

Wongpit, Piya

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Trade costs and impacts of trade facilitation on manufacturing exports by Thailand

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Asia-Pacific Research and Training Network on Trade

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Piya Wongpit

No. 127/June 2013

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Piya Wongpit¹

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¹ Piya Wongpit is a Lecturer at the Faculty of Economics and Business Management, Department of Commerce, National University of Laos, the Lao People's Democratic Republic. The views expressed in this paper are those of the author and do not represent the views of the National University of Laos or any other institution the author is associated with. The author appreciates comments by anonymous referees and the suggestions received from Mr. Yann Duval and Ms. Chorthip Utoktham. The author also acknowledges the technical support of the United Nations Economic and Social Commission for Asia and the Pacific and ARTNeT Secretariat. Any remaining errors are the responsibility of the author, who can be contacted at yasahoy@hotmail.com

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Abstract

The improvement of international trade in recent years has been influenced by the reduction of trade costs. The attention of international trade is to minimize trade costs through tariffs, trade facilitation and trade logistics, both inbound and outbound. As one of the emerging economies in international trade, Thailand's economy depends much on trade and therefore the Government has been attempting to eliminate all trade barriers. Since Thailand's manufacturing trade amounts to some 90% of total trade, trade costs must play a significant role in such trade. The objective of this paper is to estimate trade costs of manufacturing exports between Thailand and its trading partners, and to analyse the impacts of trade facilitation on such exports by Thailand. The study first estimates the comprehensive trade costs of the manufacturing industry for Thailand and 23 trading partners from 1999 to 2010 by using the Chen and Novy (2009) model. Then the comprehensive trade costs are decomposed into their component parts. The impacts of trade facilitation, including documentation and time involved in the export and import process, and the liner shipping connectivity index on manufacturing exports by Thailand are also discussed. The results indicate that manufacturing trade costs have continuously decreased over time due to the reduction of tariff and non-tariff costs. The manufacturing trade costs between Thailand and Singapore are the lowest while between Thailand and Japan, the most important trading partner of Thailand, they are the third lowest. On the other hand, the manufacturing trade costs between Thailand and the European Union are relative high due to the distance between the two regions. Distance contributed the highest proportion of trade costs. Trade facilitation, such as the reduction of the number of documents and time involved in manufacturing exports and imports have also been an important factor associated with trade costs in recent years. The trade facilitation factor has had an impact on manufacturing exports by Thailand and has become more important in the country's manufacturing trade. The results of this study are robust and exhibit consistency with previous studies that have found that the improvement of trade facilitation enhances manufacturing exports by Thailand.

JEL code: F14

Keywords: Trade costs, trade facilitation, manufacturing exports, Thailand

Introduction

The improvement of international trade in the 2000s has been influenced by the reduction of trade costs. Recent studies of international trade have emphasized the role played by trade costs in exports and imports. Anderson and van Wincoop (2004) estimated the trade cost equivalent to ad valorem tariffs for industrialized countries to be 170%. The intention of international trade is to minimize trade costs through tariffs, trade facilitation and trade logistics. Recent evidence indicates that tariffs have been reduced on average to lower than 5% for developed countries and 10-20%, with a few exceptions, for developing countries (Anderson and van Wincoop, 2004). In addition, many countries attempt to reduce trade costs by improving trade facilitation, including infrastructure and time costs. The developing countries have continued to develop their infrastructure such as road, seaport and airport construction. Furthermore, the time costs for such procedures as well as lead times have been dramatically reduced.

As an emerging economy in international trade, Thailand depends much on trade and the Government of Thailand has therefore been attempting to eliminate all trade barriers. Since manufacturing trade shares around 90% of total trade, related costs must play a significant role in manufacturing trade by Thailand. The overall tariff rate in Thailand has been reduced since the country joined the Association of Southeast Asian Nations (ASEAN) Free Trade Area (FTA) and signed bilateral trade agreements with many countries. In addition, the Government of Thailand has improved infrastructure and trade facilitation in recent years. Therefore, the reduction of trade costs, including tariff costs and trade facilitation, must benefit the country's manufacturing exports.

In view of the fact that trade costs have been reduced around the world, the questions are how much are the trade costs between Thailand and its trading partners, and which components of trade costs are the most important. Furthermore, since trade facilitation has become an important component in international trade, another question is concerns the impacts of trade facilitation on the manufacturing exports of Thailand. Therefore, the objectives of this paper are: (a) to estimate trade costs incurred by the manufacturing industry in trading between Thailand and its trading partners; and (b) to analyse the impacts of trade facilitation on exports by the manufacturing industry in Thailand. The study covers 23 trading partners that account for a more than 90% share of Thailand's manufacturing trade. The paper covers 1999 to 2010, when the country was

in its recovery period after the Asian financial crisis of 1997. Furthermore, during that period manufacturing exports were recording a high growth rate averaging 12% per year.

1. Literature review

Trade costs have become a topic of attention in the international trade context during the 2000s. Many studies have estimated trade costs and analysed the impacts of such costs on the trade, both among countries and regions. Anderson and van Wincoop (2003) derived the gravity model from a microeconomic foundation and later called it the AvW model. The model emphasizes the role of trade costs, which are calculated from distance, inward and outward trade barriers. The results indicate that an absence of national border restrictions reduces trade costs between industrial countries by a moderate level of 20%-30%. Anderson and van Wincoop (2004) surveyed various measurements of trade costs and found that although they were high in wealthy countries, poor countries faced even greater trade costs.

Chen and Novy (2009) derived the comprehensive trade costs from the AvW model. They defined them as: “Comprehensive trade costs include all additional costs involved in trading goods internationally with another partner (i.e., bilaterally) relative to those involved in trading goods intra-nationally (i.e., internally or domestically)” (Duval and Utoktham, 2011b). The comprehensive trade cost is a general concept, which includes not only international transport costs and tariffs costs but also other components such as costs associated with the use of different language and currencies. Comprehensive trade costs also include direct and indirect costs associated with completing trade procedures or obtaining necessary information (Duval and Utoktham, 2011b).

Duval and Utoktham (2011b) estimated the comprehensive trade costs of Asia and Pacific countries using the Chen and Novy (2009) equation. They pointed out that most countries and subregions had made significant progress in reducing trade costs; trade costs among Asian countries still often exceed costs of trade between Asian countries and developed countries outside the region; in fact, tariff costs account for only a small portion of comprehensive trade costs, although tariff cuts accounted for a large share of overall trade cost reduction during the past decade. Arvis et al. (2012) re-estimated trade costs during 1995-2010 of the manufacturing and agriculture industries using a new data set of 178 countries. The results clearly indicated that

trade costs were falling noticeably faster in developed countries than in developing countries. They also found that maritime transport connectivity and logistics performance were important factors in determining trade costs between two countries.

Because many countries have improved trade facilitation, such as infrastructure and trade procedures, it is important to investigate the impacts of trade facilitation on trade. De (2006) applied the augmented gravity model to eight sectors in 10 Asian countries in order to examine the effects of both policy and non-policy barriers on trade. Infrastructure quality, transportation and tariffs were found to be the main determinants for Asia's trade flows. Shepherd and Wilson (2008) estimated trade costs resulting from various factors, such as distance, tariff rates, and quality of airports and seaports, in order to study the impact of trade costs on trade by ASEAN member countries. They used that information to produce a gravity model of exports and imports in the region. The results indicated that a 1% increase in bilateral distance decreased trade by 0.4%, the reduction of tariffs increased intraregional trade by about 2%, and improved port facilities boosted trade by 7.5%.

Moise and Sorescu (2013) studied the impacts of trade facilitation on trade by developing countries. Sixteen trade facilitation factors were constructed from the Organisation for Economic Co-operation and Development (OECD) database and other sources. They also used the ESCAP and ESCAP-World Bank trade cost database. The result suggested that enhancing trade facilitation had positive impacts on trade flow. Furthermore, it was apparent that the most significant trade facilitation measures (i.e., those that have the highest impact on trade volumes) were information availability, harmonization and simplification of documents, automated processes and risk management, streamlining of border procedures, and good governance and impartiality.

Based on previous literature, there are some gaps in the research that need to be filled. Many studies have applied different techniques and factors to estimate trade costs, which have yielded various results. The comprehensive trade costs model of Chen and Novy (2009) is applied in this paper. The study follows the approach of Duval and Utoktham (2011b) in estimating the manufacturing trade costs by using different data sets. Furthermore, the comprehensive trade costs are decomposed into their components; therefore, the contribution of their components to trade costs can be analysed. The impacts of trade facilitation – including time spent in the processing of exports and imports, and the liner shipping connectivity index – on manufacturing

exports by Thailand are also discussed in this paper. This research applied the augmented gravity model in the investigation of the impact of trade facilitation on the manufacturing exports of Thailand.

2. Methodology and data

A. Comprehensive trade costs

First, trade costs of the manufacturing industry in Thailand and its trading partners are estimated. The comprehensive trade costs model of Chen and Novy (2009) is derived from the AvW model where it is specified as:

$$X_{ij}^k = \frac{Y_i^k E_j^k}{Y^k} \left\{ \frac{\tau_{ij}^k}{\Pi_i^k P_j^k} \right\}^{1-\sigma_k} \quad (1)$$

where $X_{ij,t}^k$ is total export of sector k from country i to country j ; Y_i^k is income of country i earned from total worldwide sales of all locally-made varieties in sector k , E_j^k is country j 's expenditure in sector k , Y^k is total world output in sector k , σ_k is intra-sectoral elasticity of substitution of sector k , and τ_{ij}^k is trade costs of sector k from country i to country j . Trade of an “ice-berg” can be used as an example of τ_{ij}^k . The exporter must export more than one unit of ice in order to have one unit of ice at the destination since the ice melts during the transportation. Trade cost measures how much of the ice is melting.

The outward multinational resistance, Π_i^k , essentially captures the fact that exports from country i to country j depend on trade costs across all possible export markets and is defined as follows:

$$\Pi_i^k = \sum_{j=1}^c \left\{ \frac{\tau_{ij}^k}{P_j^k} \right\}^{1-\sigma_k} \frac{E_j^k}{Y^k} \quad (2)$$

The inward multinational resistance, P_j^k , captures the dependence of imports into country i from country j on trade costs across all possible suppliers and is specified as:

$$P_j^k = \sum_{i=1}^c \left\{ \frac{\tau_{ij}^k}{\Pi_j^k} \right\}^{1-\sigma_k} \frac{Y_i^k}{Y^k} \quad (3)$$

The comprehensive trade costs model of Chen and Novy (2009) is derived as follows. Recall the AvW model as shown below:

$$X_{ij} = \frac{Y_i Y_j}{Y} \left(\frac{\tau_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \quad (4)$$

where X_{ij} denotes the nominal exports from i to j ; Y_i and Y_j denotes the nominal income from country i and j respectively; Y denotes world income; $\sigma > 1$ denotes elasticity of substitution across goods; Π_i denotes outward multinational resistance of country i ; P_j denotes inward multinational resistance from country j ; and τ_{ij} denotes bilateral trade costs (as one plus ad valorem term). Chen and Novy (2009) suggested the expression of intra-national trade should be made as:

$$X_{ii} = \frac{Y_i Y_i}{Y} \left(\frac{\tau_{ii}}{\Pi_i P_i} \right)^{1-\sigma} \quad (5)$$

where τ_{ii} becomes intranational trade costs. Re-arranging equation (5) as the product of multilateral resistance terms yields:

$$\begin{aligned} X_{ii} &= \frac{Y_i Y_i}{Y} \left(\frac{\Pi_i P_i}{\tau_{ii}} \right)^{\sigma-1} \\ (\Pi_i P_i)^{\sigma-1} &= \frac{X_{ii} Y}{Y_i Y_i} \tau_{ii}^{\sigma-1} \\ (\Pi_i P_i)^{\sigma-1} &= \frac{X_{ii}/Y_i}{Y_i/Y} \tau_{ii}^{\sigma-1} \\ \Pi_i P_i &= \left(\frac{X_{ii}/Y_i}{Y_i/Y} \right)^{\frac{1}{\sigma-1}} \tau_{ii} \end{aligned} \quad (6)$$

Using the same concept, the opposite direction of trade flows in equation (4) can be written as:

$$X_{ji} = \frac{Y_j Y_i}{Y} \left(\frac{\tau_{ji}}{\Pi_j P_i} \right)^{1-\sigma} \quad (7)$$

Multiplying equations (4) and (7) together gives:

$$X_{ij} X_{ji} = \left(\frac{Y_i Y_j}{Y} \right)^2 \left(\frac{\tau_{ij} \tau_{ji}}{\Pi_i \Pi_j P_i P_j} \right)^{1-\sigma}$$

Substitute with the result from equation (6):

$$X_{ij} X_{ji} = \left(\frac{Y_i Y_j}{Y} \right)^2 \left(\frac{\Pi_i \Pi_j P_i P_j}{\tau_{ij} \tau_{ji}} \right)^{\sigma-1}$$

$$X_{ij}X_{ji} = \left(\frac{Y_i Y_j}{Y}\right)^2 \left(\frac{1}{\tau_{ij}\tau_{ji}}\right)^{\sigma-1} \left(\frac{X_{ii}/Y_i}{Y_i/Y}\right) \tau_{ii}^{\sigma-1} \left(\frac{X_{jj}/Y_j}{Y_j/Y}\right) \tau_{jj}^{\sigma-1}$$

$$X_{ij}X_{ji} = \left(\frac{\tau_{ii}\tau_{jj}}{\tau_{ij}\tau_{ji}}\right)^{\sigma-1} X_{ii}X_{jj}$$

$$\frac{X_{ij}X_{ji}}{X_{ii}X_{jj}} = \left(\frac{\tau_{ii}\tau_{jj}}{\tau_{ij}\tau_{ji}}\right)^{\sigma-1}$$

Then, the product of bi-directional trade costs relative to the product of their intra-national trade cost is equivalent to:

$$\frac{\tau_{ij}\tau_{ji}}{\tau_{ii}\tau_{jj}} = \left(\frac{X_{ii}X_{jj}}{X_{ij}X_{ji}}\right)^{\frac{1}{\sigma-1}} \quad (8)$$

Therefore, the geometric average of bilateral trade cost is defined as:

$$t_{ij} = \left(\frac{\tau_{ij}\tau_{ji}}{\tau_{ii}\tau_{jj}}\right)^{1/2} = \left(\frac{X_{ii}X_{jj}}{X_{ij}X_{ji}}\right)^{\frac{1}{2(\sigma-1)}} \quad (9)$$

The tariff-equivalent term is made by deducting 1 from equation (9), thus giving:

$$t_{ij} = \left(\frac{\tau_{ij}\tau_{ji}}{\tau_{ii}\tau_{jj}}\right)^{1/2} - 1 = \left(\frac{X_{ii}X_{jj}}{X_{ij}X_{ji}}\right)^{\frac{1}{2(\sigma-1)}} - 1 \quad (10)$$

Trade costs of sector k at time t is defined as

$$t_{ij,t}^k \equiv \left(\frac{\tau_{ij,t}^k \tau_{ji,t}^k}{\tau_{ii,t}^k \tau_{jj,t}^k}\right)^{\frac{1}{2}} = \left(\frac{X_{ii,t}^k X_{jj,t}^k}{X_{ij,t}^k X_{ji,t}^k}\right)^{\frac{1}{2(1-\sigma_k)}} \quad (11)$$

where $t_{ij,t}^k$ = comprehensive trade cost, which is calculated by geometric average trade costs of sector k between country i and country j at time t ;

$\tau_{ij,t}^k$ = international trade costs of sector k from country i to country j at time t ;

$\tau_{ji,t}^k$ = international trade costs of sector k from country j to country i at time t ;

$\tau_{ii,t}^k$ = intra-national trade costs of sector k in country i at time t ;

$\tau_{jj,t}^k$ = intra-national trade costs of sector k in country j at time t ;

$X_{ij,t}^k$ = international trade flows of sector k from country i to country j at time t ;

$X_{ji,t}^k$ = international trade flows of sector k from country j to country i at time t ;

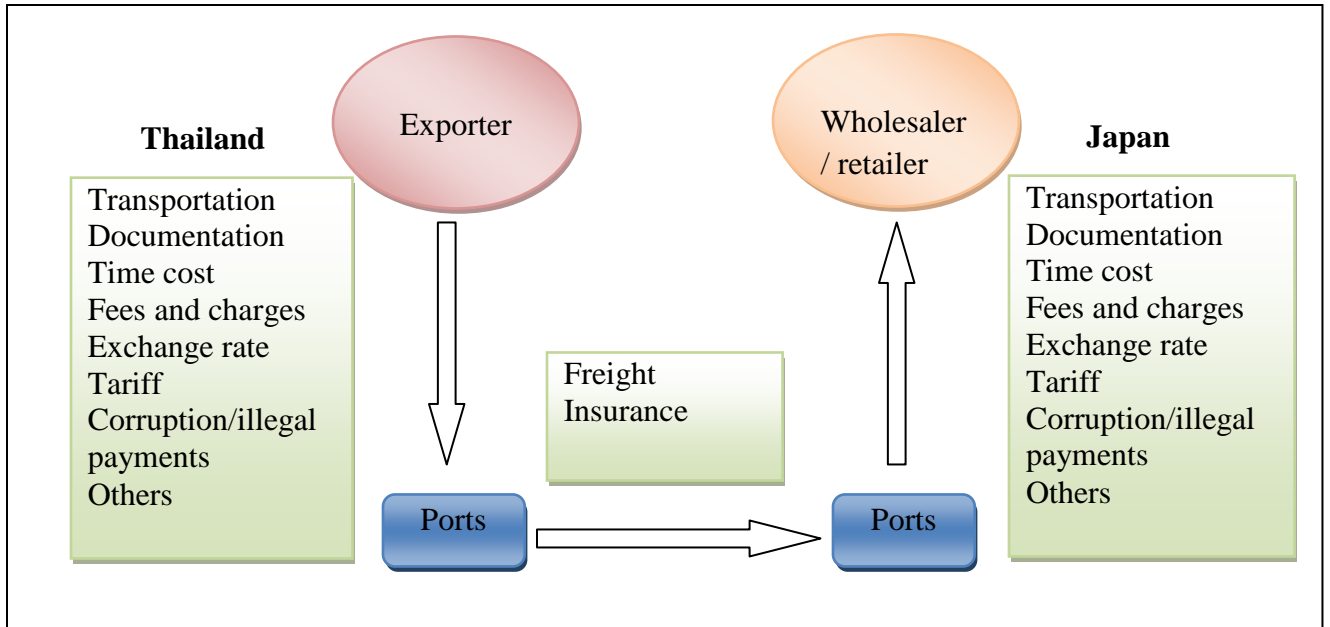
$X_{ii,t}^k$ = intra-national trade of sector k in country i at time t ;

$X_{jj,t}^k$ = intra-national trade of sector k in country j at time t ; and

σ_k = sector specific elasticity of substitution between goods in sector k .

According to equation (11), trade costs are directly inferred from observable bilateral and intra-national (domestic) trade data, showing how much more expensive bilateral international trade is relative to intra-national trade. In order to understand the concept of comprehensive trade costs, an example of the flow of exports from Thailand to Japan is provided in figure 1.

Figure 1. Trade cost in export flows from Thailand to Japan



From the factory to port in Thailand, the exporter is required to obtain export documents, which generates costs such as fees and charges, transportation and export tariffs (if any). Then the shipment of cargo from the port in Thailand to the port in Japan incurs freight and insurance costs. Trade costs from the port in Japan to sellers include the costs of obtaining essential documents, import tariffs, transportation, fees and charges etc. Trade costs also include all currency exchange costs. Therefore, comprehensive trade costs include all costs that are formulated during the shipment from the exporter in Thailand to wholesaler/retailer in Japan. It should be noted here that comprehensive trade costs are the average of trade costs from country i to country j , and trade costs from country j to country i . From the example, the comprehensive

trade costs for Thailand and Japan are the average total trade costs from Thailand to Japan and from Japan to Thailand.

In order to calculate comprehensive trade costs, data are required on the manufacturing exports from country i to country j , and the manufacturing exports from country j to country i . The exports by the manufacturing industry cover the industry from product group 15 to 37 under ISIC classification. The sources of data used in this section are given in table 1.

Table 1. Summary of data sources of trade costs

Variables	Data source
Manufacturing export	World Integrate Trade Solution. Retrieved on 13 January 2013 from https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx
Gross outputs of the manufacturing industry	United Nations National Account database. Retrieved 10 January 2013 from http://unstats.un.org/unsd/snaamaelbasicFast.asp .
Value added of the manufacturing industry	UNCTADSTAT database. Retrieved 7 February 2013 from http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx
Manufacturing exports by Singapore	<i>Yearbook of Statistics Singapore, 2007 and 2012.</i>

Next, intra-national trade data are required. Duval and Utoktham (2011b) used gross output based on shipments to represent the intra-national trade. This is consistent with the export data, which are expressed on a gross shipment basis. However, many countries do not report their gross national output of manufacturing industry. Therefore, the gross national output of the manufacturing industry has to be estimated from the value-added of the manufacturing industry. Duval and Utoktham (2011b) estimated gross output from the value-added of the manufacturing industry of 73 countries during 1988-2010 by using OLS. By using the same method, the present study found that coefficients of value-added of the manufacturing industry for middle-income and high income countries on gross output ranged from 2.64 to 3.29 and from 2.07 to 2.73, respectively.

Table 2. List of countries

Countries/area reports gross national output of manufacturing industry		Countries/area reports missing value of gross national output and showing only value-added of manufacturing industry	
Austria	Italy	Australia	Sweden
Belgium	Japan	Indonesia	Switzerland
Canada	Republic of Korea	Malaysia	Taiwan Province of China
Denmark	Netherlands	Singapore	Thailand
France	Philippines		
Germany	Spain		
Hong Kong, China	United Kingdom		
India	United States		

The coefficients of value-added of the manufacturing industry on gross output were used to estimate gross output of the manufacturing industry for those countries on the right-hand side of table 2. In order to get the value of domestic shipment or intra-national trade, the gross outputs were subtracted by the manufacturing exports to the world by each country. The data on manufacturing exports by Singapore in the WITS database contain large re-export value, which reflects the actual value of domestic shipment. Instead of using export data from the WITS database, data of the manufacturing export by Singapore were taken from the *Yearbook of Statistics Singapore 2007* and *2012*.

The use of comprehensive trade costs has some limitations. First, they are derived solely from international trade and intra-national trade data. Sometimes this does not reflect the real trade situation. For example, trade costs are higher when countries tend to trade more within themselves than they do with others, i.e. $\left(\frac{X_{ii}X_{jj}}{X_{ij}X_{ji}}\right)$ as the ratio increases. Trade costs fall when the countries trade more internationally than domestically. Although comprehensive trade costs exhibit this shortcoming, this paper still uses this approach since the calculation is possible by using observable data; with other approaches the problem is the lack of data.

Second, the elasticity of substitution across the manufacturing industry is required to estimate trade costs. However, there is no such data available in any database. Thus, it is necessary to make an assumption about the elasticity of substitution. Anderson and van Wincoop (2004) estimated the elasticity of substitution and found that it ranges from 5 to 11. Novy (2008) calculates trade cost by setting the elasticity of substitution equal to eight. Following Novy

(2008), Duval and Utoktham (2011b) and Arvis et al. (2012), the same values of elasticity of substitutions, i.e. $\sigma = 8$, are assumed here.

B. Decomposition of trade costs

From the concept of comprehensive trade costs, we can decompose trade costs into different components. Two approaches are used in this paper. Firstly, the comprehensive trade costs are divided into tariff costs and non-tariff costs. Tariff costs, $TC_{ij,t}^k$, is geometric average tariff of the manufacturing industry between country i and country j at time t where it is calculated as:

$$TC_{ij,t}^k = \sqrt{(1 + tc_{ij,t}^k)(1 + tc_{ji,t}^k)} \quad (12)$$

where subscripts i and j are Thailand and its trading partner countries, respectively; k is the manufacturing industry; $tc_{ij,t}^k$ is the weighted average import tariff of the manufacturing industry that country i imposes on country j at time t ; and $tc_{ji,t}^k$ is the weighted average import tariff of the manufacturing industry that country j imposes on country i at time t . Anderson and van Wincoop (2004) suggested that comprehensive trade costs excluded tariff costs are all additional costs other than tariff costs involved in trading goods bilaterally rather than domestically. Comprehensive trade costs excluding tariffs are defined as:

$$NTC_{ij,t}^k = \frac{t_{ij,t}^k}{TC_{ji,t}^k} \quad (13)$$

where $NTC_{ij,t}^k$ are non-tariff comprehensive trade costs between country i and country j at time t .

Second, trade costs are decomposed based on existing literature such as Anderson and van Wincoop (2004), Jack et al. (2008) and Duval and Utoktham (2011a) who defined trade costs as a function of distance, tariffs etc., as follows:

$$t_{ij,t}^k = dist_{ij}^{\beta_1} tariff_{ij,t}^{\beta_2} exch_{ij,t}^{\beta_3} doc_{ij,t}^{\beta_4} conec_{ij,t}^{\beta_5} \exp(\beta_0 + \varepsilon_{ij,t}) \quad (14)$$

The natural logarithm of equation (14) yields:

$$\ln t_{ij,t}^k = \beta_0 + \beta_1 \ln dist_{ij} + \beta_2 \ln tariff_{ij,t} + \beta_3 \ln exch_{ij,t} + \beta_4 \ln doc_{ij,t} + \beta_5 \ln conec_{ij,t} + \varepsilon_{ij,t} \quad (15)$$

where $t_{ij,t}^k$ is the comprehensive trade costs between country i and country j at time t . In fact, the data of comprehensive trade costs on the left-hand side are calculated in equation (11); $dist_{ij}$ is distance between country i and country j ; $exch_{ij,t}$ is a geometric average of the exchange rate in terms of local currency per United States dollar of country i and country j at time t . Trade facilitation factors are the number of documents and times required in the export and import procedures; and $doc_{ij,t}$ is the geometric average of number of documents in the export and import processes of country i and country j at time t where it is estimated as:

$$doc_{ij,t} = \sqrt{(im_doc_{i,t} + ex_doc_{j,t})(im_doc_{j,t} + ex_doc_{i,t})} \quad (16)$$

where $ex_doc_{i,t}$ and $ex_doc_{j,t}$ are the number of documents required in the export procedure of country i and j at time t , respectively; $im_doc_{i,t}$ and $im_doc_{j,t}$ are the number of documents required in the import procedures of country i and j at time t , respectively; and $conec_{ij,t}$ is a geometric average of the liner shipping connectivity index between country i and country j at time t . The data in this section covers 2005-2010 as the World Bank initiated the data collection of trade procedures from 2005. The sources of data in this section are shown in table 3.

Table 3. Summary of data sources of trade cost components

Variables	Data source
Distance	CEPII website. Retrieved 8 February 2013 from http://www.cepii.fr/anglaisgraph/bdd/gravity.asp
Exchange rate	UNCTADSTAT. Retrieved 7 February 2013 from http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx
Number of documents and time required in the export and import processes	Doing Business. Retrieved 7 February 2013 from http://www.doingbusiness.org/data
Liner shipping connectivity index	World Databank. Retrieved 7 February 2013 from http://databank.worldbank.org/data/home.aspx

C. Impacts of trade facilitation on manufacturing exports by Thailand

The augmented gravity model is applied in this paper to analysing the impacts of trade facilitation on the exports of the manufacturing industry where it is defined as follows:

$$\begin{aligned} \ln EX_{ij,t}^k = & \beta_0 + \beta_1 \ln Y_{i,t}^k + \beta_2 \ln Y_{j,t}^k + \beta_3 \ln dist_{ij} + \beta_4 \ln tariff_{ji,t} + \beta_5 \ln exch_{ij,t} + \beta_6 \ln doc_{ij,t} \\ & + \beta_7 \ln conec_{ij,t} + crisis + \varepsilon_{ij,t} \end{aligned} \quad (17)$$

where subscripts i and j represent Thailand and its trading partners, respectively; k is the manufacturing industry; $EX_{ij,t}^k$ is the manufacturing exports by Thailand to country j at time t which defines it in real terms; $Y_{i,t}^k$ is the real output of manufacturing industry by Thailand at time t ; $Y_{j,t}^k$ is the real output of the manufacturing industry of country j at time t ; $dist_{ij}$ is the distance from Thailand to country j ; $tariff_{ji,t}$ is the weighted average import tariff of the manufacturing industry that country j imposes to Thailand at time t ; $exch_{ij,t}$ is the real exchange rate of Thailand and country j where it defined in terms of Thai Baht per foreign currency; $doc_{ij,t}$ is a summation of number of documents required in export procedure of Thailand at time t and the number of documents required in the import procedure of country j at time t ; $conec_{ij,t}$ is the average liner shipping connectivity index of country i and country j at time t , respectively; and $\varepsilon_{ij,t}$ is the error term. The study employed a panel data of 23 partner countries with Thailand covers the period from 2005 to 2010.

3. Results and discussion

A. Descriptive results of trade cost

The summary of the descriptive statistics of the two data sets is shown in table 4; t_{ij_wb} is the manufacturing trade cost calculated by Arvis et al. (2012), which is available on the website of the World Bank, and t_{ij} is the manufacturing trade cost estimated by the author, using a different data set. The two gaps in the trade costs at the minimum point and maximum point are about 8 and 0.1, respectively. The equality tests, i.e., mean test and variance test, were applied for two data sets. The null hypothesis of the mean test is that the mean of two variables is equal. According to the results in table 4, t-test (-1.086) is lower than t-statistics (1.96) so the null hypothesis indicating that the mean of the two data sets is not significantly different cannot be rejected. The null hypothesis of the variance test is that the ratio of variance of the two data sets

is equal to one. The result shows that the F-test is lower than the F-statistics and hence the null hypothesis cannot be rejected. In addition, the correlation between data set of this study and the data set of Arvis et al. (2012) is relatively high. It can therefore be concluded that the trade costs in this paper are not different from the trade costs calculated by Arvis et al. (2012).

Table 4. Summary of statistics of trade costs and statistic tests

Variable	Obs.	Mean	Std. dev.	Min.	Max.
t_{ij_wb}	263	98.362	28.191	27.028	160.760
t_{ij}	263	101.064	28.844	35.764	160.636
Mean test	H ₀ : Mean difference = 0			t = -1.086	
	H ₁ : H ₀ is not true				
Variance test	H ₀ : Ratio of two variances = 1			F = 0.952	
	H ₁ : H ₀ is not true				
Correlation	0.812				

The manufacturing comprehensive trade costs are defined as ad valorem equivalent. For example, the ad valorem equivalent comprehensive trade costs of manufactured goods between Thailand and Australia in 1999 was 110.04%, which means that on average the cost of manufacturing trade between Thailand and Australia was 110.04% of the value of the manufactured goods (see annex). The comprehensive trade costs of the manufacturing industry between Thailand and Australia is an average of the trade costs from Thailand to Australia and trade costs from Australia to Thailand. The manufacturing trade costs of Thailand and Singapore are the lowest, as the import tariff that the manufacturing industry of Singapore imposes on Thailand is zero per cent and because two countries are close to each other. The manufacturing trade costs of Thailand and Malaysia are also low due to the two countries sharing the same border.

The manufacturing trade costs are relatively high between Thailand and European Union members. For example, the manufacturing trade costs of Thailand and Denmark, Italy, Spain and Sweden in 1999 were 146%, 143%, 160% and 144% of the value of the manufactured goods respectively. It is noteworthy that those countries' shares are a small proportion of the manufacturing trade with Thailand. Although trade cost has the shortcoming of using solely

international trade and intra-national trade data, the results obviously imply the actual trade cost to Thailand and its trading partner countries when compared across countries and over time. In general, the manufacturing trade cost between Thailand and its trading partners reduces over time. This result is consistent with trade costs of many countries around the world. Duval and Utoktham (2011b) pointed out that trade costs had decreased due to the improvement of both tariff and non-tariff costs.

Figures 2 and 3 show the comprehensive trade costs of the manufacturing industry between Thailand and five major trading partner countries and the weighted average of trade costs of 24 countries. The most important trading partner, Japan, has a relatively lower manufacturing trade costs compared with those of other countries. The manufacturing trade costs of Thailand and ASEAN countries are almost at the same level as of the manufacturing trade cost between Thailand and Japan signifying that ASEAN trade integration has improved trade costs in the region. Interestingly, the gap in trade costs between Thailand and Japan and between Thailand and China has become smaller due to the improvement of trade between Thailand and China as a consequence of the ASEAN-China FTA. However, the manufacturing trade cost between Thailand and the European Union is relative high.

Figure 2. Manufacturing trade costs of Thailand and major trading partners

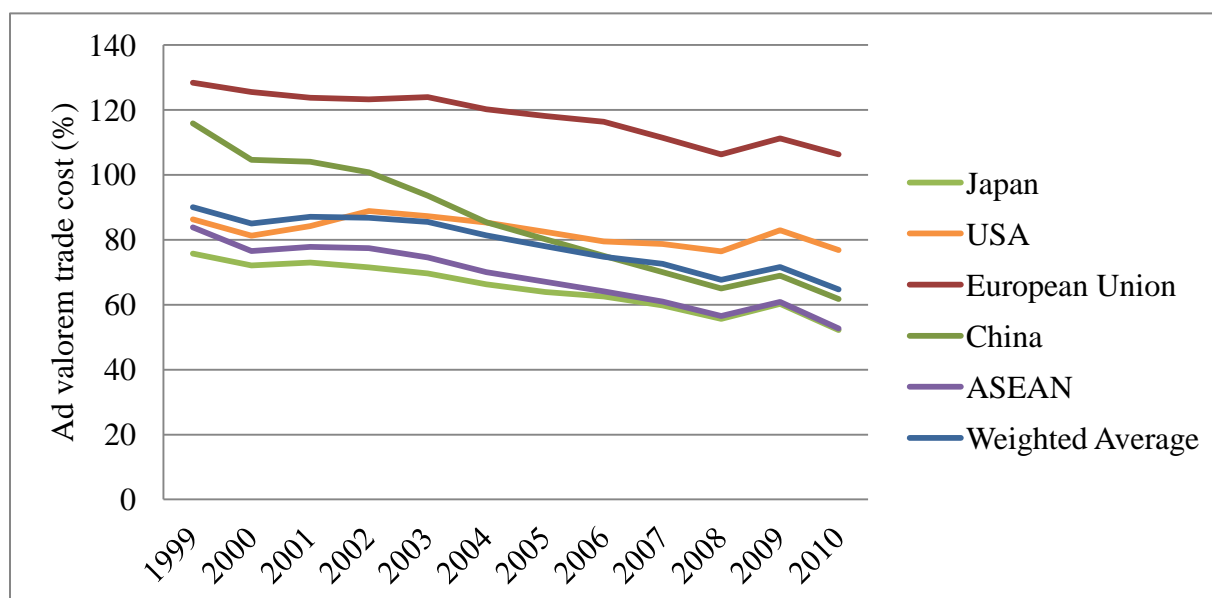
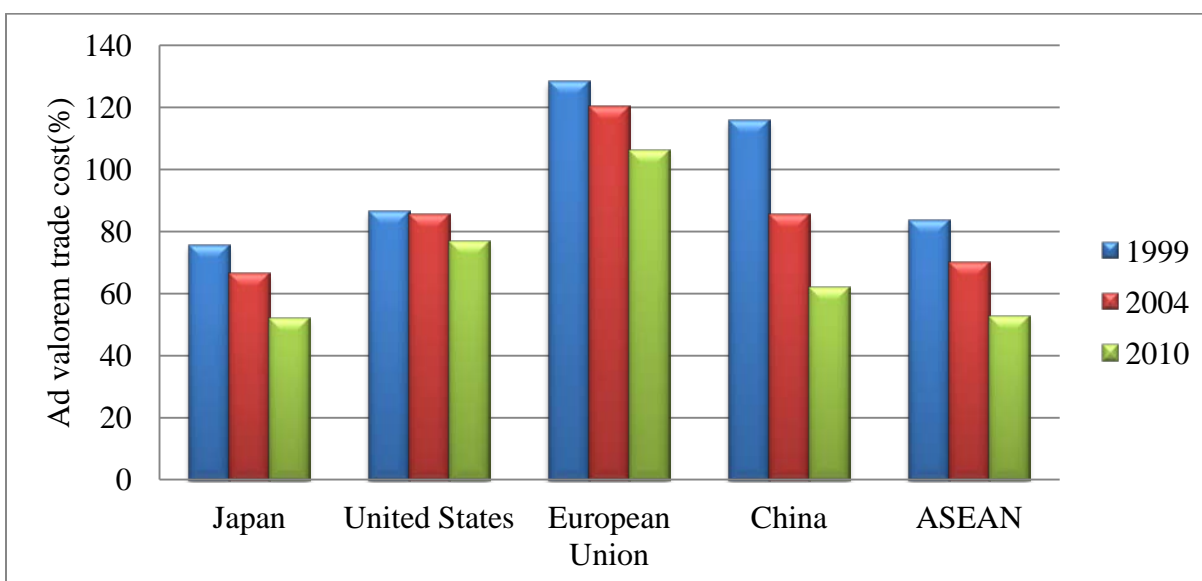


Figure 3. Comparison of the manufacturing trade costs of Thailand and major trading partners



B. Decomposition of trade costs

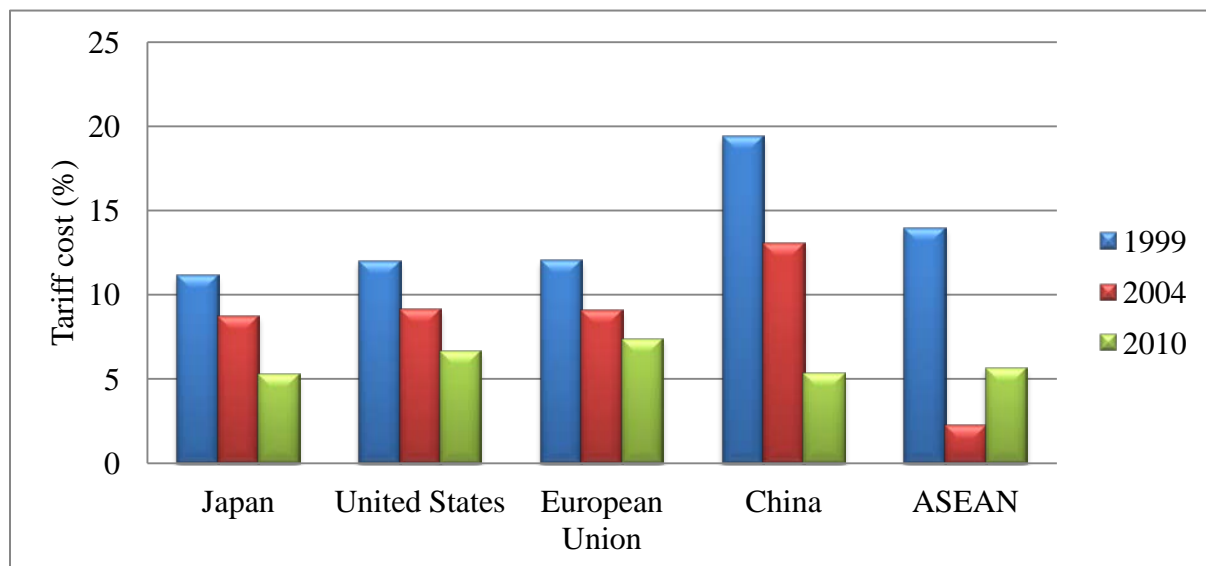
The manufacturing trade costs of Thailand have shown a dramatic decrease during the 2000s due to the reduction of both tariff and non-tariff costs. Figure 4 shows the geometric average import tariff of Thailand's manufacturing industry and five major trading partners. In general, the manufacturing tariff costs have decreased over time. Tariff costs of Thailand and its trading partners have decreased because of ASEAN's FTAs with Japan, China and the Republic of Korea. In addition, Thailand has also signed bilateral FTAs with Japan, Australia, and India and more FTA are in the process of negotiations. Interestingly, the manufacturing tariff costs of Thailand and China significantly decreased almost 20% in 1999 to 5% in 2010 following the implementation of the ASEAN-China FTA in 2002.

It is noteworthy that the average tariff costs between Thailand and other ASEAN countries in 2010 were higher than in 2004. The geometric average tariff cost is calculated by using the weighted average of the tariff that country *i* imposes on country *j*, and country *j* imposes on country *i*. It was found that in 2010 imports by Thailand from Indonesia and from the Philippines were weighted much more on trade of the manufactured vehicles, bodies, parts and accessories for vehicles where the shares of imports of these products are 13.97% and 23.27% of total import by the manufacturing industry, respectively. The average import tariff of the manufactured

vehicles, bodies, parts and accessories for vehicles that Thailand imposed on Indonesia is 24.85% while that imposes on the Philippines is 39.24%. As a result, the weighted average tariff between Thailand and other ASEAN members in 2010 was higher than in 2004.

As mentioned in the methodology section above, non-tariff costs are all additional costs other than tariff costs i.e., transportation costs, trade facilitation costs, and the costs of preparing trade documentation, customs clearance, goods transport and handling at the port. Figure 5 shows the non-tariff costs of Thailand's manufacturing industry with its major trading partner countries. In general, the non-tariff costs decrease over time. The improvement of infrastructure includes road, seaport, and airport and trade facilitations are the main factors for the reduction of non-tariff costs.

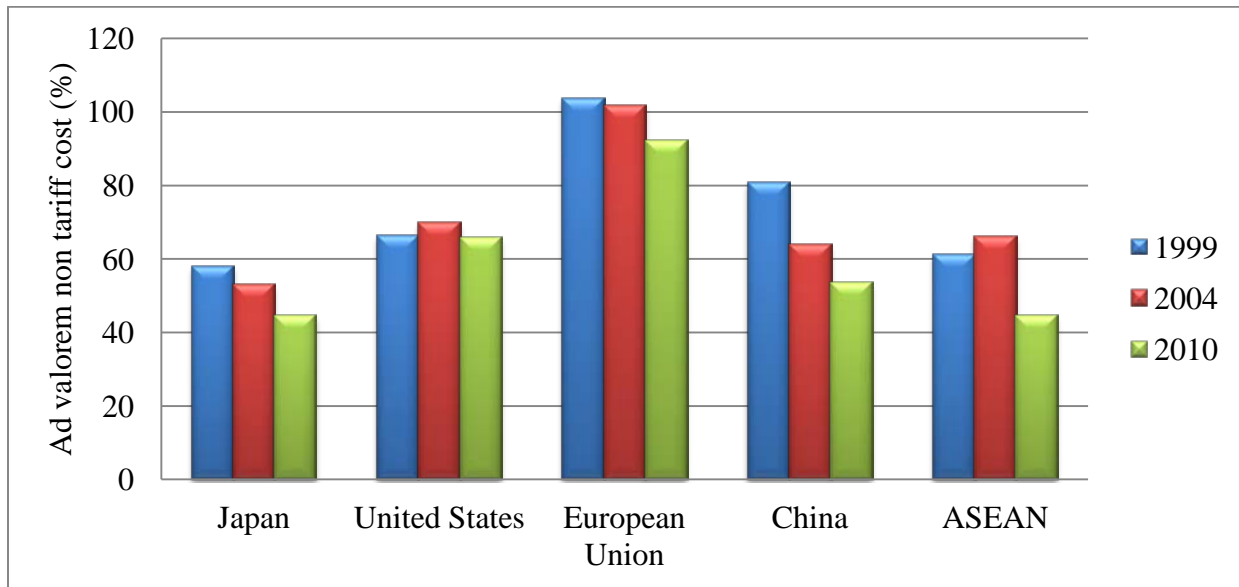
Figure 4. Tariff costs of Thailand's manufacturing industry



The non-tariff costs of the manufacturing industry in Thailand and Japan are relatively lower than in other countries. It is expected that the non-tariff costs of the manufacturing industry of Thailand and other ASEAN member will be lower than those of Thailand and Japan, since Indonesia, Malaysia and the Philippines are closer to Thailand. The transportation costs between Thailand and other ASEAN members should be lower than with other countries. However, trade facilitation indicators in ASEAN countries (except Singapore) are more complicated than those in Japan. For example, the time for exports by Indonesia, Malaysia and the Philippines are 17, 13 and 15 days, respectively, while the time for exports by Japan is 10 days. In addition, the logistic

performance and quality of port infrastructure of ASEAN countries (except Singapore) is far behind those of Japan (table 5 and 6). Non-tariff costs of Thailand and European Union countries are weighted much more on transportation costs although the performances of trade facilitation in the European Union are relative better than those in ASEAN countries.

Figure 5. Non-tariff cost of Thailand's manufacturing industry



The second approach used the pooled least square regression of equation (14). Equation (14) is regressed twice by changing the geometric average number of documents in the export and import procedures by the geometric average of time export and import procedures, since the correlation between these two variables is moderately high. In general, two regressions provide identical coefficients in terms of the sign, but they are slightly different in terms of degree of impact.

Table 5. Statistics of trade facilitation and logistic performance of ASEAN countries

Trade facilitation factors	Thailand		Indonesia		Malaysia		Philippines		Singapore	
	2005	2010	2005	2010	2005	2010	2005	2010	2005	2010
Export documents (number)	24	14	4	4	5	5	7	7	4	4
Time for exports (days)	10	10	22	17	13	13	17	15	5	5
Cost of exports (US\$)	848	625	486	644	432	450	755	630	415	456
Import documents (number)	12	5	7	7	6	6	8	8	4	4
Time for imports (days)	22	13	27	27	10	10	18	14	4	4
Cost of imports (US\$)	1042	795	430	545	385	450	800	730	367	439
Logistic performance index (1=low to 5=high)	-	3.29	-	2.76	-	3.44	-	3.14	-	4.09
Quality of port infrastructure (1= extremely underdeveloped to 7 = well developed)	-	5.03	-	3.62	-	5.57	-	2.76	-	6.76

Source: World Bank, 2013

Table 6. Statistics of trade facilitation and logistic performance of Thailand's major trading partners

Trade facilitation factors	Japan		United States		China		Germany		France	
	2005	2010	2006	2010	2005	2010	2005	2010	2005	2010
Export documents (number)	3	3	4	4	8	8	4	4	7	2
Time for exports (days)	10	10	6	6	23	21	7	7	18	9
Cost of exports (US\$)	859	880	960	1050	390	500	740	872	1028	1072
Import document (number)	5	5	5	5	6	5	5	5	13	2
Time for imports (days)	11	11	5	5	26	24	7	7	20	11
Cost of imports (US\$)	957	970	1160	1315	430	545	765	937	1148	1248
Logistic performance index (1=low to 5=high)	-	3.97	-	3.86	-	3.49	-	4.11	-	3.84
Quality of port infrastructure (1= extremely underdeveloped to 7 = well developed)	-	5.15	-	5.53	-	4.32	-	6.38	-	5.87

Source: World Bank, 2013

The coefficients of variables in table 7 are interpreted as the elasticity of trade cost. For example, the coefficient of distance is 0.31, indicating that a 1% increase in the distance between Thailand and its trading partners results in the manufacturing trade costs between Thailand and its trading partner countries increasing by 0.31%. The average tariff rate of the manufacturing industry increases the trade costs since the tariff rate is directly added to the price of the manufactured goods. The coefficient of the exchange rate is statistically insignificant. The reason is that the exchange rates of Thailand and its major partners of Thailand such as Japan, the European Union and China, were stable during 2005-2010. Therefore, the exchange rate is relative low. Consequently, there is no impact by the exchange rate on the manufacturing trade costs of Thailand. The coefficient of the liner shipping connectivity index shows a negative impact on trade cost, signifying that trade costs between Thailand and its trading partners are lower if they have a higher liner shipping connectivity index. The reason is that if a country has more shipment connections to other countries, it tends to manage transportation routes more efficiently than those having less shipment connection; therefore, that country can reduce time costs and other costs.

The coefficients of trade facilitation factors such as time and documents required for the of export and import processes are positively significant. The cost of import and export documents is incurred by the exporter and importer having to get the necessary documentation from the relevant agencies. The main documents include an export permit, cargo movement permit, cargo insurance, customs declaration among others. Some countries provide these documents in one place, i.e., a “one-stop service”, while in many other countries these documents have to be acquired from different offices. The greater the number of documents involved in the export and import processes, the higher the trade costs, not only in terms of money (fees, service charge and taxes), but also in terms of opportunity cost (waiting time).

Table 7. Decomposition of the manufacturing trade costs

Variables	Coefficient	Beta	Coefficient	Beta
<i>ln_{dist}_{ij}</i>	0.310*** (0.023)	0.703	0.321*** (0.054)	0.730
<i>ln_{tariff}_{ij}</i>	4.797*** (0.787)	0.285	4.274*** (1.451)	0.254
<i>ln_{exch}_{ij}</i>	-0.000 (0.012)	-0.005	0.002 (0.110)	0.014
<i>ln_{conec}_{ij}</i>	-0.199*** (0.041)	-0.254	-0.158*** (0.033)	-0.201
<i>ln_{doc}_{ij}</i>	0.221*** (0.073)	0.157		
<i>ln_{time}_{ij}</i>			0.319*** (0.127)	0.243
<i>constant</i>	-1.709*** (0.319)			
	N = 138		N = 138	
	R ² = 0.779		R ² = 0.802	

Note: Standard errors in parentheses, *** p<0.01

The time requirement in the export and import processes also has a positive impact on trade cost. Time requirements for exports and imports here include time spent in getting documents and permission, customs clearance and inspection at the border checkpoint at seaports and airports. The time requirement for exports and imports add to trade costs if there is any uncertainty (exchange rate, insurances and accidents) during transportation from factory to destination. For the manufacture of processed foods, which are sensitive to time, the cost of damage and spoilage should be taken into account.

It is important to compare the contribution of the components of trade cost to total trade cost. The standardized coefficients (beta)² are calculated. Standardization of the coefficient is usually done in order to answer the question of what level the effect of each variable is on the dependent variables in a multiple regression analysis where beta is simply dividing coefficient by the ratio of standard deviation of corresponding variables. According to table 7, a one standard deviation increase in bilateral distance is associated with about a 0.703 standard deviation increase in the manufacturing trade costs. Distance makes the strongest contribution to the manufacturing trade cost compared to other variables. This result rejects the “death of distance” hypothesis in trade costs (Disdier and Head, 2008).

The average tariff rate contributes more to trade costs than average documents required in the export and import procedures. However, when the time for export and import replaces the number of documents for export and import, the contribution of the time required in the procedures to trade cost is almost the same as the contribution of tariffs to trade costs, indicating that trade facilitation has become more important in recent international trade. The other reason is that most of the tariffs in the manufacturing industry of Thailand and its trading partners are already at a low level since 2005 (see figure 4). The liner shipping connectivity index makes a significant contribution to trade costs.

C. Impacts of trade facilitation on manufacturing exports of Thailand

The impacts of trade facilitation on the exports by the manufacturing industry are investigated by using an augmented gravity model. The Hausman-Taylor estimator is an instrumental variable estimator used to solve the problem of inconsistency in the random effect model since the Hausman test suggests the random effect model. Here $\ln Y_{j,t}$ is assumed to correlate with the random effects. The fixed effect transformation of $\widehat{\ln Y_{j,t}} = \ln Y_{j,t} - \overline{\ln Y_{j,t}}$ eliminates the correlation with the random effects; therefore, $\widehat{\ln Y_{j,t}}$ is the suitable instrument for $\ln Y_{j,t}$. Table 8 shows results of regression using the Hausman-Taylor model.

In general, the coefficients are consistent with the theory of the gravity model and previous studies in terms of sign. The coefficients are interpreted as the elasticity of the manufacturing

² Standardized coefficients are calculated as follows: $\widehat{\beta}_j^* = \widehat{\beta}_j \frac{S_{x_j}}{S_Y}$, where $\widehat{\beta}_j$ is coefficient from regression, S_{x_j} and S_Y are standard deviations independent variable (X_j) and dependent variable (Y), respectively.

export. For example, the coefficient $\ln Y_{j,t}$ is 0.927 in equation (1), which means a 1% increase in the manufacturing output of country j increases manufacturing exports by Thailand by 0.927%. Distance is one important factor in trade costs and manufacturing exports by Thailand. If country j is further from Thailand by 1%, the manufacturing exports by Thailand to country j decrease by 1.331%. The coefficient of the exchange rate is positively significant at the 1% level, indicating that a 1% increase in the exchange rate will increase manufacturing exports by 0.195%. In other words, if the value of the Thai baht appreciates by 1%, manufacturing exports by Thailand increase by 0.195%. It is noteworthy that tariffs that country j imposes on manufacturing import from Thailand are negative but not statistically significant. The present study found that tariff rates of the manufacturing industry were stable at a low level after 2005, except in the case of China where tariffs decreased slightly.

The main focus of this section is how trade facilitation affects manufacturing exports by Thailand. The average number of documents in the export and import procedures is negatively significant at the 10% level, indicating that a 1% increase in the number of documents decreases manufacturing exports by 0.2%. The documents in the process of export and import require approval from the related offices. For example, the customs declaration form requires approval from the customs office while a letter of credit needs to be prepared and approved by a bank. The transportation from one office to another office incurs both direct cost (fees and service charge and transportation cost) and indirect cost (opportunity cost). If many documents are involved in the process flow of exports and imports is distorted. A lengthy and complicated process is therefore an obstacle to exporters and importers as well as to investors who plan to invest in exporting from Thailand.

In Thailand, the number of documents required in the export process is relatively higher than in its partners (table 5). They are even greater in number than in certain other comparable ASEAN members such as Malaysia. Keretho and Naklada (2011) showed the exporting auto spare parts from Thailand to India required 29 documents including more than 800 data elements, while the import process in Thailand for electronic devices from China required 24 documents, including 700 data elements. Twelve parties are involved in the process of exporting auto spare parts. OECD (2003) indicated that direct and indirect costs from export and import procedures covered between 1% and 15% of product costs. This cost equals tariff cost in many developed countries.

Table 8. Impact of trade facilitation on manufacturing exports by Thailand

Variables	(1)	(2)
$\ln Y_{i,t}$	0.927*** (0.129)	0.674*** (0.146)
$\ln Y_{j,t}$	0.508*** (0.113)	0.550*** (0.109)
$\ln dist_{ij}$	-1.331*** (0.364)	-1.338*** (0.328)
$\ln exch_{ij,t}$	0.195** (0.096)	0.177** (0.087)
$\ln t_{ji,t}$	-1.099 (1.111)	-0.776 (1.079)
$\ln doc_{ij,t}$	-0.200* (0.108)	
$\ln time_{ij,t}$		-0.449*** (0.125)
$\ln conec_{ij,t}$	0.034 (0.226)	0.109 (0.215)
$crisis$	-0.034 (0.032)	-0.032 (0.031)
$constant$	1.284 (3.270)	4.722 (3.177)
N	138	138

Note: Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Model (2) presents the results as alternative variable since time involved exporting and importing reflects the number of documents required for the export and import processes. In other words, times for export and import are highly correlated with the number of documents in export and import processes. In general, the results are consistent with model (1). The coefficient of time for exports and imports is negatively significant at the 1% level, indicating that a 1% decrease in the

time taken by the export and import processes increases manufacturing exports by 0.445%. In other words, each day of delay in the export and import procedures decreases manufacturing exports by Thailand.

The export and import time are still the main barrier facing exporters and importers in Thailand. Keretho and Naklada (2011) showed that the time required for exporting auto spare parts from Thailand to India was 51 days while the time for importing electronic devices from China was 5 days. A survey by Cheewatrakoolpong and Ariyasajjakorn (2012) of the trade costs of 500 firms in Thailand found that the average export procedure of manufacturing products was 9.16 days. They also found that the composition of time associated with trade facilitation for manufacturing products included 3.75 days for standard and conformity assessment, 2.29 days for in-land transportation, 2.38 days for customs procedures and 0.72 day for port handling. The average export procedure accounted for 8.29% of the value of the manufacturing exports by Thailand.

Since trade facilitation is an important factor in exports and imports by Thailand, the Government implemented a Logistic Master Plan, 2011. The purpose of the plan is to reduce the logistic cost, and one objective is to enhance trade facilitation by implementing a single window service. This project intends to reduce redundant information as well as the number of documents and time involved in export and import procedures. World Bank (2013) statistics also show that cross-border trade indicators for Thailand have made significant progress. The export cost for Thailand was reduced from US\$ 848 per 20-foot container in 2005 to US\$ 625 per 20-foot container in 2010 while the import cost for Thailand decreased from US\$ 1,042 per 20-foot container in 2005 to US\$ 750 per 20-foot container in 2010. The export and import process times were also reduced from 24 and 22 days, respectively, in 2005 to 14 and 13 days, respectively, in 2010. This is one of the reasons why manufacturing exports by Thailand flourished in the late 2000s.

Conclusion and policy implications

This study applies the trade costs model of Chen and Novy (2009) in estimating comprehensive trade costs for the manufacturing industry of Thailand. The results indicate that manufacturing trade costs continually decreased over time due to the reduction of tariff and non-tariff costs. The manufacturing trade costs between Thailand and Singapore are the lowest while trade costs between Thailand and Japan, the most important trading partner of Thailand, are the third lowest. On the other hand, the manufacturing trade costs between Thailand and the European Union are relative high due to distance. Next, the manufacturing trade costs were broken down into their components. Distance contributed the highest proportion of trade costs. Trade facilitation, such as number of documents and time involved in exporting and importing, has also been an important factor associated with trade cost in recent years. This factor has had a strong impact on manufacturing exports by Thailand and has become a more important component of that trade. The results of this study are robust and exhibit consistency with previous studies that have found the improvement of trade facilitation enhanced manufacturing exports by Thailand. Based on the results of this study, the following recommendations are proposed:

- (a) The negotiation of FTAs with important markets such as the United States and the European Union should be continued in order to reduce trade barriers. Non-tariff costs such as logistics costs should be reduced by developing and improving infrastructure such as roads, seaports and airports;
- (b) The Government of Thailand should fully implement the National Single Window Service and ASEAN Single Window Service at all border checkpoints. This will shorten export and import procedures, which involve excessive documents, authorizing agents and duplication;
- (c) Promote the Single Window Service, with a clear and detailed explanation, among exporters and importers.

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Annex

Comprehensive manufacturing trade costs between Thailand and its trading partners											Unit = %	
Country/area	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Australia	110.04	106.19	108.86	103.57	99.12	90.73	79.79	73.06	67.02	58.22	56.71	52.05
Austria	135.92	151.41	145.94	149.65	135.80	129.37	131.81	124.62	117.45	115.11	122.81	120.94
Belgium	98.96	92.22	81.62	51.86	83.83	95.87	92.13	92.46	91.29	88.86	92.39	86.02
Canada	137.67	133.27	132.06	129.64	126.58	122.88	120.48	112.96	108.01	97.92	107.24	97.41
China	115.86	104.65	104.05	100.79	93.58	85.37	80.17	75.05	70.08	65.04	68.94	61.75
Denmark	146.86	140.60	148.04	150.77	146.36	141.81	143.11	135.78	133.80	124.36	128.41	119.77
France	124.03	119.52	118.67	124.29	126.04	121.53	109.23	120.00	112.22	107.83	108.12	103.65
Germany	112.10	108.22	106.34	109.27	110.48	107.33	107.18	105.25	101.12	96.05	99.42	94.99
Hong Kong, China	84.18	81.28	83.23	80.67	73.97	66.75	65.46	62.29	68.23	51.16	53.46	55.71
India	139.12	137.23	132.17	133.68	131.48	127.42	118.59	112.69	107.01	101.08	103.12	97.05
Indonesia	110.44	105.20	107.55	107.21	101.21	90.77	85.03	84.62	76.65	68.45	76.94	64.29
Italy	143.84	133.79	135.90	136.48	133.92	126.62	128.01	125.68	119.67	114.33	122.47	117.56
Japan	75.71	72.10	73.00	71.53	69.67	66.30	63.91	62.54	59.79	55.68	60.29	52.17
Rep. Korea	107.45	100.72	101.67	100.57	100.47	98.08	97.56	93.00	90.05	84.76	88.58	81.07
Malaysia	70.96	67.81	69.46	66.51	64.84	57.70	55.14	52.19	49.28	47.90	49.13	43.17
Netherlands	119.71	116.36	115.52	115.27	112.13	103.44	103.00	98.62	96.46	91.78	95.88	92.57
Philippines	99.23	81.50	80.63	82.82	78.99	81.28	81.49	77.99	76.84	73.62	78.85	67.62
Singapore	54.59	51.79	53.58	53.20	53.42	50.19	46.58	41.83	41.20	35.96	38.41	35.76
Spain	160.64	159.60	152.59	159.57	156.38	148.63	142.67	139.69	130.32	123.20	133.28	127.54
Sweden	144.36	136.00	140.68	138.47	143.07	143.88	141.96	135.50	132.88	125.21	129.34	123.22
Switzerland	127.83	123.75	124.13	123.71	122.43	120.19	117.82	115.26	110.81	103.95	111.00	104.76
Taiwan Province												
of China	86.77	82.34	88.27	89.61	85.99	84.74	83.59	77.62	77.26	80.34	85.50	77.99
United Kingdom	113.31	108.21	109.00	111.74	110.21	107.37	106.25	105.32	100.40	95.63	98.21	93.45
United States	86.32	81.26	84.20	88.83	87.33	85.28	82.49	79.52	78.66	76.47	82.94	76.79

Source: Author calculation, 2013

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ARTNeT Secretariat

United Nations
Economic and Social Commission for Asia and the Pacific
Trade and Investment Division
United Nations Building
Rajadamnern Nok Avenue
Bangkok 10200, Thailand
Tel.: +66 (0)2-288-2251
Fax.: +66 (0)2-288-1027
E-mail: artnetontrade@un.org
Web site: www.artnetontrade.org