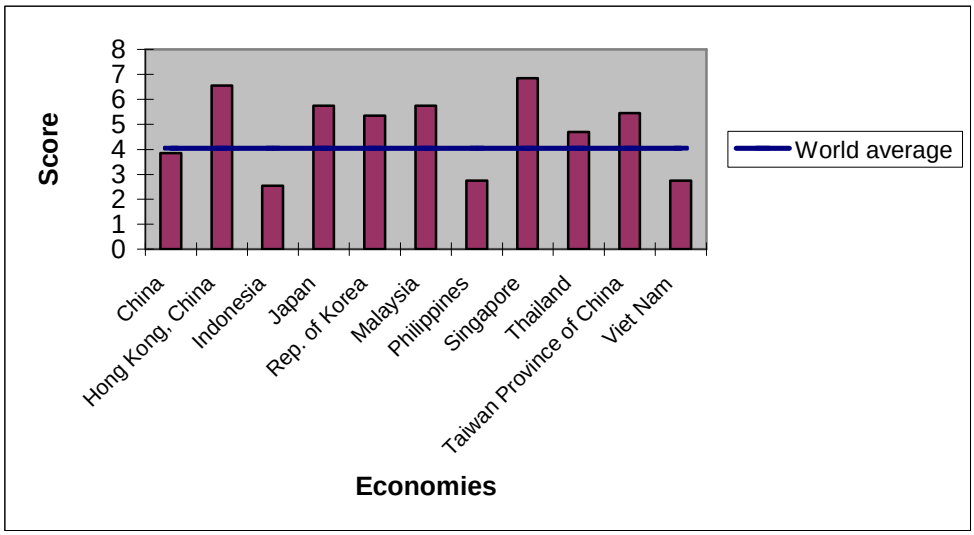
The increasing share trend was also found for the region as a whole as well as in all economies given in figure 3, although Singapore, Thailand, Taiwan Province of China and Viet Nam experienced decreases during one or two years. This trend may indicate that the impacts of increase in the relative price of homogenous products to differentiated products have dominated the impacts of development on the export structure among East Asian economies. The more developed economies tend to export less homogenous products.

B. Trade facilitation of selected economies

Figure 4 presents the average score during 2006 and 2007 of the selected economies in terms of seaport efficiency. Efficiency of seaports in these economies can be classified into three groups. The best group comprises Singapore and Hong Kong, China; the fact that they are a city-based country/territory as well as transportation hubs in the region could be the reasons for their performance. The second group comprises five economies, including two economies (the Republic of Korea and Taiwan Province of China) from the first tier of NICs, two economies (Malaysia and Thailand) from the second tier of NICs and Japan. This group considerably outperformed the world average. Although the performance of Japan led this group, that lead was small; this implies that NIC economies have gradually been catching up with Japan in terms of transport

infrastructure efficiency. The remaining economies are China, Indonesia, Philippines and Viet Nam. The performance of those economies was quite low compared with the second group as well as the world average. However, China appears to be moving much closer to the second group. Indonesia and the Philippines are also classified as second-tier NICs, but they are in the low-income group together with China and Viet Nam. Thus, their low performances in transport infrastructure efficiency are understandable.

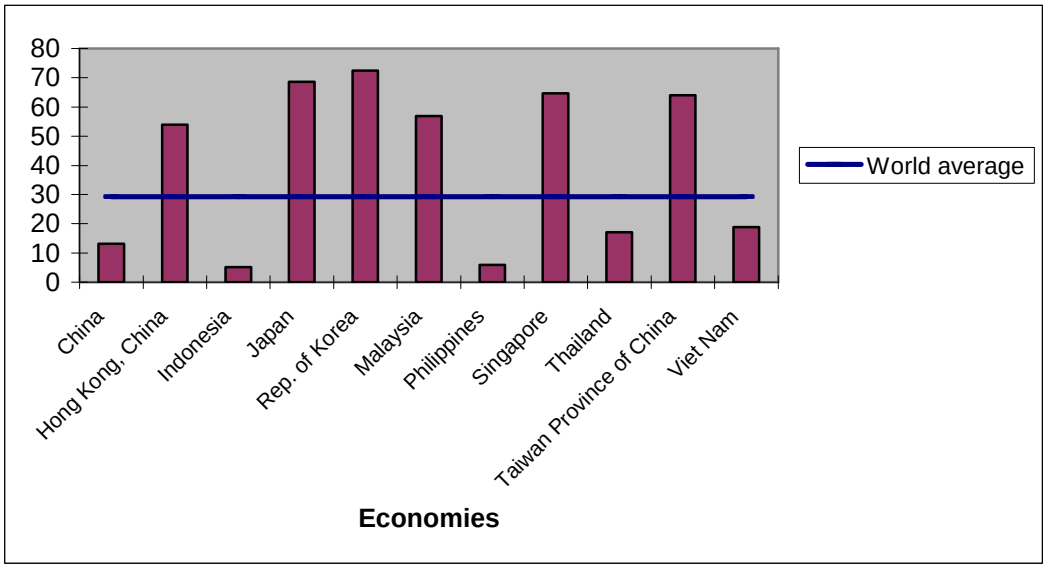
Figure 4. Average scores of seaport efficiency



Source: Travel and Tourism Competitiveness Reports.

In terms of communications infrastructure (figure 5), the gap between the economies varies much more. The Republic of Korea was the best performer, followed by Japan, Singapore and Taiwan Province of China. Those economies could be regarded as comprising the first group since their performance was considerably higher than the world average. The second group includes Malaysia and Hong Kong, China, whose performance was also remarkably higher than the world average. The remaining economies are far below the second group as well as the world average. The performance of Indonesia and the Philippines was quite poor at just over five and six Internet users per 100 head of their populations, while the world average and that of the Republic of Korea were 29.2 and 72.4, respectively.

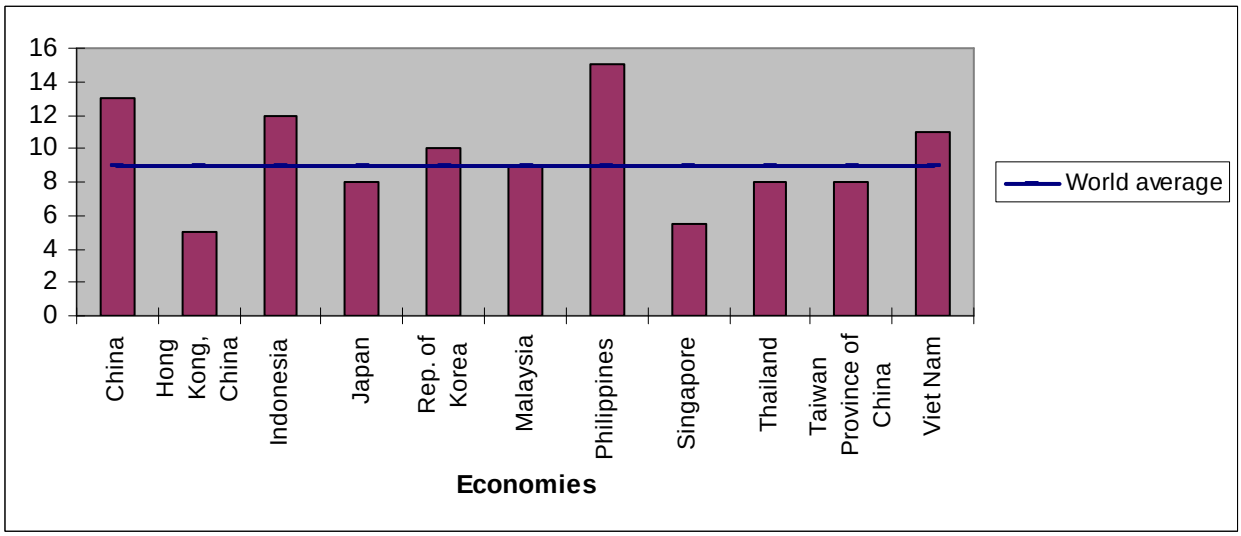
Figure 5. Average number of Internet users per 100 head of population



Source: Travel and Tourism Competitiveness Report and *Global Competitiveness Report.*

The groupings are less clear with regard to the number of documents required for starting a business, although the variation is quite pronounced (figure 6). Only five documents are needed to start a business in Hong Kong, China compared with 12, 13 and 15 in Indonesia, China, and the Philippines, respectively. It should also be noted that some of the selected economies that performed well in terms of transport and communications infrastructure showed a poorer performance for this indicator. Even the Republic of Korea was worse than the world average.

Figure 6. Average number of documents required for starting a business



Source: World Bank, "Doing Business" database.

This subsection is only intended to provide an approximate overview of trade facilitation performance of selected economies in the region. Overall, considerable heterogeneity can be seen among the economies in terms of trade facilitation performance. Hong Kong, China and Singapore performed best in terms of transport infrastructure. Thailand was close to the top performers in the region in transport

infrastructure but was low in terms of communication infrastructure. The Republic of Korea led in communication infrastructure but the number of documents required for starting a business was relatively high compared to the top performers for that indicator as well as the world average. The performance of China, Indonesia, the Philippines and Viet Nam was consistently poor in every indicator and the gaps between those four economies and the top performers as well as the world averages were considerable. That indicates they need to make improvements of all trade facilitation factors.

3. Evaluation of impacts of trade facilitation on product groups

This section describes the use of the gravity model to evaluate the impacts of above-mentioned trade facilitation factors on exports of the two product groups by East Asian economies. Formulae of models and descriptions of variables are discussed first, followed by notes about data and estimation results, scenarios and simulations of trade gains if trade facilitation is improved.

A. Estimation model and description of variables

The model used here is the same as that employed by Sadikov (2007) with a modification of proxy for "outward" multilateral resistance terms of exporters. The estimation form below is similar to the now widely accepted estimation form of the gravity model derived from work by Anderson and van Wincoop (2003 and 2004). Exports from country j to country i in year t is a function of trade facilitation factors, trade costs and other specific factors of the two countries. Specifically, the estimation form of the model is:

$$\begin{aligned} LnE_{ijt} = {} & \beta_1 transport_{jt} + \beta_2 commu_{jt} + \beta_3 start_{jt} + \gamma_1 \ln Y_{jt} + \gamma_2 \ln Y_{pcjt} \\ & + \gamma_3 tariff_{ijt} + \gamma_4 Year + \gamma_5 Dcity + Z_{ij}' \Gamma + \gamma_6 \ln Pjt + D' \zeta + \varepsilon_{ij} \end{aligned} \quad (1)$$

In this model, E_{ijt} represents exports from country j to country i in year t measured by imports reported by country i from country j in year t, while $transport_{jt}$ is the score of port efficiency in year t, $commu_{jt}$ is communications infrastructure development in year t and $start_{jt}$ is the number of documents required for starting a business in year t of exporter j. Because these variables have different scales, they are standardized by dividing their mean values of the sample while $tariff_{ijt}$ is the simple average of tariff lines that country i is imposing on goods imported from country j in year t. This is calculated separately for homogeneous and differentiated product groups. Import/export values can be used as weights when calculating the effective tariff but the authors used the simple average of tariff lines to gain a general measure of protection; import/export values are partially determined by tariffs and making the weighted tariffs endogenous. Y_{jt}, Y_{pcjt} are the exporter's GDP and GDP per capita (*GDP_PC*)[9] in year t. The standard gravity model requires exact economic 'mass' of the product/product group corresponding to those studied, which means economic sizes of homogeneous products and differentiated products in exporters' economies would have to be included here; however, as such data were unavailable, *GDP* had to be used as a proxy. Z_{ij} represents

[9] The name of the variable in the latter estimation result is given in parentheses. If no name is provided in parentheses, the name of the variable in the latter estimation result is the same as it appears here.

conventional bilateral gravity variables, including: (a) distance between the two countries' capitals (*Distance*); (b) contiguity (*Border*), which is a dummy variable that takes 1 if two countries share a border, 0 otherwise; (c) common language (*Comlang_off*), which takes 1 if two countries have the same official language; (d) colonial relationship between the two countries (*Colony*); (e) common colonizer post-1945 between two countries (*Comcol*); and (f) whether countries are or were the same country (*Smctry*). The data for these variables are sourced from the CEPPII database. D is the vector of importer-year fixed effects, to capture the importer's "multilateral resistance" term as in Anderson and van Wincoop (2003). An additional variable was included to capture any landlocked situation of importers (*Landlocked*) in order to improve the precision of the estimation results. That information was also sourced from the CEPPII database. *Year* is the time fixed effect as the estimation is for more than one year. To capture the fixed effects of the three city-based economies (Hong Kong, China; Macau, China; and Singapore) *Dcity* was added.

Because $transport_{jt}$, $commu_{jt}$ and $start_{jt}$ are exporter specifics, the exporter's "multilateral resistance", $\ln P_{jt}$, could not be captured by exporter-year fixed effects or exporter-fixed effects due to the short period of the study as well as the fact that these variables changed only slightly during that period. Instead, an approximation derived by Baier and Bergstrand (2009) was employed. According to Baier and Bergstrand, with an assumption of "bilaterally symmetric trade costs" and the use of Taylor's series expansion, the exporter's "multilateral resistance"/trade costs for product groups could be calculated as:

$$\ln P_{jt,p} = \left[\sum_{i=1}^{N} \theta_{it,p} \ln t_{ijt,p} - (1/2) \sum_{k=1}^{N} \sum_{m=1}^{N} \theta_{kt,p} \theta_{mt,p} \ln t_{ktmt,p} \right] \quad (2)$$

where p denotes groups of products, *tijt* is the trade cost from exporter j to importer i at year t and t_{ktmt} is the trade cost from country m to country k at year t. $\theta_{jt,p}, \theta_{kt,p}, \theta_{mt,p}$ are shares of the exporter's output to the world's total output of product p at year t. However, as these data were unavailable, a proxy of GDP share, $\theta_{jt}, \theta_{kt}, \theta_{mt}$, was used. Following Baier and Bergstrand, it was assumed the trade cost was the same for all the products, in the form of:

$$t_{ij} = DIS_{ij}^{\alpha} e^{-\beta BORDER_{ij}} \quad (3)$$

where DIS_{ij} is the distance between j and i, and $BORDER_{ij}$ is whether j and i share a common border. Taking the logarithm of (3) and substituting it in (2), a unique estimated form of exporter's "multilateral resistance" for the two groups of products is derived as:

$$\begin{aligned} \ln P_{jt} = {} & \alpha \left[\sum_{i=1}^{N} \theta_{jt} \ln(DIS_{ij}) - (1/2) \sum_{k=1}^{N} \sum_{m=1}^{N} \theta_{kt} \theta_{mt} \ln(DIS_{km}) \right] \\ & + \beta \left[\sum_{i=1}^{N} \theta_{jt} BORDER_{ij} - (1/2) \sum_{k=1}^{N} \sum_{m=1}^{N} \theta_{kt} \theta_{mt} BORDER_{km} \right] \end{aligned} \quad (4)$$

It can be seen that the "multilateral resistance" includes two components: distance (*Resist_dist*)[10] and the border (*Resist_border*).

[10] This includes internal distance as noted in Baier and Bergstrand (2009). The internal distance is also provided in the CEPTII dataset, calculated as the square root of the countries' areas and multiplied by 0.3761264 (this number was estimated by the authors).

In sum, the estimation form of the model is:

$$\begin{aligned} LnE_{ijt} &= \beta_1 transport_{jt} + \beta_2 commu_{jt} + \beta_3 start_{jt} + \gamma_1 \ln Y_{jt} + \gamma_2 \ln Y_{pcjt} + \gamma_3 tariff_{ijt} \\ &+ \gamma_4 Year + \gamma_5 Dcity + Z'_{ij}\Gamma + \varphi_1 \mathrm{Re}sist\_dist + \varphi_2 \mathrm{Re}sist\_border + D'\zeta + \varepsilon_{ij} \end{aligned} \quad (5)$$

The model for homogeneous products and differentiated products is estimated separately to fully capture the potentially different impacts of trade facilitation factors as well as other variables on two product groups. Wald tests were conducted to test the significance of the differences between estimated coefficients of trade facilitation variables in the two product groups.

As argued by Sadikov (2007), equations (1) and (5) may suffer from endogeneity in that if exports make significant contributions to a country's economy, the country policymakers may have made efforts to improve trade facilitation. In addition, exporters may have been able to influence the policy process in order to promote trade facilitation. These factors imply possible causality effects on trade facilitation of exports. Thus, following Sadikov, the authors estimated the difference between exports of differentiated products and homogeneous products from an exporter to an importer as $\ln\left(E_{ijt,d} / E_{ijt,h}\right)$, with explanatory variables in equation (5) as a check for endogeneity. The key assumption for the validity of this check is that exports of two product groups have approximately equal influence on trade facilitation improvements:

$$\begin{aligned} \ln\left(E_{ijt,d} / E_{ijt,h}\right) &= \eta_1 transport_{jt} + \eta_2 commu_{jt} + \eta_3 start_{jt} + \rho_1 \ln Y_{jt} + \rho_2 \ln Y_{pcjt} \\ &+ \rho_3 tariff_{ijt,d} + \rho_4 \mathrm{tariff}_{\mathrm{ijt,h}} + \rho_5 Year + \rho_6 Dcity + Z'_{ij}\Gamma \\ &+ \psi_1 \mathrm{Re}sist\_dist + \psi_2 \mathrm{Re}sist\_border + D'\zeta + \varepsilon_{ij} \end{aligned} \quad (6)$$

The tariffs of different product groups (*Tariff_homo* and *Tariff_diff*) are included separately in equation (6) as they are not equal among the product groups. If the estimation result of this equation is consistent with the separate estimation results of equation (5) for the two product groups, there may be less likelihood of the occurrence of the serious endogeneity problem with trade facilitation variables in equations (1) and (5).

B. Estimation results

(1) Data limitations and economies under study

Data used in this study was drawn from different sources; however, as some countries were missing from individual datasets, it was necessary to base this analysis on selected economies. As importer time-fixed effects were used, only import and tariff data were required for import economies.

The import data were taken from WITS-COMTRADE and the tariff data from WITS-TRAINS. The study started with trade data from 2006 and 2007, for which import data were available for 157 economies. However, 21 economies with import values of less than US$ 500 million and oversea territories of some European countries were excluded. The former economies were excluded in order to make the analysis more concentrated while the latter economies were excluded to eliminate possible "abnormal"

import patterns as their main trade relationship is often with the mainland countries. Furthermore, six economies for which tariff data were unavailable or too old, or for which tariff information was only available for 2008, were also excluded. In addition, as there appeared to be an error in the 2007 import data of Peru, that country was also excluded from the sample. As a result, the analysis covered 129 importers (See annex 2 for the list of these economies.)

Among 19 economies in the region, information of trade facilitation in 2006 is unavailable for the following: Brunei Darussalam; the Democratic People's Republic of Korea; the Lao People's Democratic Republic; Macau, China; Myanmar; and Timor-Leste. Although trade facilitation data are available for Cambodia, the latest import data are for 2004; therefore, it was excluded from the sample of importers and removed from the list of exporters. Among the remaining economies, Mongolia was the only landlocked country, and its exports as well as the impact of trade facilitation may be marked differently from the other economies. Therefore, as evaluating the potential differences would have been quite complicated and in order to take advantage of similarities among exporters (as explained in the introduction), Mongolia was also excluded. As a result, the estimation included only 11 economies as exporters (i.e., China, Hong Kong, China, Indonesia, Japan, the Republic of Korea, Malaysia, the Philippines, Singapore, Thailand, Taiwan Province of China and Viet Nam).

The World Bank's "Doing Business" database provides information for 2003 onwards. However, the authors were only able to access transport infrastructure data for 2006, 2007, and 2008 from the *Travel and Tourism Competitiveness Reports* and *Global Competitiveness Reports*. The latest trade data (including tariffs) was for 2008, which was available at the end of 2009. Thus, it was only possible to analyze the three years from 2006. However, the authors only investigated 2006 and 2007 for three reasons: (a) data for 2008 were available for only 112 of the 129 economies mentioned above; (b) data on Internet users in 2008 were available for only 5 of the 11 economies studied; and (c) the very high increase in the price index of homogeneous products in 2008 could have implications that could not simply be tracked by year-fix effects or price index variables, which could disturb impacts of changes in trade facilitation in unexpected ways.

It should be noted that the score for measuring the efficiency of seaports changed the method of calculation in 2007. The score in 2006 were based on data surveyed in that year, but the score in 2007 were based on data surveyed in both 2006 and 2007, with weights for each year. A score could be returned that is based only on data surveyed in 2007 as comparable to 2006. However, the data in the Global Competitiveness Reports have been rounded up to only one decimal place; thus the calculation based on rounded-up data is not accurate enough, since the value only ranges from 1 to 7 and could therefore result in marked errors in the 2007 data. Thus, the 2007 data as presented in the report have been retained.

(2) Estimation result

Columns (1) and (2) of table 2 report the estimation results of equation (5) for homogeneous and differentiated products, respectively. These results were estimated using the OLS procedure and robust to heteroskedasticity of standard errors. The economies in the East Asian region have a wide exporting network covering almost all the economies studied. However, there is still a problem of zero value. To check for any

potential bias stemming from this problem, the Heckman selection model as suggested by Helpman, Melitz and Rubinstein (2008) was employed as a supplementary estimation to the main OLS estimation. The estimation results from using the two-step Heckman selection model for differentiated and homogeneous products, which are provided in annex 3, are almost the same as those from the OLS estimation. This similarity in the results could be attributed to the small fraction of zero value trade. There were only 34 cases of zero value in data for differentiated products among 2,816 observations, while for homogeneous products the figure was 83. Thus, the OLS estimation results were used as the primary result for the analysis.

Table 2. Estimation results

	Product group separation				Difference of the two product groups	
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Homogenous**	**Differentiated**	**Homogenous**	**Differentiated**		
Transport	1.823***	2.453***	1.980***	2.399***	0.590**	0.426*
	(0.256)	(0.163)	(0.230)	(0.136)	(0.256)	(0.223)
Communications (Internet)	0.975***	0.338***			-0.600***	
	(0.126)	(0.091)			(0.123)	
Communications (telephone)			2.594***	1.224***		-1.403***
			(0.236)	(0.143)		(0.218)
Start	-1.105***	-1.105***	-0.741***	-0.979***	0.123	-0.101
	(0.256)	(0.167)	(0.244)	(0.156)	(0.253)	(0.241)
Tariff	-0.171	-0.287***	-0.358***	-0.358***		
	(0.137)	(0.080)	(0.138)	(0.078)		
Tariff_hom.					-0.227	-0.295
					(0.370)	(0.378)
Tariff_diff.					0.137	0.295
					(0.304)	(0.312)
Distance	-1.032***	-0.783***	-0.964***	-0.750***	-0.252***	0.209**
	(0.104)	(0.070)	(0.102)	(0.068)	(0.089)	(0.090)
Comlang_off.	0.454***	0.072	0.326**	0.033	-0.137	-0.055
	(0.132)	(0.122)	(0.130)	(0.121)	(0.125)	(0.125)
Colony	0.416**	0.125	0.491**	0.158	-0.341	-0.386
	(0.208)	(0.160)	(0.224)	(0.155)	(0.223)	(0.235)
Comcol	0.660***	0.614***	0.852***	0.692***	-0.110	-0.222*
	(0.128)	(0.098)	(0.128)	(0.099)	(0.119)	(0.119)
Border	-0.053	-0.115	-0.087	-0.139	0.005	0.024
	(0.244)	(0.193)	(0.228)	(0.185)	(0.139)	(0.137)
Landlocked	1.165	4.953***	0.697	4.698***	-0.265	-0.349
	(1.312)	(1.376)	(1.469)	(1.409)	(1.123)	(1.175)
Smctry	-0.319	0.238	-0.423	0.190	0.445	0.506*
	(0.311)	(0.275)	(0.287)	(0.267)	(0.298)	(0.294)
Year	0.117	-1.089	0.077	-1.121	-0.241	-0.060

	(0.725)	(1.341)	(0.630)	(1.375)	(1.017)	(1.064)
Dcity	0.302	0.259	-0.725***	-0.050	0.087	0.747***
	(0.256)	(0.175)	(0.180)	(0.115)	(0.248)	(0.182)
GDP	1.352***	1.308***	1.481***	1.410***	-0.071	-0.118**
	(0.057)	(0.040)	(0.053)	(0.036)	(0.055)	(0.050)
GDP_PC	-1.750***	-1.025***	-1.759***	-1.133***	0.677***	0.622***
	(0.143)	(0.101)	(0.115)	(0.074)	(0.134)	(0.108)
Resist_dist	2.806***	0.034	5.847***	1.498***	-3.029***	-4.652***
	(0.332)	(0.196)	(0.460)	(0.278)	(0.334)	(0.443)
Resist_border	-13.853***	-5.299**	-11.276***	-5.928***	6.629**	4.129*
	(3.099)	(2.154)	(2.546)	(1.645)	(2.893)	(2.435)
Constant	-33.276***	-7.856***	-62.822***	-22.682***	26.454***	42.253***
	(3.704)	(2.089)	(5.071)	(2.993)	(3.562)	(4.730)
Observations	2733	2782	2733	2782	2729	2729
R-squared	0.818	0.910	0.822	0.911	0.487	0.489

Note:
Dependent variable in columns (1) and (3) – log of imports of homogeneous products.
Dependent variable in columns (2) and (4) **–** log of imports of differentiated products.
Dependent variable in columns (5) and (6) – log of relative import of differentiated products to homogeneous product.
Robust standard errors are in parentheses under the coefficients.
Tariff = ln(1+tariff).
Distance, GDP, and GDP_PC are log values.
Trade facilitation indicators (Transport, communications, starting a business) are log values after standardizing.
*** significant at 1 per cent; ** significant at 5 per cent; * significant at 10 per cent.

R-squared is quite high for differentiated products, i.e., about 91 per cent of the variations in the exports of the products by East Asian economies could be captured by the model. Although this level is lower for homogeneous products, it is still high at about 82 per cent. The similarities among the economies in the region could partially explain this high level. The performances of estimated coefficients are also good. The coefficients of tariffs in both product groups are negative but are insignificant for homogenous products. This result is counter-intuitive since exports of homogenous products are often more sensitive to tariffs than differentiated products.

However, three major features of East Asian economies could affect the impacts of tariffs and other factors on exports of the two product groups:

(a) Industrial policies, which have been a coherent part of the growth policy among economies in the region. Although policies that were directly in favor of the manufacturing export sector dominated by differentiated products were eliminated in the 1990s (Weiss, 2005) it is believed that the manufacturing export sector is still in a better position, in terms of accessing production resources as well as policy priorities, compared to its counterpart, the primary production sector;

(b) The critical role of multinational corporations in exports of manufactured goods by some East Asian economies, as cited in Hill and Athukorala (1998). Shares of foreign affiliates in exports by China (1996), Malaysia (1991) and

Singapore (1991) of manufactured products were 47.6 per cent, 75.6 per cent and 91.5 per cent, respectively;

(c) The relatively high proportion of parts and components in total exports by the region.[11] This could be regarded as a result of (b). Multinational corporations locate their subsidies in some East Asian economies and produce parts and components for affiliates in other economies.

In addition, standardization of production fragmentation has allowed entities that do not belong to multinational corporations to get involved in components trading through "arm's length trade", although their participation has been minor (Athukorala, 2003). The implications of (b) and (c) for impacts of tariffs on differentiated products are that instead of importing parts and components or finished products for their affiliates or for sale in an economy imposing high tariffs against East Asian economies, multinational corporations may import from their affiliates in other economies that impose a lower tariff or may even localize their production more in a higher tariff protected economy. Meanwhile, one potential reason for insensitiveness to tariffs on East Asian economies' exports in homogenous products are unfavourable policies on primary product exports, which could lead to East Asian economies only exporting primary products in which they have high comparative advantages.

The smaller estimated coefficient of distance in differentiated products is consistent with other studies that showed differentiated products to be less sensitive to distance. However, this result is opposite to the results of tariffs. Full explanations for these results are complicated and go beyond scope of the current study. However, the domination of impacts of transportation costs on trade in homogenous products over the impacts of tariffs could be a reason for this result. Other variables that have counter-intuitive estimated coefficients are *Comlang_off* and *Landlocked*. The former is expected to have larger or even significant impacts on differentiated products, while the latter is expected to be negative. This abnormal result could be partially attributed to the important role of multinational corporations as well as the large proportion of parts and components in manufactured exports of the economies in the region. The standardization of products and the network of the multinational corporations have clearly reduced the relevance of a common language in the trade of differentiated products. Multinational corporations may import final-manufactured products from their affiliates in East Asian economies to sell in landlocked countries instead of producing them locally because of unfavourable connections of those countries to the global transportation network. This could be a reason for the odd result for landlocked countries.

GDP as a proxy for "economic mass" of an exporter's production in the two product groups is positive and is significantly consistent with other studies. GDP per capita (GDP_PC) could be expected to have positive impacts on exports of differentiated products as this indicator often positively correlates with an economy's level of technology. The Association of Southeast Asian Nations economies, except Singapore, with lower levels of GDP per capita depend more on exports to their East Asian counterparts; this is a reason for the negative association between GDP_PC and exports of differentiated products. However, smaller in magnitude of the estimated coefficient for differentiated goods is consistent with the fact revealed in Figure 3, that GDP per capita

[11] See Athukorala, 2003 for a discussion of trade in parts and components among East Asian economies.

increase would largely reduce exports of homogenous products and increase shares of differentiated products.

The positive coefficient of the distance component of exporters' "multilateral resistance", although insignificant for differentiated products, is consistent with the argument that a country located far from other countries tends to have more trade with a closer partner, taking into account the economic mass. Meanwhile, the negativity of the "border" components is also as expected, in that countries sharing a border will trade more with each other and less with other countries.

Turning to trade facilitation factors, it is surprising that the impact of communications infrastructure measured by the number of Internet users per 100 habitants is significantly higher in the case of homogenous products. Arguments in section 1 indicate that development of communication infrastructure is highly in favour of trade in differentiated products. Although the number of telephones per 100 habitants – both fixed landline and mobile phones – has its own problem in reflecting the development of the communications infrastructure, as discussed in section 1, the average of the two numbers could actually reduce the "history" problem of the fixed landline telephone. Therefore, this indicator was used as a check for the communications infrastructure. The estimation results from equation (5), using the average number of two types of telephones per 100 habitants as an alternative measure of communications infrastructure development, are presented in columns (3) and (4) of table 2. It can be seen that the relative estimated coefficients for the two product groups are almost the same as that for Internet users, except that tariffs become significant for homogenous products.

Wald tests were conducted to test the significance of differences formally in the trade facilitation variables in the two product groups. These results are given in table 3.

The estimated coefficients of transport infrastructure are positive and significant at the 1 per cent level in both product groups, indicating that transport infrastructure has significant impacts on promoting exports of both product groups. This result is not new as other studies – for example, Shepherd and Wilson (2009), and Hernandez and Taningco (2010) – frequently found strong impacts of infrastructure on trade. In terms of magnitude, transport infrastructure has had higher impacts on differentiated products. The test results shown in table 3 also indicate that the difference is significant.

Table 3. Results of Wald tests on differences in estimated coefficients for the two product groups

Measure	**Internet users per 100 habitants**		**Average telephone subscribers**	
Variables	Chi2	Prob > chi2	Chi2	Prob > chi2
Transport	4.760	0.029	2.730	0.099
Communications (Internet)	18.650	0.000		
Communications (telephone)			27.290	0.000
Start	0.000	0.999	0.750	0.387

The above-mentioned outstanding features of the studied economies could be reasons for the significantly higher positive impacts of communications development on homogenous products. Communications networks of multinational corporations may be

less affected by the level of development of host economies than their local counterparts as they often follow their own overall required standard. Thus, the development of communications infrastructure of an economy will not result in the same level of development in affiliates of multinational corporations. In addition, trade in parts and components within or among multinational corporations requires less communication for trading in final goods between two independent partners located in two different economies. Thus, the impacts of communication infrastructure development on trading of differentiated products may not be as strong among East Asian economies compared with other economies.

Another potential reason for strong impacts of communications infrastructure development on homogenous products comes from industrial policy. In the past, producers of homogenous products had less priority in accessing basic services. Although more equal policies among sectors have been implemented since the 1990s, they may still have lasting effects. The development of communications infrastructure may serve as a proxy for the development of other services, e.g., electricity generation and supply. Thus, improvements in communications infrastructure represent even larger opportunities for producers of homogenous products in accessing services in general.

The number of documents required for starting a business is also significant at the 1 per cent level in both product groups; it is negative, as expected, and almost the same for the two product groups. For the Asian and Pacific region in general, Duval and Utoktham (2009) reported on the depth of credit information and contract enforcement – two other aspects of domestic regulation that have strong impacts on the aggregate trade flows. Furthermore, Hernandez and Taningco (2010) studied East Asia and confirmed that depth of credit information significantly affected intraregional trade. Taking the two product groups separately, the significance of the number of documents for starting a business in homogeneous products is different from the result reached by Sadikov (2007), who reported this indicator did not have any significant impact on exports of such products. In addition, Berkowitz, Moenius and Pistor (2006) reported that contract enforcements of exporters had negative impacts on exports of homogenous products, while Ranjan and Lee (2007) reported positive impacts. However, the latter paper also reported lower impacts of contract enforcements on homogenous products to that on differentiated products. As indicated in table 1, contract enforcements may not be a good proxy for domestic regulation in general, but the results of these authors indicate that there is more than one direction[12] of impacts of domestic regulation on homogenous products exports.

For East Asian economies, the creation of rents for the manufacturing export sector due to industrial policy have resulted in overinvestment in the sector. This fact will lead to less impact on manufacturing production as well as exports when the domestic regulation is improved. Converse, underinvestment in primary product production in the past will inflate the impacts on this sector. Thus, these directions may result in equal impacts in the two product groups as show in this paper.

As discussed in section 3, the model of the export ratio of the two product groups, in each pair of countries as the dependent variable and the same explanatory variables as

[12] Berkowitz, Moenius and Pistor (2006) argued that there were two opposite directions of impacts of institution quality on exports of homogenous products and that the total effect was ambiguous.

those in the gravity model, could be a check for the endogeneity problem in trade facilitation indicators in the gravity model. Although the East Asian economies have implemented unequal policies among sectors, those policies have been actively implemented by the Governments. In addition, unequal policies have been significantly eliminated since the 1990s. Thus, the assumption of the checking capacity validity of the model – that exports of two product groups having approximately equal influences on trade facilitation improvements – is held at a certain level.

The estimation results from this model, with two measures of communications infrastructure development, are reported in columns (5) and (6) of table 2. The main interests of the study reported in this paper are coefficients of trade facilitation indicators. The estimated coefficients of these variables are consistent between the two measures of communications infrastructure both in terms of significance and directions. The results are also consistent with the results in columns (1), (2), (3) and (4) of the same table and in table 3 that transport infrastructure has a significantly higher impact while communications infrastructure has significantly lower impacts on differentiated products.

The estimation results of the present study indicate trade facilitation dimensions have strong impacts on both product groups. Cross-border transport infrastructure has stronger impacts on exports of differentiated products, as expected. However, the results for communications infrastructure and domestic regulation in the two product groups are somewhat different from those given in other studies, which reported that communications infrastructure surprisingly has a higher impact on homogenous products while the impacts of domestic regulation are the same in the two product groups. Although this paper gives three features of the economies under study that could be reasons for the differences, an in-depth analysis of each economy as well as the region as a whole, are needed in order to gain a more complete explanation for these differences.

C. Simulation results

To make the results given here more policy relevant, a simulation was conducted of trade gains if the trade facilitation dimensions that were improved. The approach by Shepherd and Wilson (2009), and Wilson, Catherine and Otsuki (2005) in which estimated coefficients were used as a platform to estimate trade gains, was employed. The quantity of improvement in each trade facilitation factor is first assumed, and then the corresponding estimated coefficient of the trade facilitation factor was used as the elasticity to estimate trade gain. The estimated coefficients in columns (1) and (2) of table 2 were used for the simulation calculation and the base year was 2007. The counterfactual analysis was implemented under a broad scenario that each factor improved by a given quantity. Specifically, the authors considered an improvement score of 0.25 (out of 7) in transport infrastructure, an increase of one Internet user per 100 inhabitants and a reduction of one in the number of documents required for starting a business. Before discussing the simulation results, however, it must be emphasized that this analysis is only intended to be an approximate idea of the export gains if trade facilitation factors are improved, and it is subject to a number of caveats as noted in Shepherd and Wilson (2009).

Table 4 presents the simulation results. If East Asian economies increase their transport infrastructure performance by a 0.25 score, the export gain would be large. Under this scenario, Singapore would have a perfect score of (7) for transport infrastructure and it would increase total exports by almost 6.8 per cent, the lowest gain among the economies. The Philippines would have the highest relative increases while China would have the largest absolute export increases. Japan, the Republic of Korea and Taiwan Province of China would also have considerable increases of about 10 per cent or more, although these relative increases are smaller than would be the case in some South-East Asian economies. An increase of one Internet user per 100 habitants would result in the lowest export gain among three sub-scenarios for each trade facilitation dimension, although this is not comparable among these sub-scenarios due to the different scales of trade facilitation factors. In fact, the export gains would still be considerable for some economies under the communications infrastructure sub-scenario, especially in relative terms; for example, total exports by Indonesia would increase by 12.7 per cent. Due to the economies requiring different numbers of documents for starting a business in 2007, the relative export gains with a reduction of one document would be different among the economies. China would increase its total exports by 8.5 per cent, which would be about 1 per cent higher than that of the Philippines – the lowest relative gain economy – but China would gain the largest in absolute value as it is the largest exporter among the economies.

The simulation results show that increases in exports of the economies in the sample would be large if the trade facilitation factors are improved. Based on the elasticities (the estimated coefficients), we can see that the improvement in transport infrastructure would lead the largest increase in exports, followed by a reduction in the number of documents required for starting a business and improvement in communications infrastructure. However, it should again be noted that the counterfactual analysis here is only intended to provide an approximate and initial picture of export gains. A number of elements, such as cost of implementation, dynamics of domestic production and export activities, need to be taken into account in deciding whether a trade facilitation dimension can be considered to have improved.

Table 4. Simulation results when trade facilitation factors are improved by quantities

	Differentiated products		Homogeneous products		Total	
Transport infrastructure increased by 0.25						
Economy (ISO3 codes)*	**Trade gain value**	**Trade gain percentage**	**Trade gain value**	**Trade gain percentage**	**Trade gain value**	**Trade gain percentage**
CHN	176.00	15.33	17.80	11.39	193.80	14.86
HKG	4.74	9.43	0.81	7.01	5.55	8.98
IDN	11.10	22.71	11.80	16.88	22.90	19.32
JPN	67.00	11.15	8.09	8.29	75.09	10.75
KOR	30.40	11.15	5.19	8.29	35.59	10.61
MYS	13.90	10.76	4.17	8.00	18.07	9.99
PHL	13.60	21.90	1.72	16.28	15.32	21.14
SGP	7.28	7.21	1.68	5.36	8.96	6.77
THA	13.70	13.05	3.83	9.70	17.53	12.12
TWN	25.20	11.15	4.08	8.29	29.28	10.63
VNM	6.62	21.90	3.15	16.28	9.76	19.71
Increase of one in number of Internet users per 100 habitants						
CHN	24.60	2.14	9.61	6.17	34.21	2.62
HKG	0.31	0.61	0.21	1.77	0.51	0.83
IDN	2.94	6.04	12.10	17.41	15.04	12.69
JPN	2.95	0.49	1.38	1.42	4.33	0.62
KOR	1.25	0.46	0.83	1.32	2.08	0.62
MYS	0.73	0.57	0.85	1.63	1.58	0.87
PHL	3.49	5.63	1.71	16.25	5.20	7.18
SGP	0.49	0.48	0.44	1.39	0.92	0.70
THA	1.69	1.61	1.83	4.64	3.53	2.44
TWN	1.19	0.52	0.75	1.51	1.93	0.70
VNM	0.50	1.65	0.92	4.76	1.42	2.86
Reduction of one document for starting a business						
CHN	97.60	8.50	13.20	8.50	110.80	8.50
HKG	11.10	22.10	2.57	22.10	13.67	22.11
IDN	4.49	9.21	6.42	9.21	10.91	9.21
JPN	83.00	13.81	13.50	13.81	96.50	13.81
KOR	30.10	11.05	6.92	11.05	37.02	11.04
MYS	15.80	12.28	6.40	12.28	22.20	12.28
PHL	4.56	7.37	0.78	7.37	5.34	7.37
SGP	22.30	22.10	6.93	22.10	29.23	22.10
THA	14.50	13.81	5.45	13.81	19.95	13.79
TWN	31.30	13.81	6.80	13.81	38.10	13.83
VNM	3.04	10.05	1.94	10.05	4.98	10.05

Source: Authors' calculation, based on estimation results.

Note: Values of trade gain are in billion United States dollars. Percentages of trade gains are relative to 2007 export values.

* See annex 3 for full country names.

4. Conclusion

Using data from different sources, the effects of different dimensions of trade facilitation on East Asian economies' exports of two product groups were studied. The standard gravity model with the appropriate approximation for exporter's "multilateral resistance"/trade cost effects was employed. The trade facilitation factors were found to have significant impacts in both product groups. In addition, the directions of impacts were as expected. Transport infrastructure was found to have significantly larger impacts on differentiated products. Meanwhile, communications infrastructure was found to have significantly stronger impacts on homogenous products, which was a different result to that of other studies. Among the three trade facilitation dimensions, transport infrastructure was found to have the strongest impacts on exports of both product groups.

This paper has attempted to explain the reason for the "abnormal" results from the impacts of communications infrastructure as well as some other conventional gravity variables. It appears that the popular presence of multinational corporations as well as industrial policy in the economies studied have significantly manipulated the impacts of gravity variables in general and trade facilitation elements in particular. This is especially so in the case of communications infrastructure. However, the authors are of the opinion that the explanations given here are not fully established, and that in-depth analyses of the economies are needed.

The simulation results show that East Asian economies could increase exports considerably if the trade facilitation elements are improved, especially in the case of some countries that have recorded poor trade facilitation performances. However, these results are estimated with the aim of providing a broad and initial picture of export gains; when initiating reforms for improvement, other elements such as the cost of implementation must be taken into account.

Since differentiated and homogenous products were studied separately, any policy implications for individual product groups should take into account other dimensions of economic development such as changes in economic structure and the direction of export evolution. More exports of manufactured goods, especially more sophisticated products, appears to be a common export evolution of East Asian economies. Tentatively, therefore, East Asian economies should prioritize the improvement of cross-border infrastructure, i.e., ports. This would not only result in the highest export gains by differentiated and homogenous products separately but would also lead to relatively higher export gains by differentiated products – which coincide with manufactured products. This would accelerate improvements in the export's structure. However, given the recent relatively considerable increase in prices of primary products – which correlate significantly with homogenous products – as well as a greater positive association between communications infrastructure and exports of homogenous products, East Asian economies should also pay attention to improving communications infrastructure for primary exports of homogenous products, at least in the short term.

The lack of data on a number of economies means that the current analysis is not complete, and more effort may have to be made to control the heterogeneity of other factors such as endowments, export related policies etc., which may become more serious when the similarities of economies under study decrease.

The approach taken in the current study is static. Domestic production and export activities are dynamic processes, and when trade facilitation is improved it will result in lower costs of exports and greater participation by firms in export activities. Participation in international trade activities, in turn, often has positive impacts on the productivity of firms, which also encourages those businesses to participate more in international markets. These processes need to be studied over a longer study period as well as detailed data on firms in all economies.

Although the study detailed in this paper employed the approximation in Baier and Bergstrand (2009), which were carefully derived for exporter's "multilateral resistance"/trade-cost effects, the assumption of equal bilateral trade cost of a pair countries may not hold in reality. Equally, the form of trade costs used for the estimation may not fully capture all the elements. Relaxing the assumption and trying other forms of trade costs would make any such analysis more rigorous.

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Annexes

Annex 1. East Asian economies and corresponding ISO3 codes

East Asian region		South-East Asian region	
Economy	ISO3 code	Economy	ISO3 code
China	CHN	Brunei Darussalam	BRN
Hong Kong, China	HKG	Cambodia	KHM
Dem. Rep. of Korea	PRK	Indonesia	IDN
Rep. of Korea	KOR	Lao People's Dem. Rep.	LAO
Macao, China	MAC	Malaysia	MYS
Mongolia	MNG	Myanmar	MMR
Taiwan Province of China	TWN	Philippines	PHL
		Singapore	SGP
		Thailand	THA
		Timor-Leste	TLS
		Viet Nam	VNM

Annex 2. List of countries as importers

Country/Territory	Country/Territory	Country/Territory	Country/Territory
Albania	Estonia	Madagascar	Senegal
Algeria	Ethiopia	Malawi	Seychelles
Antigua and Barbuda	Finland	Malaysia	Singapore
Argentina	France	Maldives	Slovak Republic
Armenia	Georgia	Mali	Slovenia
Australia	Germany	Malta	South Africa
Austria	Ghana	Mauritania	Spain
Azerbaijan	Greece	Mauritius	Sri Lanka
Bahamas	Guatemala	Mexico	Sudan
Bahrain	Guinea	Moldova	Suriname
Bangladesh	Guyana	Mongolia	Swaziland
Barbados	Honduras	Morocco	Sweden
Belgium	Hong Kong, China	Mozambique	Switzerland
Belize	Hungary	Namibia	Taiwan Province of China
Bolivia	Iceland	Netherlands	Tanzania
Bosnia and Herzegovina	India	New Zealand	Thailand
Botswana	Indonesia	Nicaragua	Trinidad and Tobago
Brazil	Ireland	Niger	Tunisia
Bulgaria	Israel	Nigeria	Turkey
Canada	Italy	Norway	Uganda
Cape Verde	Jamaica	Oman	Ukraine
Chile	Japan	Pakistan	United Arab Emirates
China	Jordan	Panama	United Kingdom
Colombia	Kenya	Paraguay	United States
Costa Rica	Korea, Republic of	Philippines	Uruguay

Cote d'Ivoire	Kuwait	Poland	Venezuela
Croatia	Kyrgyz Republic	Portugal	Viet Nam
Cyprus	Latvia	Qatar	Yemen
Czech Republic	Lebanon	Romania	Zambia
Denmark	Lithuania	Russian Federation	Zimbabwe
Ecuador	Luxembourg	Rwanda	
Egypt, Arab Rep.	Macao, China	Saint Lucia	
El Salvador	Macedonia, FYR	Saudi Arabia	

Annex 3. Heckman sample selection estimation results

	Homogeneous		Differentiated		Relative	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
Transport	**1.824*** **	0.256	**2.453*** **	0.170	**0.578** **	0.246
Communications (Internet)	**0.974*** **	0.114	**0.338*** **	0.075	**-0.593*** **	0.109
Start	**-1.109*** **	0.248	**-1.105*** **	0.164	**0.150**	0.238
Tariff	-0.174	0.165	-0.286***	0.097		
Tariff_homo					-0.185	0.602
Tariff_diff					0.117	0.529
Distance	-1.033***	0.128	-0.783***	0.086	0.259**	0.124
Comlang_off	0.452***	0.129	0.071	0.083	-0.127	0.123
Colony	0.416	0.309	0.125	0.207	-0.342	0.297
Comcol	0.660***	0.123	0.614***	0.081	-0.108	0.118
Border	-0.056	0.291	-0.115	0.195	0.022	0.280
Landlocked	1.654*	1.003	4.932***	0.708	-1.967*	1.017
Smctry	-0.318	0.407	0.238	0.272	0.439	0.391
Year	-0.328	1.262	5.566***	0.504	-0.494	0.754
Dcity	0.296	0.240	0.259	0.158	0.129	0.230
GDP	1.353***	0.052	1.308***	0.034	-0.082	0.050
GDP_PC	-1.748***	0.133	-1.025***	0.088	0.668***	0.128
Resist_dist	2.815***	0.352	0.033	0.234	-3.082***	0.338
Resist_border	-13.795***	2.881	-5.296***	1.903	6.286**	2.767
Constant	-33.482***	3.830	-14.480***	2.600	29.044	3.757
Censored obs	83		34		87	
Uncensored obs	2733		2782		2729	
Wald chi2	11413.6		30923.57		2670.2	
Prob > chi2	0		0		0	
Dependent variable	Log of imports of homogeneous products		Log of imports of differentiated products		Log of relative import of differentiated products to homogeneous product	

Note: See table 2 for notes of exact definition of some independent variables.
*** Significant at 1 per cent; ** significant at 5 per cent; * significant at 10 per cent.