

## TRADE COSTS IN ASIA AND THE PACIFIC: IMPROVED AND SECTORAL ESTIMATES

(December 2011; revised 15 January 2012)

### *Abstract*

There is ample evidence that successful implementation of bilateral or regional trade and economic integration initiatives would have a very significant impact on intraregional trade in Asia and the Pacific. However, little is known about the level of intraregional trade costs in the region and to what extent these costs may have decreased over time. This paper introduces new aggregate and sectoral estimates of bilateral trade costs in Asia and the Pacific available in an updated and extended version of the ESCAP Trade Cost Database (Version 2). The new data suggests that (1) most countries and subregions have made improvements in reducing trade costs; (2) Trade costs among Asian countries still often exceed the costs of trade of Asian countries with developed countries outside the region; and (3) tariff costs accounts for only a small portion of comprehensive trade costs – although tariff cuts account for a large share of overall trade cost reduction over the past decade. At the sectoral level, agricultural trade costs are systematically found to exceed manufacturing trade costs, even when tariff costs are excluded. The fact that agricultural trade costs in many developing countries are twice as high as their trade costs in manufactured goods suggest that focusing trade facilitation efforts on that sector may be particularly productive, especially given the importance of this sector for poverty reduction and more inclusive and sustainable development.

**Keywords:** trade costs, bilateral trade, Asia and the Pacific, sectoral data, trade facilitation

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## CONTENTS

|  |    |
|--|----|
| 1. INTRODUCTION .....  | 1  |
| 2. DEFINITION AND CALCULATION OF COMPREHENSIVE TRADE COSTS .....           | 1  |
| 3. COMPREHENSIVE TRADE COSTS IN ASIA AND THE PACIFIC: AT A GLANCE ....     | 3  |
| Tariffs in Comprehensive Trade Costs .....                                 | 4  |
| Evolution of Comprehensive Trade Costs in Asia and the Pacific .....       | 5  |
| 4. INTRAREGIONAL COMPREHENSIVE TRADE COSTS.....                            | 8  |
| 5. AGRICULTURE VS. MANUFACTURING COMPREHENSIVE TRADE COSTS.....            | 9  |
| CONCLUSION.....  | 11 |
| Annex 1 – Derivation of Trade Cost Equation .....                          | 13 |
| Annex 2 – Methodology and Data Sources for Comprehensive Trade Costs ..... | 15 |
| Annex 3 – Bilateral Tariff.....  | 21 |
| Annex 4 – Regional and Subregional CTC and NT-CTC: Overall .....           | 22 |
| Annex 5 – Regional and Subregional CTC and NT-CTC: Agriculture.....        | 23 |
| Annex 6 – Regional and Subregional CTC and NT-CTC: Manufacturing .....     | 24 |

### List of Figures

|   |   |
|---|---|
| Figure 1: Comprehensive Trade Costs (CTC) and CTC excluding tariff (NT-CTC) between selected economies and the United States of America (2007-2009) ..... | 4 |
| Figure 2: Comprehensive Trade Costs (CTC) and CTC excluding tariff (NT-CTC) between selected economies and China (2007-2009) .....                        | 5 |
| Figure 3: Evolution of ESCAP and OECD Trade Costs with USA .....  | 6 |
| Figure 4: Evolution of ESCAP and OECD Trade Costs with China .....  | 7 |

### List of Tables

|  |   |
|--|---|
| Table 1: Non-tariff intra- and extra- regional trade costs in Asia and the Pacific ..... | 9 |
|--|---|

## 1. INTRODUCTION

Most Asian countries are already actively engaged in bilateral or regional trade and economic integration initiatives, and many of these initiatives include trade facilitation or trade cost reduction programs or targets. There is ample evidence that successful implementation of these programs – or achievement of targets – would have a very significant impact on intraregional trade. However, little is known about the level of intraregional trade costs in Asia and to what extent these costs may have decreased over time.

In an effort to address this knowledge gap, a first database of bilateral trade costs was developed at ESCAP in 2010, based on a new measure derived by Chen and Novy in 2009.<sup>1</sup> Since then, further efforts have been made to both expand and enhance the accuracy of the trade cost estimates, in particular by developing more accurate proxies for the underlying data necessary to compute the bilateral trade cost measure and introducing sectoral-level trade cost estimates. This paper introduces the methodology and presents a very preliminary analysis of the Second Version of the ESCAP Trade Cost database, a database released in December 2011 covering bilateral comprehensive trade costs (CTC) of over 100 economies from 2000 to 2009.<sup>2</sup>

## 2. DEFINITION AND CALCULATION OF COMPREHENSIVE TRADE COSTS

As shown by Jack, Meissner, and Novy (2008; 2009), gravity equations derived from the Anderson and van Wincoop (2003) trade model as well as other leading trade models such as the model with heterogeneous firms of Melitz and Ottaviano (2008), can be solved for an expression of bilateral comprehensive trade costs. This bilateral measure of trade costs is truly comprehensive in the sense that it includes *all additional costs involved in trading goods internationally with another partner (i.e. bilaterally) relative to those involved in trading goods intranationally (i.e., internally or domestically)*. It captures trade costs in its wider sense, including not only international transport costs and tariffs but also other trade cost components discussed in Anderson and van Wincoop (2004), such as costs associated with the use of different language and currencies. Direct and indirect costs associated with completing trade procedures or obtaining necessary information are also included.

Following Chen and Novy (2009), such all-inclusive trade costs may be defined as follows:

$$\tau_{ijkt} \equiv \left( \frac{t_{ijkt} t_{jikt}}{t_{iikt} t_{jjkt}} \right)^{\frac{1}{2}} = \left( \frac{x_{iikt} x_{jikt}}{x_{ijkt} x_{jjkt}} \right)^{\frac{1}{2(\sigma_k - 1)}} \quad ; \text{ at sector } k, \text{ time } t \quad (1)^3$$

where  $\tau_{ij}$  denotes geometric average trade costs between country  $i$  and country  $j$   
 $t_{ij}$  denotes international trade costs from country  $i$  to country  $j$   
 $t_{ji}$  denotes international trade costs from country  $j$  to country  $i$   
 $t_{ii}$  denotes intranational trade costs of country  $i$   
 $t_{jj}$  denotes intranational trade costs of country  $j$

<sup>1</sup>See Duval, Yann, and Utoktham, C. (2010), “*Intraregional Trade Cost in Asia: A Primer*”, Trade and Investment Division, ESCAP Staff Working Paper 01/10.

<sup>2</sup>Available at: <http://www.unescap.org/tid/artnet/trade-costs.asp>. 2010 data for selected countries is available upon request.

<sup>3</sup>As in Jack, Meissner, and Novy (2008), trade costs may be expressed in tariff-equivalent form, defined as  $TET_{ij} = T_{ij} - 1$ . See Annex 1 for the full derivation of trade cost from the micro-founded gravity equation of Anderson and van Wincoop. For simplicity, the study drops sector  $k$  and time  $t$  subscript.

$x_{ij}$  denotes international trade flows from country  $i$  to country  $j$   
 $x_{ji}$  denotes international trade flows from country  $j$  to country  $i$   
 $x_{ii}$  denotes intranational trade of country  $i$   
 $x_{jj}$  denotes intranational trade of country  $j$   
 $\sigma_k$  denotes sector-specific elasticity of substitution between goods in the sector  $k$

According to this equation, these comprehensive trade costs (CTC) are directly inferred from observable bilateral and intranational (domestic) trade data, showing how much more expensive bilateral international trade is relative to intranational trade. Intranational trade is ideally defined as gross output less export. However, since gross output data is not available for most developing countries in Asia, alternative measures are needed.

Earlier work used gross domestic product in place of gross output to calculate intranational trade and comprehensive trade costs (e.g., see Chen and Novy, 2009; Brooks and Ferrarini, 2010; or Duval and Utoktham, 2010).<sup>4</sup> However, the basis for doing so is unclear, particularly since GDP is a measure of value-added, while export is expressed in gross shipment basis. In an effort to address this issue, we therefore estimate a simple model of gross output as a function of Value Added in current US dollar from World Development Indicator (which is a closed proxy to GDP) - with year, sector and income group fixed effects. Details of the method used for estimation of gross output are in Annex 2.

Another improvement made compared to earlier work is the use of sectoral-level data for the calculation of CTC in goods. As a result, we are able to report not only aggregate level bilateral CTC estimates, but also sectoral-level CTCs for both the agricultural and manufacturing sectors.<sup>5</sup> While the previous literature suggests that elasticities of substitution are sector-specific and may be higher for agricultural products than manufacturing products, we use the same elasticity of substitution for all sectoral and aggregate level estimates. Following Anderson and van Wincoop (2004) and Novy (2008), it is set to  $\sigma = 8$ .<sup>6</sup> This approach facilitates both comparisons with the previous literatures as well as cross-sectoral comparisons, in particular the testing of the hypothesis that agricultural trade costs will be consistently higher than trade costs in manufacturing goods regardless of the value of  $\sigma$  due to the intrinsic characteristics of agricultural and food products, e.g., perishability and of more complex regulatory and handling procedures.

Following Anderson and van Wincoop (2004), comprehensive trade costs excluding tariff (NT-CTC), which encompasses *all additional costs other than tariff costs involved in trading goods bilaterally rather than domestically*, are also calculated as  $CTC_{ij}/(1+\text{tariff}_{ij*ji})$  where  $\text{tariff}_{ij*ji}$  is the geometric average of  $\text{tariff}_{ij}$  and  $\text{tariff}_{ji}$ , and  $\text{tariff}_{ij}$  is the simple average effective import tariff imposed by country  $i$  on country  $j$  and  $\text{tariff}_{ji}$  is the simple average effective import tariff imposed by country  $j$  on country  $i$ .<sup>7</sup>

<sup>4</sup> The first version of the ESCAP Trade Cost Database was also based on this approach.

<sup>5</sup> Agricultural sector is defined as Sector 1-5 (Agriculture, Hunting, Forestry; Fishing) and Manufacturing sector as Sector 15-37 (Manufacturing), both under ISIC Revision 3. See Annex 2 for details.

<sup>6</sup> Sector-specific elasticity of substitutions are discussed in Chen and Novy (2009), on the basis of those presented by Hummels (2001) under 2-digit SITC. As part of checking the robustness of our results, trade costs with elasticity of substitution equals 5, 8 and 10 were calculated and compared, but relative bilateral trade costs are indeed found to be stable across different values of elasticity of substitution. This supports earlier findings (e.g., by Anderson and van Wincoop, 2003; and Jacks, Meissner and Novy, 2009), which suggest that results (relative trade costs) are not sensitive to the choice of parameter.

<sup>7</sup> Since CTC is by nature a bi-directional term. i.e. a term combining the costs of importing from and the cost of exporting to a given trade partner, the tariff component term is of the same nature. See Annex 3 for details on tariff's data acquisition.

Bilateral international trade flows<sup>8</sup> from 1998-2010 are obtained from UN Commodity trade database (COMTRADE) and downloaded using the World Integrated Trade Solution (WITS: <http://wits.worldbank.org>). Bilateral import data is used as it is generally believed to be of better quality than export data. Gross output is acquired from National Accounts Official Country Data maintained by UN Statistics Division (<http://data.un.org>). Value-added and gross exports, which are used in calculation of bilateral intranational trade, are obtained from World Development Indicators (WDI) and UN COMTRADE, respectively.<sup>9</sup> Bilateral tariff data used to calculate non-tariff trade costs at the subregional level are from the UNCTAD TRAINS database.<sup>10</sup>

### 3. COMPREHENSIVE TRADE COSTS IN ASIA AND THE PACIFIC: AT A GLANCE

Aggregate level CTC of selected economies with the United States of America and China are shown in figures 1 and 2, respectively. On average, CTC of these economies with the USA is found to be lower than with China. The absolute as well as the relative trade cost performance (ranking) of each country is found to vary significantly depending on the trade partner under consideration. The Republic of Korea is the top ranked economy in terms of CTC with China, while Germany is the top ranked economy in terms of CTC with the USA. This highlights the importance of “natural” trade costs, i.e, costs related to the relative geographical distance between countries and other factors (e.g., difference in languages) mostly independent of economic policy decisions.

That said, some countries exhibit consistently low CTC with both China, the USA and other major trade partners. They include most developed countries, as well as a number of middle income countries in Southeast and East Asia in particular, including Malaysia and Thailand. The best trade cost performer among low-income countries studied is Viet Nam – a finding consistent with the ranking of the World Bank’s Logistics Performance Index 2010.

Landlocked countries (e.g, Bhutan and Kyrgyzstan) and small and isolated South Pacific Island States (e.g., Vanuatu) feature CTC three to five times (or more) those of developed economies. Most least developed countries (LDCs) also exhibit very high trade costs, although much less so. Bangladesh, the best performing LDC among those included in the database, has CTC about twice as high as those of developed countries.

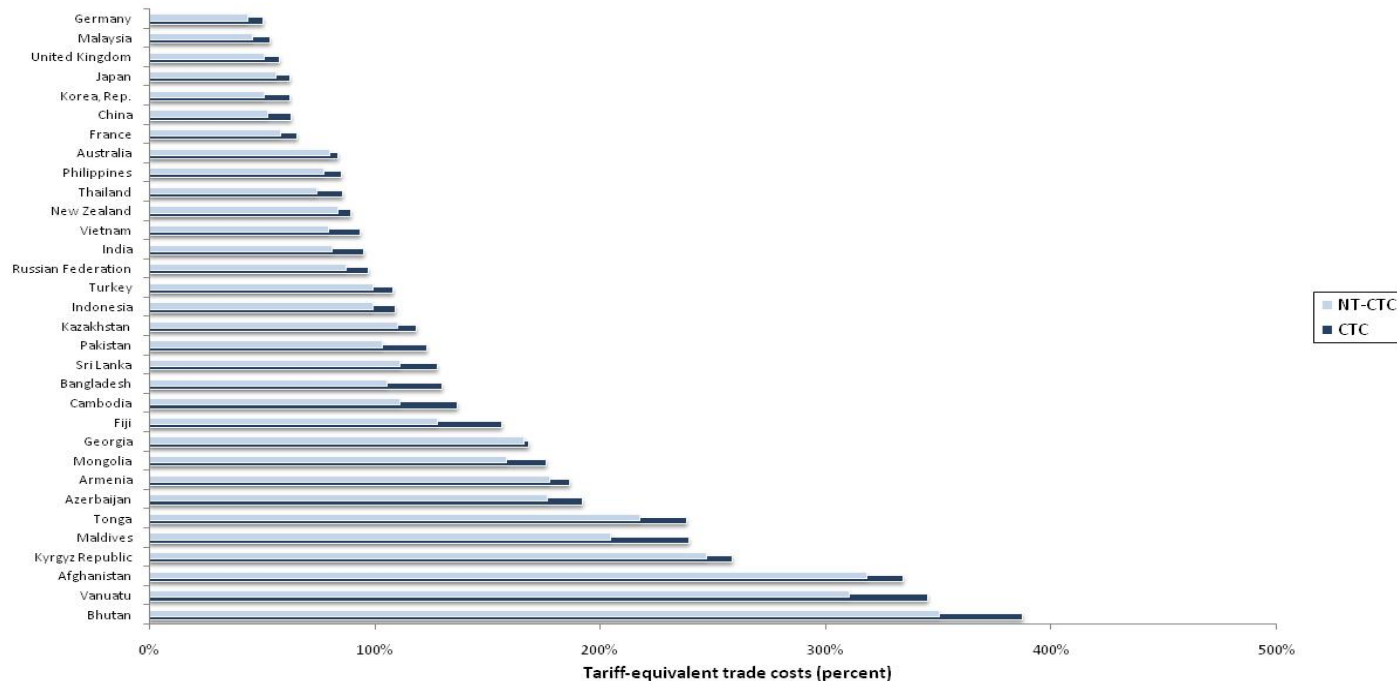
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<sup>8</sup> Bilateral trade flows used for calculating trade costs are bilateral imports. See Annex 2 for details.

<sup>9</sup> All above mentioned data was downloaded in November 2011, except gross output data which was downloaded in August 2011. See Annex 2 for details.

<sup>10</sup> Data downloaded through WITS as simple average of effectively applied tariff in Nov 2011. See Annex 3 for details.

**Figure 1: Comprehensive Trade Costs (CTC) and CTC excluding tariff (NT-CTC) between selected economies and the United States of America (2007-2009)**



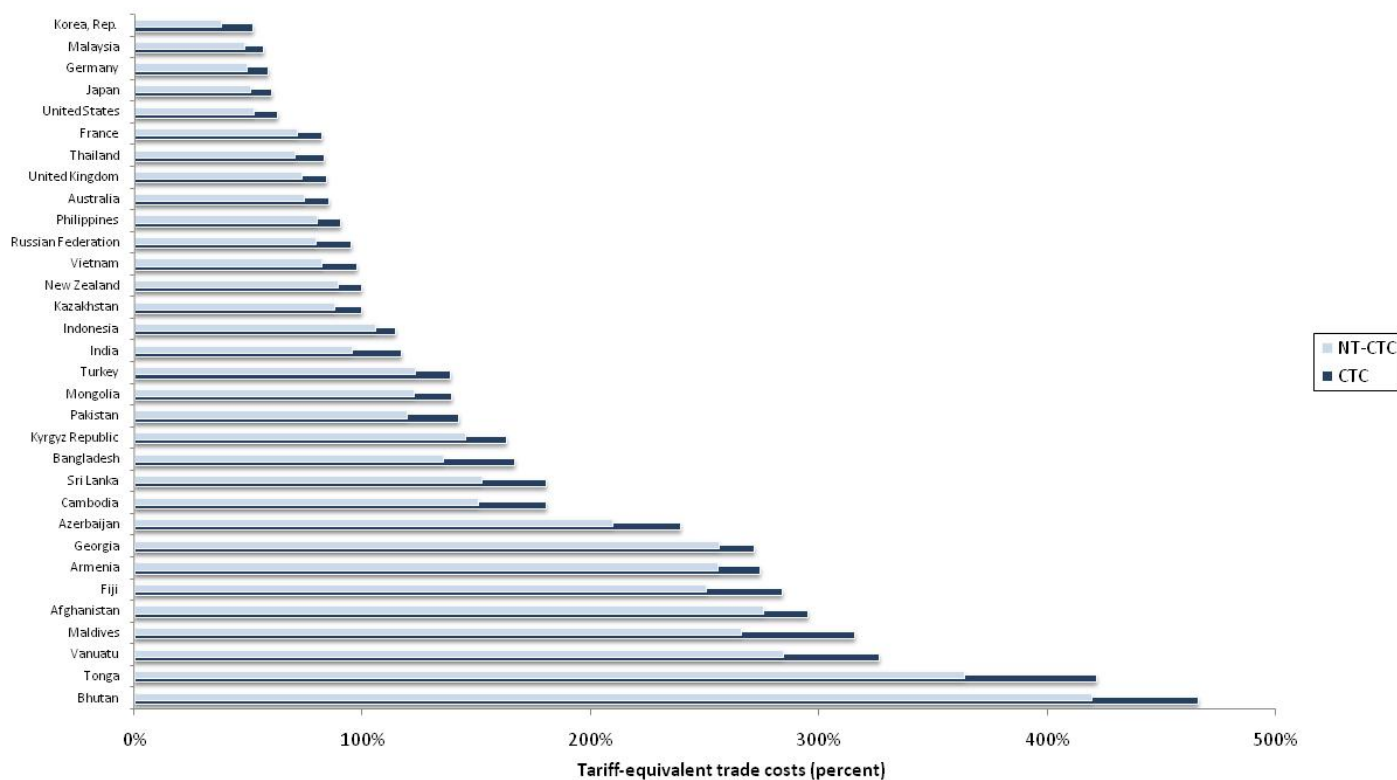
Source: ESCAP Trade Cost Database (version 2)

### *Tariffs in Comprehensive Trade Costs*

Both figure 1 and 2 show that, while tariff costs still do affect relative trade cost ranking of economies with their trade partners, they often account for a very small portion of overall trade costs. Tariff costs account on average for only 13% of CTC. As tariffs continue to fall – in part due to implementation of free trade commitments under the multitude of bilateral and regional agreements that have recently entered into force-, countries aiming to maintain their competitiveness will have to increase their attention to non-tariff trade costs, including those arising from unnecessarily cumbersome procedures and regulations or inadequate logistics services.

Interestingly, the difference between CTC and NT-CTC –when both are expressed in tariff equivalent form - is found to be 21% on average. In comparison, the average tariff rate in the sample of countries in the ESCAP trade cost database is 8%. While this would certainly deserve a more detailed investigation, this result implies that the hidden costs associated with the imposition of a non-zero tariff (e.g., cost associated with the additional procedures involved in enforcing the tariff) may be so significant as to exceed the tariff rate itself.

**Figure 2: Comprehensive Trade Costs (CTC) and CTC excluding tariff (NT-CTC) between selected economies and China (2007-2009)**



Source: ESCAP Trade Cost Database (version 2)

***Evolution of Comprehensive Trade Costs in Asia and the Pacific***

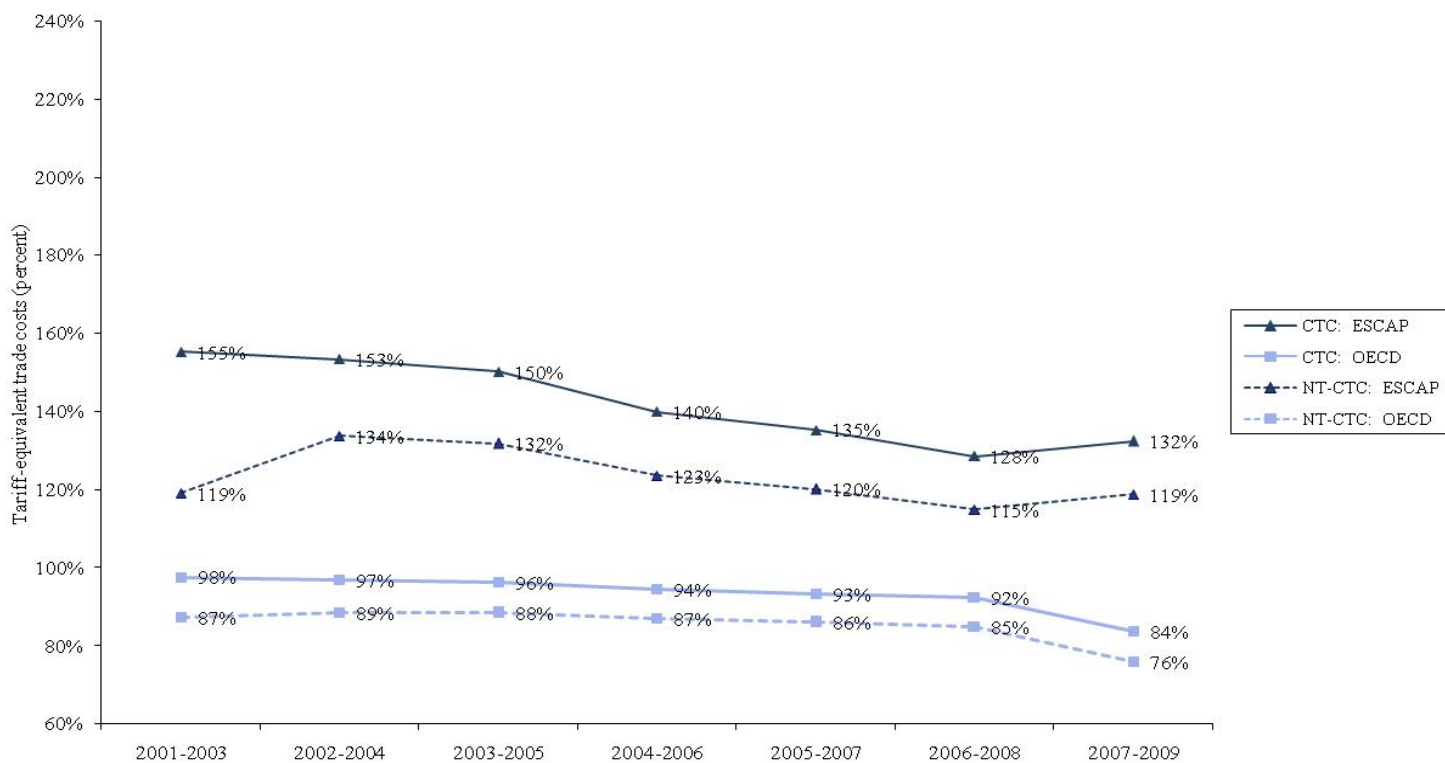
Figure 3 and 4 show how trade costs of ESCAP and OECD members have changed with the USA and China, respectively, over the past decade. ESCAP and OECD<sup>11</sup> CTCs with China are found to have fallen significantly since 2001, with ESCAP CTC falling by about 20% during the period considered. ESCAP trade costs with China are found to have fallen faster than those of OECD with China.

The evolution of ESCAP trade costs with the USA provides a more mixed picture. While ESCAP CTC with the USA fell by almost 13% between 2001 and 2009, the fall in trade cost when tariff costs are excluded is much less obvious. In fact, both in the case of ESCAP and OECD trade costs with USA and China, it appears that tariff reductions has been a major driver of trade costs reductions. Overall, OECD trade costs remain almost 40% lower than those of ESCAP as a whole.

<sup>11</sup> There are incomplete missing trade cost data series for ESCAP, namely, Afghanistan, Brunei, Bhutan, Fiji, Kiribati, Lao PDR, Marshall Islands, Micronesia, Myanmar, Mongolia, Nepal, Nauru, Palau, Papua New Guinea, Samoa, Singapore, Solomon Islands, Tajikistan, Turkmenistan, Tonga, Uzbekistan, and Vanuatu; and for OECD, namely, Belgium and Luxembourg

Interestingly, while trade costs have been consistently decreasing between 2002-2004 and 2006-2008 for both ESCAP and OECD members, trade costs are found to have increase slightly from 2006-2008 and 2007-2009 in the case of ESCAP members – while those of OECD have kept falling. This recent trend reversal in the case of ESCAP economies would deserve more detailed analysis to identify the factors and individual countries (or subregions) that may have caused it. Apart from the global financial crisis that hit Asian trade very hard during that period, one hypothesis that may be advanced is that the trade logistics infrastructure and trade procedures in place in many countries of the region may not allow them to cope with the fast growing volumes of trade, leading to increases in trade costs as a percentage of value of goods.

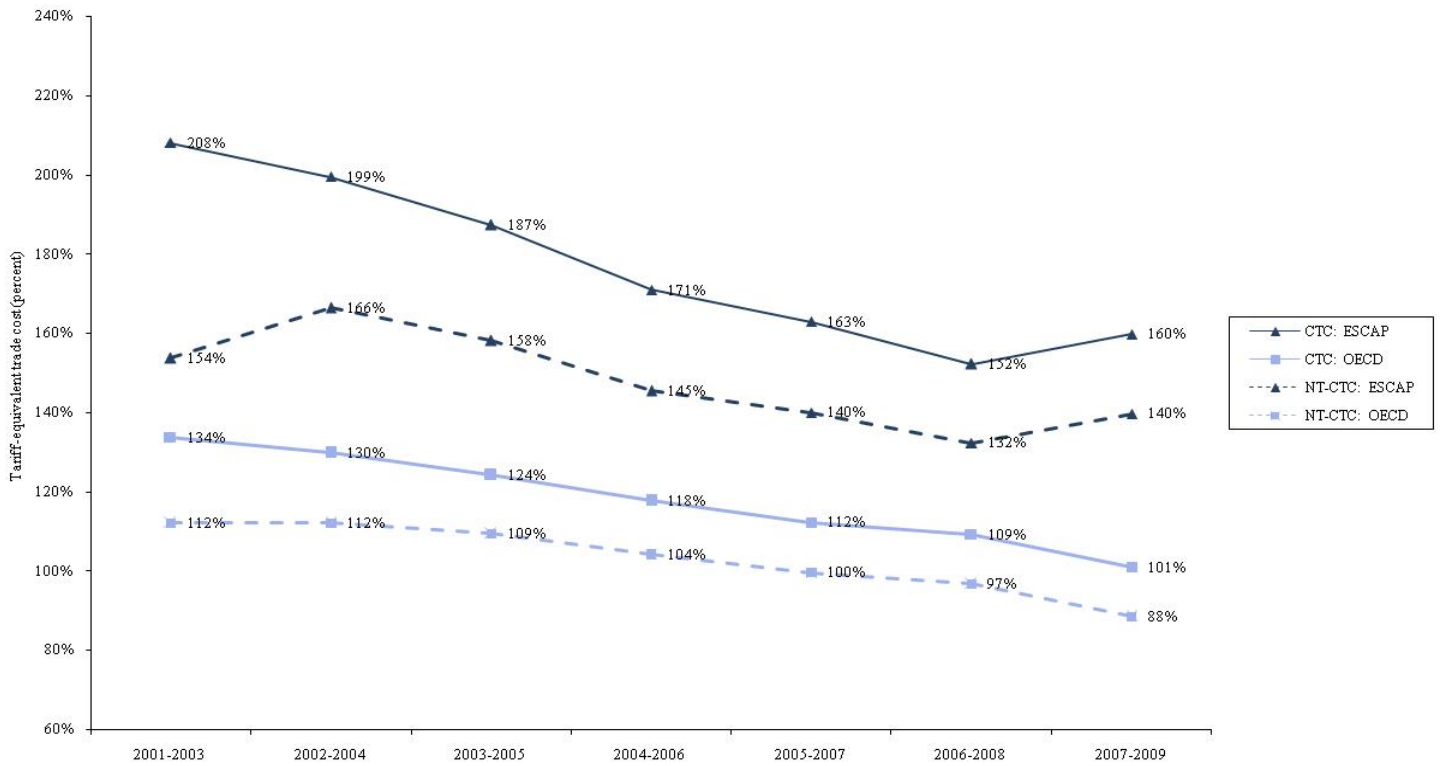
**Figure 3: Evolution of ESCAP and OECD Trade Costs with USA**



Source: ESCAP Trade Cost Database (version 2)



**Figure 4: Evolution of ESCAP and OECD Trade Costs with China**



Source: ESCAP Trade Cost Database (version 2)

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#### 4. INTRAREGIONAL COMPREHENSIVE TRADE COSTS<sup>12</sup>

Intraregional trade facilitation performance varies greatly among the subregions of Asia and the Pacific. However, trade costs of economies in the region with each other often still exceed those they face when trading outside the region.

NT-CTC between China, the Republic of Korea and Japan (East Asia-3) are among the lowest in the world, averaging less than 50% tariff-equivalent in 2007-2009. This is particularly remarkable given the absence of free trade agreements between those countries during that period. ASEAN has also achieved high levels of international trade efficiency among its largest middle-income members (i.e. Indonesia, Malaysia, the Philippines and Thailand, or ASEAN-4), but average trade costs among the larger ASEAN membership, including in particular its two least developed countries, is still more than double those among East Asia-3. Intraregional trade costs among North & Central Asia, at 149%, are highest in the region, followed by those among South Asian countries, at 113%.

Comprehensive intraregional trade costs are usually expected to be lower than interregional trade costs due to the geographic proximity between countries of the same region as well as similarities in languages and culture. Table 1 shows that this holds true among Asian subregions, with one small exception: comprehensive trade costs of ASEAN-4 with East Asia-3, and China in particular, are found to be slightly lower than ASEAN-4 intraregional trade costs. However, the costs of trade between Asia-Pacific economies of different subregions are higher than those with non-Asia-Pacific economies or subregions. For example, the non-tariff costs of trade between ASEAN and SAARC are on average nearly double the costs of trade between ASEAN and the USA. Similarly, the costs of trade between North & Central Asia and South Asia are almost twice those between North & Central Asia and the European Union.

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<sup>12</sup>Here “regional” refers to more narrowly defined subregions within Asia and the Pacific, such as South-East Asia (or ASEAN), South Asia, North & Central Asia etc.

**Table 1: Non-tariff intra- and extra- regional trade costs in Asia and the Pacific, 2007-2009**

| Region               | ASEAN-4          | East Asia-3      | North & Central Asia | SAARC-4          | AUS-NZL          | EU-3             | USA             |
|----------------------|------------------|------------------|----------------------|------------------|------------------|------------------|-----------------|
| ASEAN-4              | 79%<br>(-9.5%)   | 73%<br>(-5.9%)   | 291%<br>(-14.2%)     | 134%<br>(2.1%)   | 90%<br>(-12.3%)  | 97%<br>(-4.9%)   | 77%<br>(3.0%)   |
| East Asia-3          | 73%<br>(-5.9%)   | 47%<br>(-21.1%)  | 187%<br>(-32.7%)     | 119%<br>(-2.8%)  | 78%<br>(-15.7%)  | 70%<br>(-19.0%)  | 53%<br>(-13.5%) |
| North & Central Asia | 291%<br>(-14.2%) | 187%<br>(-32.7%) | 149%<br>(-20.5%)     | 270%<br>(-22.4%) | 270%<br>(-22.2%) | 149%<br>(-26.0%) | 165%<br>(5.0%)  |
| SAARC-4              | 134%<br>(2.1%)   | 119%<br>(-2.8%)  | 270%<br>(-22.4%)     | 113%<br>(5.0%)   | 130%<br>(-2.7%)  | 101%<br>(-3.2%)  | 99%<br>(5.9%)   |
| AUS-NZL              | 90%<br>(-12.3%)  | 78%<br>(-15.7%)  | 270%<br>(-22.2%)     | 130%<br>(-2.7%)  | 45%<br>(-23.5%)  | 89%<br>(-17.0%)  | 82%<br>(-11.1%) |
| EU3                  | 97%<br>(-4.9%)   | 70%<br>(-19.0%)  | 149%<br>(-26.0%)     | 101%<br>(-3.2%)  | 89%<br>(-17.0%)  | 32%<br>(-32.6%)  | 51%<br>(-18.2%) |
| USA                  | 77%<br>(3.0%)    | 53%<br>(-13.5%)  | 165%<br>(-17.3%)     | 99%<br>(5.9%)    | 82%<br>(-11.1%)  | 51%<br>(-18.2%)  |                 |

Source: ESCAP Trade Cost Database (version 2).

Note: Trade costs may be interpreted as tariff equivalents. Percentage changes in trade costs between 2001-2003 and 2007-2009 are in parentheses. ASEAN-4: Indonesia, Malaysia, the Philippines and Thailand; East Asia-3: China, Japan and Korea; North and Central Asia: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, and Russian Federation; SAARC-4: Bangladesh, India, Pakistan and Sri Lanka; AUS-NZL: Australia and New Zealand; EU-3: France, Germany, and the United Kingdom; Percentage change in parentheses relative to 2001-2003.

All subregions in Asia and the Pacific made progress in reducing non-tariff trade costs with at least two other subregions between 2001-2003 and 2007-2009. North and Central Asia, the subregion with the highest international trade costs, made significant progress in reducing both its intra- and extraregional non-tariff trade costs during that period. Interestingly, trade costs decreased by nearly 33% between East Asia-3 and North & Central Asia during the period reviewed, the highest improvement among all pairs of subregions reviewed. Although overall trade costs of SAARC-4 are significantly lower than those of North & Central Asia, South Asia made least improvements overall. Indeed, the data suggests it is the only Asian subregion that has made no significant progress in cutting non-tariff trade costs.<sup>13</sup>

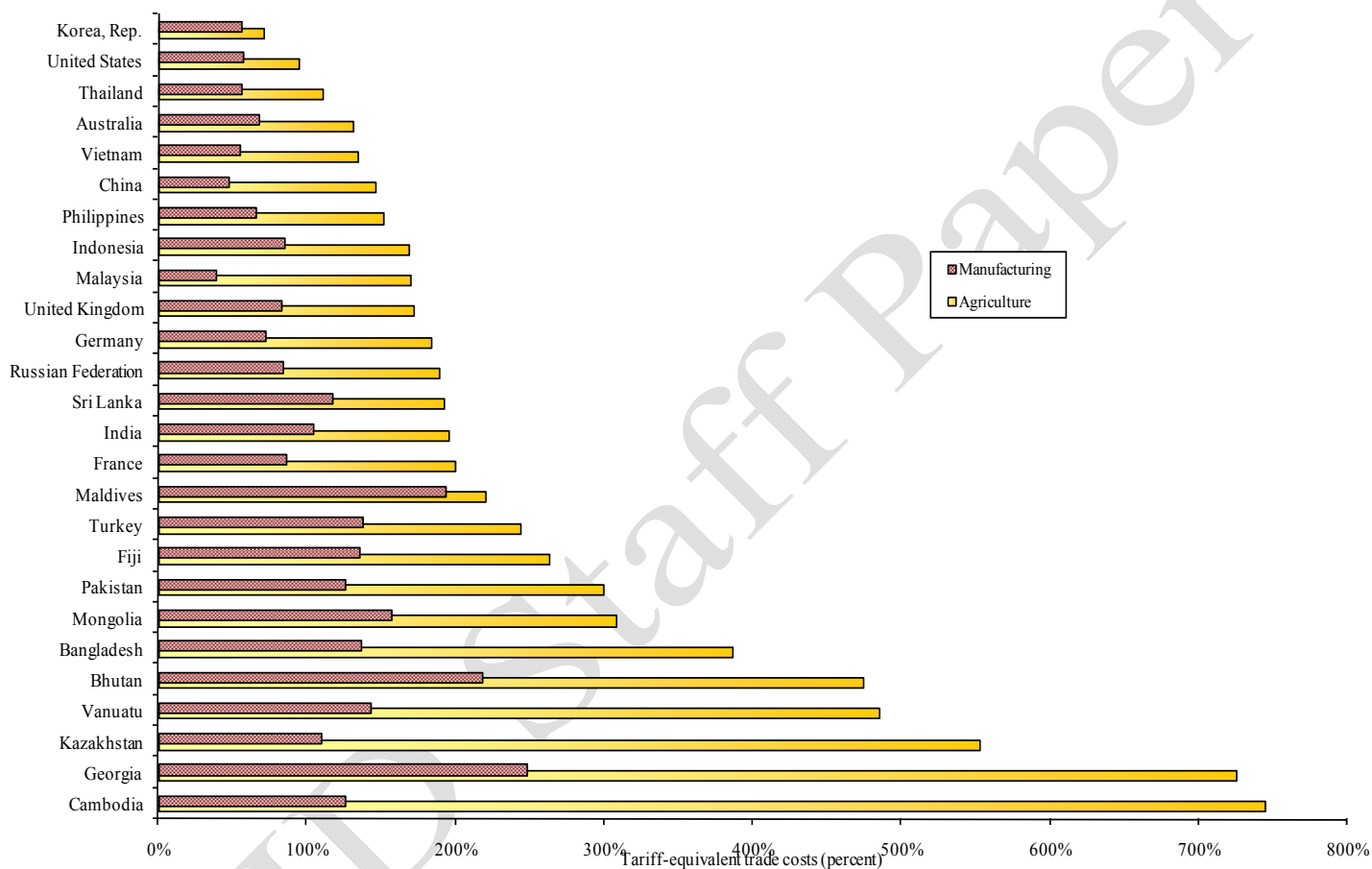
## 5. AGRICULTURE VS. MANUFACTURING COMPREHENSIVE TRADE COSTS (EXCLUDING TARIFFS)

At the sectoral level, the costs associated with trading agricultural products across borders are found to generally far exceed those involved in trading manufactured goods even when tariff costs are excluded, as illustrated in Figure 5. This is partly explained by the nature of the products (e.g., perishability), which can make them harder to trade across borders, as well as the higher level of

<sup>13</sup>Taking into account tariff costs, it did make improvements in cutting overall trade costs from 152% in 2001-2003 to 139% in 2007-2009.

regulations these products attract for food safety or food security reasons.<sup>14</sup> The fact that the cost premium for trading agricultural goods vary so widely from country to country suggests that significant scope for reduction exist in many countries of the region.

**Figure 5: Agricultural and Manufacturing Comprehensive Trade Costs, excluding tariffs, between Selected Economies and Japan**



Source: ESCAP Trade Cost Database (version 2)

<sup>14</sup> For more details on this issue, see ESCAP (2011), “Facilitating Agricultural Trade in Asia and the Pacific”, Trade and Investment Series No. 72 [forthcoming].

## CONCLUSION

This paper introduced the new aggregate and sectoral estimates of bilateral trade costs in Asia and the Pacific available in the ESCAP Trade Cost Database (Version 2). While the methodological improvements made resulted in trade costs estimates that sometime differed substantially from the ones previously calculated, the main results and findings stand: (1) most countries and subregions have made improvements in reducing trade costs; (2) Trade costs among Asian countries still often exceed the costs of trade of Asian countries with developed countries outside the region; and (3) tariff accounts for only a small portion of comprehensive trade costs (typically less than 10%, and falling), calling for policymakers to focus negotiations and policies on reducing the non-tariff component of trade costs, including costs related to inefficient logistics infrastructure and services and cumbersome trade procedures (i.e., trade facilitation).

At the sectoral level, agricultural trade costs are systematically found to exceed manufacturing trade costs, even when tariff costs are excluded. The fact that agricultural trade costs in many developing countries are twice as high as their trade costs in manufactured goods suggest that focusing trade facilitation efforts on that sector may be particularly productive, especially given the importance of this sector for poverty reduction and more inclusive and sustainable development.

The analysis presented here was essentially descriptive and did not cover the full scope of the ESCAP Trade Cost Database (Version 2), which includes 107 countries – 48 of which only are Asian or South Pacific economies. We encourage others to use the database to conduct deeper descriptive as well as econometric analysis using this unique bilateral trade cost dataset. Indeed, much work remains to be done in identifying the policies and other factors that matter most in reducing comprehensive trade costs in specific sectors, countries, or regions.<sup>15</sup>

Building on the existing ESCAP Database, development of a more comprehensive global database would also be important, as the availability and use of a common set of accepted and verified bilateral trade cost data would increase the credibility of empirical analyses conducted in the future while also enabling more meaningful cross-regional as well as meta-analysis.<sup>16</sup>

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<sup>15</sup>Duval and Utoktham (2011) began to address this question using the first version of the ESCAP Trade Cost Database.

<sup>16</sup> As explained in Duval and Utoktham (2010), comparison of trade cost estimates in different papers is currently difficult because of small (and sometime larger) differences in calculation methods and assumption, even when the same theoretical derivation of trade cost is used.

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### Annex 1 – Derivation of Trade Cost Equation<sup>17</sup>

Anderson and vanWincoop (2003) derived the micro-founded gravity equation with trade cost component as

$$x_{ij} = \frac{y_i y_j}{y^w} \left( \frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \quad (1)$$

where  $x_{ij}$  denotes nominal exports from  $i$  to  $j$ ;  $y_i$  and  $y_j$  denotes nominal income from country  $i$  and  $j$  respectively;  $y^w$  denotes world income;  $\sigma > 1$  denotes elasticity of substitution across goods;  $\Pi_i$  and  $P_j$  denotes price index of country  $i$  and  $j$  respectively;  $t_{ij}$  denotes bilateral trade costs (as one plus ad valorem term).

Anderson and van Wincoop (2003) defines  $\Pi_i$  and  $P_j$  as multilateral resistance term as those price indices incorporate average trade barriers with all other trading partners. Novy (2009) suggests the expression of intranational trade as

$$x_{ii} = \frac{y_i y_i}{y^w} \left( \frac{t_{ii}}{\Pi_i P_i} \right)^{1-\sigma} \quad (2)$$

where  $t_{ii}$  becomes intranational trade costs.

Re-arranging (2) as the product of multilateral resistance term as follows:

$$\begin{aligned} x_{ii} &= \frac{y_i y_i}{y^w} \left( \frac{\Pi_i P_i}{t_{ii}} \right)^{\sigma-1} \\ (\Pi_i P_i)^{\sigma-1} &= \frac{x_{ii} y^w}{y_i y_i} t_{ii}^{\sigma-1} \\ (\Pi_i P_i)^{\sigma-1} &= \frac{x_{ii} / y_i}{y_i / y^w} t_{ii}^{\sigma-1} \\ \Pi_i P_i &= \left( \frac{x_{ii} / y_i}{y_i / y^w} \right)^{\frac{1}{\sigma-1}} t_{ii} \end{aligned} \quad (3)$$

In the same analogy, the opposite direction of trade flows in (1) can be written as

$$x_{ji} = \frac{y_j y_i}{y^w} \left( \frac{t_{ji}}{\Pi_j P_i} \right)^{1-\sigma} \quad (4)$$

Multiply (1) and (4) together and get

<sup>17</sup>For simplicity, the paper drops sector  $k$  and time  $t$  subscript.

$$x_{ij}x_{ji} = \left( \frac{y_i y_j}{y^w} \right)^2 \left( \frac{t_{ij} t_{ji}}{\prod_i \prod_j P_i P_j} \right)^{1-\sigma}$$

Substitute the result from (3)

$$x_{ij}x_{ji} = \left( \frac{y_i y_j}{y^w} \right)^2 \left( \frac{\prod_i \prod_j P_i P_j}{t_{ij} t_{ji}} \right)^{\sigma-1}$$

$$x_{ij}x_{ji} = \left( \frac{y_i y_j}{y^w} \right)^2 \left( \frac{1}{t_{ij} t_{ji}} \right)^{\sigma-1} \left( \frac{x_{ii}/y_i}{y_i/y^w} \right) t_{ii}^{\sigma-1} \left( \frac{x_{jj}/y_j}{y_j/y^w} \right) t_{jj}^{\sigma-1}$$

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

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

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

Then, the product of bidirectional trade costs relative to the product of their intranational trade costs is equivalent to

$$\frac{t_{ij} t_{ji}}{t_{ii} t_{jj}} = \left( \frac{x_{ii} x_{jj}}{x_{ij} x_{ji}} \right)^{\frac{1}{\sigma-1}} \quad (5)$$

Therefore, geometric average of bilateral trade costs is defined as

$$T_{ij} = \left( \frac{t_{ij} t_{ji}}{t_{ii} t_{jj}} \right)^{\frac{1}{2}} = \left( \frac{x_{ii} x_{jj}}{x_{ij} x_{ji}} \right)^{\frac{1}{2(\sigma-1)}} \quad (6)$$

Tariff-equivalent term is done by deducting one from (6) and thus,

$$\tau_{ij} = \left( \frac{t_{ij} t_{ji}}{t_{ii} t_{jj}} \right)^{\frac{1}{2}} - 1 = \left( \frac{x_{ii} x_{jj}}{x_{ij} x_{ji}} \right)^{\frac{1}{2(\sigma-1)}} - 1 \quad (7)$$



## Annex 2 – Methodology and Data Sources for Comprehensive Trade Costs

### Country, Year, and Sectoral Coverage of the Database

The database covers 107 countries accounting for more than 95% of world trade. It features aggregate bilateral costs of trade in goods from 1988 to 2010, as well as bilateral costs of trade in agricultural goods, and bilateral costs of trade in manufacturing goods.

As explained in the next section, since different data sources and methods can be used to calculate bilateral comprehensive trade costs in practice, the new database currently include 6 different ways of calculating it.<sup>18</sup>

Table 1 – Database current country coverage

| Asian and South Pacific Economies**   |  |  |   |  | Middle East<br>(3)                | Africa (5)  |
|---|--|--|---|--|-----------------------------------|---|
| East and<br>Northeast<br>Asia (7)   | Southeast<br>Asia (10)   | South and<br>Southwest<br>Asia (10)  | North and Central<br>Asia (9)   | South Pacific (12)   |                                   |   |
| China<br>Hong Kong,<br>China<br>Japan<br>Korea<br>(Rep.of)<br>Korea<br>(Democratic<br>Republic of)<br>Macao,<br>China<br>Mongolia | Brunei<br>Cambodia<br>Indonesia<br>Lao PDR<br>Malaysia<br>Myanmar<br>Philippines<br>Singapore<br>Thailand<br>Vietnam | Afghanistan<br>Bangladesh<br>Bhutan<br>India<br>Iran<br>Maldives<br>Nepal<br>Pakistan<br>Sri Lanka<br>Turkey | Armenia<br>Azerbaijan<br>Georgia<br>Kazakhstan<br>Kyrgyz Rep.<br>Russian Fed.<br>Tajikistan<br>Turkmenistan<br>Uzbekistan | Fiji<br>French Polynesia<br>Kiribati<br>Marshall Islands<br>Micronesia<br>New Caledonia<br>Palau<br>Papua New Guinea<br>Samoa<br>Solomon Islands<br>Tonga<br>Vanuatu | Israel<br>Oman<br>Yemen           | Cameroon<br>Lesotho<br>Mozambique<br>Namibia<br>South Africa  |
| AUS-NZL<br>(2)  | EU25 (25)  |  |   | Europe-others (8)  | North America<br>(3)              | Other America<br>(13)   |
| Australia<br>New<br>Zealand   | Austria<br>Belgium<br>Cyprus<br>Czech Rep.<br>Denmark<br>Estonia<br>Finland<br>France                                | Germany<br>Greece<br>Hungary<br>Ireland<br>Italy<br>Latvia<br>Lithuania<br>Luxembourg                        | Malta<br>Netherlands<br>Poland<br>Portugal<br>Slovak Rep.<br>Slovenia<br>Spain<br>Sweden<br>United Kingdom                | Bulgaria<br>Croatia<br>Iceland<br>Macedonia<br>Moldova<br>Norway<br>Romania<br>Switzerland   | Canada<br>Mexico<br>United States | Argentina<br>Bahamas<br>Bolivia<br>Brazil<br>Chile<br>Colombia<br>DominicanRep<br>Ecuador.<br>Nicaragua<br>Paraguay<br>Peru<br>Uruguay<br>Venesuela |

<sup>18</sup> The first version of the database features 2 additional ways of calculating trade costs: (1) simply using GDP as a proxy for GO when calculating intranational trade; and (2) using GDP as a proxy for GO but applying a “correction factor” based on the service sector share of GDP to the international trade calculated as (GDP-Exports). See Duval and Uthoktham (2010) for details.

### **Underlying Methodology and data Sources.**

Based on the general definition of bilateral comprehensive trade costs provided earlier, the basic data needed includes

- A. Bilateral international trade flows & total exports of each country
- B. Gross output of each country
- C. Exchange rate
- D. Elasticity of substitution

Details of how this data was obtained or approximated - when not directly available – is provided below.

#### **A. Bilateral international trade flows & total exports of each country**

Bilateral imports and exports as well as total imports and exports are downloaded from COMTRADE using the **World Integrated Trade Solution (WITS)** on **November 2011**.

Sectoral trade flows are downloaded using ISIC Revision 3 - with reported nomenclature from HS 1988/92 for the purpose of getting the longest possible data series available under ISIC Revision 3.

Agricultural trade costs are based on trade flows in “Agriculture, hunting, forestry and fishing” defined as the aggregate of the following sub-sectors:

#### *Agriculture, hunting, forestry and fishing*

A - Agriculture, hunting and forestry

01 - Agriculture, hunting and related service activities

02 - Forestry, logging and related service activities

B – Fishing

05 - Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing

Manufacturing trade costs are based on trade flows in “Manufacturing” defined as the aggregate of the following sub-sectors:

#### *Manufacturing*

D – Manufacturing

15 - Manufacture of food products and beverages

16 - Manufacture of tobacco products

17 - Manufacture of textiles

18 - Manufacture of wearing apparel; dressing and dyeing of fur

19 - Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear

20 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials

21 - Manufacture of paper and paper products

22 - Publishing, printing and reproduction of recorded media

23 - Manufacture of coke, refined petroleum products and nuclear fuel

24 - Manufacture of chemicals and chemical products

25 - Manufacture of rubber and plastics products

26 - Manufacture of other non-metallic mineral products

27 - Manufacture of basic metals

28 - Manufacture of fabricated metal products, except machinery and equipment

29 - Manufacture of machinery and equipment n.e.c.

30 - Manufacture of office, accounting and computing machinery

- 31 - Manufacture of electrical machinery and apparatus n.e.c.  
 32 - Manufacture of radio, television and communication equipment and apparatus  
 33 - Manufacture of medical, precision and optical instruments, watches and clocks  
 34 - Manufacture of motor vehicles, trailers and semi-trailers  
 35 - Manufacture of other transport equipment  
 36 - Manufacture of furniture; manufacturing n.e.c.  
 37 - Recycling

Aggregate trade costs are based on trade flows in all tradable sub-sectors, which include all sectors listed above. Total exports of each country are the sum of export flows of that country to the world in each of the sectors listed above.

## B. Gross output of each country

Matching data for gross output (GO) and gross value added (VA) by sector is obtained from National Accounts Official Country Data, available at: <http://data.un.org> and World Development Indicator DataBank, available at <http://data.worldbank.org> respectively. The most updated data (which is labeled under the combination of Systems of National Accounts (SNA) and series codes<sup>19</sup>) are retrieved. The following ISIC rev. 3 sectors are downloaded: A+B (Agriculture, hunting and forestry; Fishing) and; D (Manufacturing). Total goods sector is the sum of agriculture and manufacturing sectors.

Since GO is not available for most developing economies, however, missing GO data is approximated based on sectoral VA data – available for most countries. 73 Countries whose gross output is available are as follows:

Table 1 – GO Database current country coverage

| Asian and South Pacific Economies**                            |   |   |   |  | Middle East (3)         | Africa (5)  |
|--|---|---|---|--|-------------------------|---|
| East and Northeast Asia (5)                                    | Southeast Asia (2)  | South and Southwest Asia (5)  | North and Central Asia (5)  | South Pacific (1)  |                         |   |
| Hong Kong, China<br>Japan<br>Korea<br>Macao, China<br>Mongolia | Myanmar<br>Philippines  | Bangladesh<br>Bhutan<br>India<br>Iran<br>Sri Lanka                                  | Armenia<br>Azerbaijan<br>Kazakhstan<br>Kyrgyz Rep.<br>Russian Fed.                    | Fiji   | Israel<br>Oman<br>Yemen | Cameroon<br>Lesotho<br>Mozambique<br>Namibia<br>South Africa  |
| AUS/NZL (1)  | EU25 (24)   |   |   | Europe-others (6)  | North America (3)       | Other America (13)  |
| New Zealand  | Austria<br>Belgium<br>Cyprus<br>Czech Rep.<br>Denmark<br>Estonia<br>Finland<br>France | Germany<br>Greece<br>Hungary<br>Italy<br>Lithuania<br>Luxembourg<br>Latvia<br>Malta | Netherlands<br>Poland<br>Portugal<br>Slovak Rep.<br>Slovenia<br>Spain<br>Sweden<br>UK | Bulgaria<br>Croatia<br>Iceland<br>Norway<br>Romania<br>Switzerland | Canada<br>Mexico<br>USA | Argentina<br>Bahamas, The<br>Bolivia<br>Brazil<br>Chile<br>Colombia<br>Dominican, Rep<br>Ecuador<br>Nicaragua<br>Paraguay<br>Peru<br>Uruguay<br>Venezuela |

The estimation method involves OLS of a simple ad-hoc gross output model using a cross-sectional dataset of countries for which both GO and VA data is available, specified as follows:

$$\ln(GO_{ikt}) = \beta_1 \ln(VA_{ikt}) + \beta_2 year\_dum + \beta_3 sector\_dum + \beta_4 incgrp\_dum \quad (2)$$

<sup>19</sup> Introduction part of National Accounts Statistics: Main Aggregates and Detailed Tables provide more details on SNA and series code.

where  $GO_{ikt}$  is gross output of country i, sector k at time t  
 $VA_{ikt}$  is gross value added of country i, sector k at time t  
 year\_dum is year dummy  
 sector\_dum is sector dummy  
 incgrp\_dum is income group dummy

The estimated equation is then used to estimate  $GO_{ikt}^{hat}$  in countries for which GO data it is not available.

In addition, since GO data featured in the UN database are based on different fiscal periods/year (FY),<sup>20</sup> we also calculate weighted GO values for all countries and years so they all match the western calendar year – used to report trade flow data.<sup>21</sup>

The model applies logarithm of gross output (current US Dollar) is estimated as the function of logarithm of value-added (current US Dollar), year fixed effect (1988-2010; 2010 is omitted), sector (agriculture, manufacturing and total goods – sum of the 2 sectors; total goods is omitted), and income group (high income, low income, lower middle income and upper middle income; upper middle income is omitted). Then, the study takes exponential on logarithm of gross output to get the level data. The reason the study estimated the logarithm value rather than the flat value because the percentage change tends to be more stable regardless to value of parameter, elasticity of substitution.

| VARIABLES  | ln_go               |
|------------|---------------------|
| ln_vai_wdi | 0.981***<br>[61.09] |
| yr_1988    | 1.705***<br>[4.018] |
| yr_1989    | 1.654***<br>[3.965] |
| yr_1990    | 1.667***<br>[3.957] |
| yr_1991    | 1.695***<br>[4.026] |
| yr_1992    | 1.773***<br>[4.279] |
| yr_1993    | 1.875***<br>[4.600] |
| yr_1994    | 1.553***<br>[3.828] |
| yr_1995    | 1.720***<br>[4.263] |
| yr_1996    | 1.827***<br>[4.575] |
| yr_1997    | 1.834***<br>[4.601] |
| yr_1998    | 1.835***<br>[4.605] |
| yr_1999    | 1.737***            |

<sup>20</sup> namely, a) western calendar, b) FY beginning 1 April, c) FY beginning 1 July, d) FY beginning 1 March, e) FY ending 30 June, f) FY ending 15 July and g) FY ending 30 September.

<sup>21</sup> For FY b) and d), the weighted value is the sum of 0.75 of current-year value and 0.25 of following-year value, while for c), e) and f) the weighted value is the sum of 0.5 of current-year value and of 0.5 of following-year value. For g), the weighted value is the sum of 0.25 of current-year value and of 0.75 of following-year value.

| VARIABLES       | ln_go     |
|-----------------|-----------|
|                 | [4.367]   |
| yr_2000         | 1.740***  |
|                 | [4.385]   |
| yr_2001         | 1.746***  |
|                 | [4.401]   |
| yr_2002         | 1.675***  |
|                 | [4.208]   |
| yr_2003         | 1.703***  |
|                 | [4.270]   |
| yr_2004         | 1.701***  |
|                 | [4.257]   |
| yr_2005         | 1.605***  |
|                 | [4.005]   |
| yr_2006         | 1.412***  |
|                 | [3.506]   |
| yr_2007         | 1.441***  |
|                 | [3.550]   |
| yr_2008         | 1.445***  |
|                 | [3.524]   |
| yr_2009         | 1.096**   |
|                 | [2.024]   |
| sec_agri        | -0.533*** |
|                 | [-6.933]  |
| sec_mfg         | 0.0778    |
|                 | [1.034]   |
| inc_high        | 0.00403   |
|                 | [0.0478]  |
| inc_low         | 0.219**   |
|                 | [2.115]   |
| inc_lowermiddle | 0.563***  |
|                 | [6.205]   |
| Observations    | 3,354     |
| R-squared       | 0.995     |
| Adj. R-squared  | 0.995     |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

t-stat. in square brackets

### C. Exchange Rate

Since the most recent gross output and gross value added data are typically available in local currency term, we use nominal exchange rate data from International Financial Statistics: IFS by the International Monetary Fund (IMF) to convert to USD for the period 1988-2010. For those countries that changed currency at least once in 1988-2010 period (mostly Euro countries), we follow the method proposed in IFS: Country Notes and first convert all data into their original currency before converting to USD.

For EU countries, the local exchange rate data is available until Euro becomes a legal tender (and local currency becomes missing values for those countries. Euro has to be retrieved separately in “Euro Area”). However, most recent GO data are in Euro from 1988-2010. Euro/USD rate is not available before 1999. So, database applies the Euro conversion rate (which is available in IFS: Country Notes) to all Euro

values before Euro is adopted. Then, all values are converted to USD. Detailed methodology is illustrated for Austria below:

| year | Values of GO and VA in original UN database (1) | Conversion rate (2) | First conversion to original currency (3) = (1)*(2) | Available rate in IFS (4) | USD values (5) = (3)/(4) |
|------|---|---------------------|---|---------------------------|--------------------------|
| 1997 | EUR   | 13.7603             | ATS   | ATS/USD                   | USD                      |
| 1998 | EUR   | 13.7603             | ATS   | ATS/USD                   | USD                      |
| 1999 | EUR   | 1                   | EUR   | EUR/USD                   | USD                      |
| 2000 | EUR   | 1                   | EUR   | EUR/USD                   | USD                      |

#### D. Elasticity of Substitution

Hummels (1999) finds that elasticity of substitution is lower for food-related manufacturing goods than for other more advanced manufacturing goods and ranges from 1 to 11.<sup>22</sup> Anderson and Van Wincoop (2004) propose to set elasticity of substitution to 8 for aggregate level analysis, but little consensus exists overall.

<sup>22</sup> Chen and Novy (2009) use sectoral elasticity of substitution from Hummels (2001).

### Annex 3 – Bilateral Tariff

Bilateral simple average tariffs are downloaded from TRAINS using the **World Integrated Trade Solution (WITS)** on **November 2011**. If tariff of the current are not available, the data from the preceding year is replaced. In addition to the missing data issue, tariff data contains 2 major treatments after download, which are A) Tariff of European Union and; B) trade year and tariff year issue.

#### **A. European Union (EU)'s Tariff Data and Treatment**

Bilateral tariff data can be downloaded as is except for EU countries whose data need further treatment. The database treats EU as a single market, whereas other countries do not treat EU as a single exporter. Thus, TRAINS database have EU as reporter but not individual member countries. Following the single market rule of the EU, the rate among EU members is set to zero. Illustration of the data download based on this approach follows:

##### **Data pair #1: Thailand (reporter) – Germany (partner)**

This follows the data availability from TRAINS with Thailand as reporter and Germany as partner from 1988-2010.

##### **Data pair #2: Germany (reporter) – Thailand (partner)**

As EU is treated as a single market, data acquisition is from European Union as reporter and Thailand as partner from 1988-2010.

##### **Data pair #3: Germany (reporter) – Romania (partner)**

Data acquisition follows European Union as reporter and Romania as partner from 1988-2007. Since Romania becomes EU member in 2008, data retrieval follows the duty-free intra-EU trade. Thus we fill zero tariff from 2008-2010.

##### **Data pair #4: Romania (reporter) – Germany (partner)**

Since EU is not treated as single exporter, then data acquisition follows Romania as reporter and Germany as partner from 1988-2007. Then, we follow intra-EU zero tariff rate from 2008-2010.

#### **B. Trade Year and Tariff Year**

It is ideal to have the same trade year and tariff year. However, many countries do not report tariff and trade data in the same year. Missing tariff data is replaced by the tariff data from the closest available year. Hence, for the year 2005, if tariff data for 2005 and 2004 is not available, then tariff rates from 2003 will be used.

## Annex 4 – Regional and Subregional CTC and NT-CTC: Overall

|         | Period    | Overall | SEA2 | SEA4 | AUS-NZL | EAST | EU3  | NC   | SOUTH | USA  |
|---------|-----------|---------|------|------|---------|------|------|------|-------|------|
| SEA2    | 1998-2000 | CTC     | 131% | 174% | 225%    | 168% | 162% | 468% | 322%  | 168% |
|         |           | NT-CTC  |      | 103% | 126%    | 99%  | 113% | 117% | 128%  | 140% |
|         | 2001-2003 | CTC     | 124% | 168% | 223%    | 161% | 155% | 417% | 304%  | 158% |
|         |           | NT-CTC  | 92%  | 143% | 189%    | 131% | 135% | 341% | 211%  | 130% |
|         | 2004-2006 | CTC     | 101% | 156% | 211%    | 150% | 150% | 383% | 271%  | 138% |
|         |           | NT-CTC  | 83%  | 139% | 183%    | 124% | 132% | 341% | 216%  | 115% |
|         | 2007-2009 | CTC     | 91%  | 149% | 174%    | 132% | 134% | 260% | 258%  | 115% |
|         |           | NT-CTC  | 79%  | 135% | 151%    | 110% | 118% | 234% | 210%  | 95%  |
| SEA4    | 1998-2000 | CTC     | 174% | 105% | 121%    | 102% | 116% | 392% | 172%  | 85%  |
|         |           | NT-CTC  | 103% | 84%  | 102%    | 82%  | 101% | 189% | 110%  | 72%  |
|         | 2001-2003 | CTC     | 168% | 96%  | 117%    | 94%  | 114% | 412% | 174%  | 85%  |
|         |           | NT-CTC  | 143% | 87%  | 102%    | 77%  | 102% | 339% | 131%  | 74%  |
|         | 2004-2006 | CTC     | 156% | 82%  | 109%    | 85%  | 111% | 367% | 162%  | 83%  |
|         |           | NT-CTC  | 139% | 76%  | 95%     | 72%  | 100% | 329% | 129%  | 73%  |
|         | 2007-2009 | CTC     | 149% | 87%  | 100%    | 83%  | 107% | 317% | 164%  | 86%  |
|         |           | NT-CTC  | 135% | 79%  | 90%     | 73%  | 97%  | 291% | 134%  | 77%  |
| AUS-NZL | 1998-2000 | CTC     | 225% | 121% | 61%     | 109% | 122% | 431% | 170%  | 100% |
|         |           | NT-CTC  | 126% | 102% | 55%     | 93%  | 110% | 256% | 118%  | 91%  |
|         | 2001-2003 | CTC     | 223% | 117% | 60%     | 106% | 118% | 381% | 169%  | 100% |
|         |           | NT-CTC  | 189% | 102% | 58%     | 92%  | 107% | 348% | 133%  | 92%  |
|         | 2004-2006 | CTC     | 211% | 109% | 55%     | 100% | 112% | 439% | 167%  | 97%  |
|         |           | NT-CTC  | 183% | 95%  | 55%     | 87%  | 101% | 397% | 141%  | 90%  |
|         | 2007-2009 | CTC     | 174% | 100% | 45%     | 89%  | 97%  | 288% | 151%  | 87%  |
|         |           | NT-CTC  | 151% | 90%  | 45%     | 78%  | 89%  | 270% | 130%  | 82%  |
| EAST    | 1998-2000 | CTC     | 168% | 102% | 109%    | 79%  | 103% | 401% | 162%  | 73%  |
|         |           | NT-CTC  | 99%  | 82%  | 93%     | 64%  | 90%  | 189% | 107%  | 61%  |
|         | 2001-2003 | CTC     | 161% | 94%  | 106%    | 73%  | 99%  | 324% | 160%  | 72%  |
|         |           | NT-CTC  | 131% | 77%  | 92%     | 59%  | 87%  | 278% | 122%  | 61%  |
|         | 2004-2006 | CTC     | 150% | 85%  | 100%    | 65%  | 93%  | 271% | 154%  | 69%  |
|         |           | NT-CTC  | 124% | 72%  | 87%     | 54%  | 83%  | 249% | 126%  | 60%  |
|         | 2007-2009 | CTC     | 132% | 83%  | 89%     | 58%  | 81%  | 204% | 143%  | 62%  |
|         |           | NT-CTC  | 110% | 73%  | 78%     | 47%  | 70%  | 187% | 119%  | 53%  |
| EU3     | 1998-2000 | CTC     | 162% | 116% | 122%    | 103% | 51%  | 248% | 131%  | 72%  |
|         |           | NT-CTC  | 113% | 101% | 110%    | 90%  | 51%  | 145% | 90%   | 64%  |
|         | 2001-2003 | CTC     | 155% | 114% | 118%    | 99%  | 48%  | 228% | 130%  | 70%  |
|         |           | NT-CTC  | 135% | 102% | 107%    | 87%  | 48%  | 202% | 104%  | 62%  |
|         | 2004-2006 | CTC     | 150% | 111% | 112%    | 93%  | 46%  | 198% | 127%  | 69%  |
|         |           | NT-CTC  | 132% | 100% | 101%    | 83%  | 46%  | 186% | 108%  | 62%  |
|         | 2007-2009 | CTC     | 134% | 107% | 97%     | 81%  | 32%  | 158% | 117%  | 58%  |
|         |           | NT-CTC  | 118% | 97%  | 89%     | 70%  | 32%  | 149% | 101%  | 51%  |
| NC      | 1998-2000 | CTC     | 468% | 392% | 431%    | 401% | 248% | 190% | 394%  | 256% |
|         |           | NT-CTC  | 117% | 189% | 256%    | 189% | 145% | 113% | 171%  | 146% |
|         | 2001-2003 | CTC     | 417% | 412% | 381%    | 324% | 228% | 223% | 433%  | 228% |
|         |           | NT-CTC  | 341% | 339% | 348%    | 278% | 202% | 188% | 347%  | 199% |
|         | 2004-2006 | CTC     | 383% | 367% | 439%    | 271% | 198% | 192% | 368%  | 201% |
|         |           | NT-CTC  | 341% | 329% | 397%    | 249% | 186% | 178% | 316%  | 187% |
|         | 2007-2009 | CTC     | 260% | 317% | 288%    | 204% | 158% | 150% | 307%  | 174% |
|         |           | NT-CTC  | 234% | 291% | 270%    | 187% | 149% | 149% | 270%  | 165% |
| SOUTH   | 1998-2000 | CTC     | 322% | 172% | 170%    | 162% | 131% | 394% | 135%  | 123% |
|         |           | NT-CTC  | 128% | 110% | 118%    | 107% | 90%  | 171% | 64%   | 81%  |
|         | 2001-2003 | CTC     | 304% | 174% | 169%    | 160% | 130% | 433% | 152%  | 122% |
|         |           | NT-CTC  | 211% | 131% | 133%    | 122% | 104% | 347% | 107%  | 93%  |



|     | Period    | Overall | SEA2 | SEA4 | AUS-NZL | EAST | EU3  | NC   | SOUTH | USA  |
|-----|-----------|---------|------|------|---------|------|------|------|-------|------|
|     | 2004-2006 | CTC     | 271% | 162% | 167%    | 154% | 127% | 368% | 144%  | 121% |
|     |           | NT-CTC  | 216% | 129% | 141%    | 126% | 108% | 316% | 111%  | 100% |
|     | 2007-2009 | CTC     | 258% | 164% | 151%    | 143% | 117% | 307% | 139%  | 117% |
|     |           | NT-CTC  | 210% | 134% | 130%    | 119% | 101% | 270% | 113%  | 99%  |
| USA | 1998-2000 | CTC     | 168% | 85%  | 100%    | 73%  | 72%  | 256% | 123%  |      |
|     |           | NT-CTC  | 140% | 72%  | 91%     | 61%  | 64%  | 146% | 81%   |      |
|     | 2001-2003 | CTC     | 158% | 85%  | 100%    | 72%  | 70%  | 228% | 122%  |      |
|     |           | NT-CTC  | 130% | 74%  | 92%     | 61%  | 62%  | 199% | 93%   |      |
|     | 2004-2006 | CTC     | 138% | 83%  | 97%     | 69%  | 69%  | 201% | 121%  |      |
|     |           | NT-CTC  | 115% | 73%  | 90%     | 60%  | 62%  | 187% | 100%  |      |
|     | 2007-2009 | CTC     | 115% | 86%  | 87%     | 62%  | 58%  | 174% | 117%  |      |
|     |           | NT-CTC  | 95%  | 77%  | 82%     | 53%  | 51%  | 165% | 99%   |      |

### Annex 5 – Regional and Subregional CTC and NT-CTC: Agriculture

|         | Period    | Agriculture | SEA2 | SEA4 | AUS-NZL | EAST | EU3  | NC   | SOUTH | USA  |
|---------|-----------|-------------|------|------|---------|------|------|------|-------|------|
| SEA2    | 1998-2000 | CTC         | 190% | 281% | 263%    | 296% | 335% | 446% | 250%  |      |
|         |           | NT-CTC      | 161% | 158% | 149%    | 173% | 292% | 152% |       |      |
|         | 2001-2003 | CTC         | 220% | 291% | 260%    | 292% | 303% | 343% | 340%  | 242% |
|         |           | NT-CTC      | 191% | 263% | 239%    | 249% | 282% | 246% | 237%  | 222% |
|         | 2004-2006 | CTC         | 161% | 231% | 224%    | 357% | 370% | 343% | 307%  | 213% |
|         |           | NT-CTC      | 142% | 212% | 204%    | 297% | 345% | 326% | 256%  | 195% |
|         | 2007-2009 | CTC         | 157% | 216% | 307%    | 289% | 259% | 266% | 256%  | 198% |
|         |           | NT-CTC      | 142% | 198% | 285%    | 220% | 240% | 254% | 207%  | 182% |
| SEA4    | 1998-2000 | CTC         | 281% | 192% | 175%    | 180% | 208% | 381% | 293%  | 125% |
|         |           | NT-CTC      | 161% | 154% | 154%    | 145% | 184% | 292% | 189%  | 108% |
|         | 2001-2003 | CTC         | 291% | 177% | 174%    | 178% | 206% | 388% | 269%  | 125% |
|         |           | NT-CTC      | 263% | 166% | 160%    | 148% | 188% | 330% | 212%  | 114% |
|         | 2004-2006 | CTC         | 231% | 177% | 178%    | 172% | 199% | 428% | 256%  | 124% |
|         |           | NT-CTC      | 212% | 169% | 164%    | 142% | 181% | 373% | 213%  | 114% |
|         | 2007-2009 | CTC         | 216% | 173% | 145%    | 162% | 198% | 397% | 257%  | 113% |
|         |           | NT-CTC      | 198% | 158% | 135%    | 132% | 182% | 358% | 216%  | 103% |
| AUS-NZL | 1998-2000 | CTC         | 263% | 175% | 104%    | 172% | 183% | 652% | 241%  | 142% |
|         |           | NT-CTC      | 158% | 154% | 103%    | 152% | 174% | 623% | 190%  | 140% |
|         | 2001-2003 | CTC         | 260% | 174% | 104%    | 166% | 180% | 556% | 264%  | 148% |
|         |           | NT-CTC      | 239% | 160% | 103%    | 145% | 170% | 528% | 229%  | 146% |
|         | 2004-2006 | CTC         | 224% | 178% | 95%     | 164% | 183% | 495% | 279%  | 149% |
|         |           | NT-CTC      | 204% | 164% | 95%     | 142% | 174% | 471% | 250%  | 147% |
|         | 2007-2009 | CTC         | 307% | 145% |         | 151% | 171% | 402% | 185%  | 140% |
|         |           | NT-CTC      | 285% | 135% |         | 120% | 163% | 382% | 163%  | 139% |
| EAST    | 1998-2000 | CTC         | 296% | 180% | 172%    | 149% | 221% | 539% | 311%  | 134% |
|         |           | NT-CTC      | 149% | 145% | 152%    | 111% | 195% | 272% | 227%  | 113% |
|         | 2001-2003 | CTC         | 292% | 178% | 166%    | 147% | 232% | 437% | 279%  | 130% |
|         |           | NT-CTC      | 249% | 148% | 145%    | 105% | 201% | 332% | 219%  | 108% |
|         | 2004-2006 | CTC         | 357% | 172% | 164%    | 152% | 232% | 413% | 276%  | 123% |
|         |           | NT-CTC      | 297% | 142% | 142%    | 104% | 199% | 357% | 213%  | 99%  |
|         | 2007-2009 | CTC         | 289% | 162% | 151%    | 157% | 216% | 395% | 257%  | 107% |
|         |           | NT-CTC      | 220% | 132% | 120%    | 103% | 176% | 335% | 197%  | 83%  |
| EU3     | 1998-2000 | CTC         | 335% | 208% | 183%    | 221% | 101% | 382% | 232%  | 132% |
|         |           | NT-CTC      | 173% | 184% | 174%    | 195% | 101% | 222% | 181%  | 123% |
|         | 2001-2003 | CTC         | 303% | 206% | 180%    | 232% | 98%  | 362% | 214%  | 134% |
|         |           | NT-CTC      | 282% | 188% | 170%    | 201% | 98%  | 328% | 181%  | 125% |
|         | 2004-2006 | CTC         | 370% | 199% | 183%    | 232% | 96%  | 344% | 238%  | 136% |
|         |           | NT-CTC      | 345% | 181% | 174%    | 199% | 96%  | 322% | 208%  | 126% |

|           | Period    | Agriculture | SEA2   | SEA4 | AUS-NZL | EAST | EU3  | NC   | SOUTH | USA  |
|-----------|-----------|-------------|--------|------|---------|------|------|------|-------|------|
| NC        | 2007-2009 | CTC         | 259%   | 198% | 171%    | 216% | 80%  | 268% | 220%  | 118% |
|           |           | NT-CTC      | 240%   | 182% | 163%    | 176% | 80%  | 253% | 191%  | 109% |
|           | 1998-2000 | CTC         |        | 381% | 652%    | 539% | 382% | 269% | 291%  | 373% |
|           |           | NT-CTC      |        | 292% | 623%    | 272% | 222% | 139% | 178%  | 238% |
|           | 2001-2003 | CTC         | 343%   | 388% | 556%    | 437% | 362% | 253% | 391%  | 399% |
|           |           | NT-CTC      | 246%   | 330% | 528%    | 332% | 328% | 200% | 277%  | 371% |
|           | 2004-2006 | CTC         | 343%   | 428% | 495%    | 413% | 344% | 209% | 382%  | 412% |
|           |           | NT-CTC      | 326%   | 373% | 471%    | 357% | 322% | 192% | 322%  | 394% |
|           | 2007-2009 | CTC         | 266%   | 397% | 402%    | 395% | 268% | 170% | 371%  | 379% |
|           |           | NT-CTC      | 254%   | 358% | 382%    | 335% | 253% | 162% | 303%  | 360% |
| SOUTH     | 1998-2000 | CTC         | 446%   | 293% | 241%    | 311% | 232% | 291% | 154%  | 182% |
|           |           | NT-CTC      | 292%   | 189% | 190%    | 227% | 181% | 178% | 80%   | 138% |
|           | 2001-2003 | CTC         | 340%   | 269% | 264%    | 279% | 214% | 391% | 196%  | 184% |
|           |           | NT-CTC      | 237%   | 212% | 229%    | 219% | 181% | 277% | 137%  | 152% |
|           | 2004-2006 | CTC         | 307%   | 256% | 279%    | 276% | 238% | 382% | 181%  | 186% |
|           |           | NT-CTC      | 256%   | 213% | 250%    | 213% | 208% | 322% | 142%  | 161% |
|           | 2007-2009 | CTC         | 256%   | 257% | 185%    | 257% | 220% | 371% | 166%  | 161% |
|           |           | NT-CTC      | 207%   | 216% | 163%    | 197% | 191% | 303% | 132%  | 139% |
|           | USA       | 1998-2000   | CTC    | 250% | 125%    | 142% | 134% | 132% | 373%  | 182% |
|           |           |             | NT-CTC | 152% | 108%    | 140% | 113% | 123% | 238%  | 138% |
| 2001-2003 |           | CTC         | 242%   | 125% | 148%    | 130% | 134% | 399% | 184%  |      |
|           |           | NT-CTC      | 222%   | 114% | 146%    | 108% | 125% | 371% | 152%  |      |
| 2004-2006 |           | CTC         | 213%   | 124% | 149%    | 123% | 136% | 412% | 186%  |      |
|           |           | NT-CTC      | 195%   | 114% | 147%    | 99%  | 126% | 394% | 161%  |      |
| 2007-2009 |           | CTC         | 198%   | 113% | 140%    | 107% | 118% | 379% | 161%  |      |
|           |           | NT-CTC      | 182%   | 103% | 139%    | 83%  | 109% | 360% | 139%  |      |

### Annex 6 – Regional and Subregional CTC and NT-CTC: Manufacturing

|           | Period    | Manufacturing | SEA2   | SEA4 | AUS-NZL | EAST | EU3  | NC   | SOUTH | USA  |     |
|-----------|-----------|---------------|--------|------|---------|------|------|------|-------|------|-----|
| SEA2      | 1998-2000 | CTC           | 122%   | 146% | 198%    | 148% | 139% | 476% | 275%  | 149% |     |
|           |           | NT-CTC        |        | 88%  | 113%    | 88%  | 100% |      | 131%  | 129% |     |
|           | 2001-2003 | CTC           | 98%    | 143% | 196%    | 142% | 134% | 415% | 267%  | 139% |     |
|           |           | NT-CTC        | 70%    | 120% | 164%    | 115% | 116% | 365% | 195%  | 113% |     |
|           | 2004-2006 | CTC           | 80%    | 136% | 183%    | 129% | 128% | 354% | 232%  | 119% |     |
|           |           | NT-CTC        | 64%    | 120% | 157%    | 105% | 112% | 319% | 182%  | 97%  |     |
|           | 2007-2009 | CTC           | 69%    | 120% | 153%    | 109% | 113% | 213% | 207%  | 94%  |     |
|           |           | NT-CTC        | 57%    | 108% | 132%    | 91%  | 99%  | 190% | 166%  | 76%  |     |
|           | SEA4      | 1998-2000     | CTC    | 146% | 93%     | 113% | 95%  | 109% | 486%  | 155% | 80% |
|           |           |               | NT-CTC | 88%  | 74%     | 95%  | 76%  | 94%  | 266%  | 97%  | 67% |
| 2001-2003 |           | CTC           | 143%   | 85%  | 109%    | 87%  | 107% | 390% | 156%  | 81%  |     |
|           |           | NT-CTC        | 120%   | 77%  | 95%     | 72%  | 95%  | 318% | 116%  | 70%  |     |
| 2004-2006 |           | CTC           | 136%   | 78%  | 105%    | 82%  | 108% | 345% | 152%  | 82%  |     |
|           |           | NT-CTC        | 120%   | 72%  | 91%     | 69%  | 97%  | 308% | 120%  | 72%  |     |
| 2007-2009 |           | CTC           | 120%   | 84%  | 102%    | 81%  | 105% | 300% | 153%  | 86%  |     |
|           |           | NT-CTC        | 108%   | 76%  | 91%     | 71%  | 95%  | 274% | 124%  | 77%  |     |
| AUS-NZL   | 1998-2000 | CTC           | 198%   | 113% | 56%     | 107% | 120% | 474% | 161%  | 97%  |     |
|           |           | NT-CTC        | 113%   | 95%  | 50%     | 91%  | 108% | 297% | 110%  | 88%  |     |
|           | 2001-2003 | CTC           | 196%   | 109% | 54%     | 103% | 115% | 362% | 156%  | 96%  |     |
|           |           | NT-CTC        | 164%   | 95%  | 52%     | 90%  | 104% | 331% | 121%  | 88%  |     |
|           | 2004-2006 | CTC           | 183%   | 105% | 51%     | 98%  | 109% | 401% | 158%  | 93%  |     |
|           |           | NT-CTC        | 157%   | 91%  | 50%     | 86%  | 99%  | 364% | 132%  | 86%  |     |

|           | Period    | Manufacturing | SEA2 | SEA4 | AUS-NZL | EAST | EU3  | NC   | SOUTH | USA  |
|-----------|-----------|---------------|------|------|---------|------|------|------|-------|------|
|           | 2007-2009 | CTC           | 153% | 102% | 47%     | 93%  | 101% | 268% | 147%  | 89%  |
|           |           | NT-CTC        | 132% | 91%  | 47%     | 82%  | 92%  | 251% | 125%  | 84%  |
| EAST      | 1998-2000 | CTC           | 148% | 95%  | 107%    | 76%  | 100% | 444% | 149%  | 71%  |
|           |           | NT-CTC        | 88%  | 76%  | 91%     | 61%  | 87%  | 234% | 97%   | 59%  |
|           | 2001-2003 | CTC           | 142% | 87%  | 103%    | 70%  | 96%  | 313% | 147%  | 70%  |
|           |           | NT-CTC        | 115% | 72%  | 90%     | 57%  | 84%  | 267% | 112%  | 60%  |
|           | 2004-2006 | CTC           | 129% | 82%  | 98%     | 63%  | 90%  | 249% | 144%  | 68%  |
|           |           | NT-CTC        | 105% | 69%  | 86%     | 52%  | 80%  | 229% | 118%  | 59%  |
| 2007-2009 | CTC       | 109%          | 81%  | 93%  | 56%     | 79%  | 181% | 133% | 62%   |      |
|           | NT-CTC    | 91%           | 71%  | 82%  | 45%     | 69%  | 167% | 110% | 53%   |      |
| EU3       | 1998-2000 | CTC           | 139% | 109% | 120%    | 100% | 49%  | 280% | 122%  | 70%  |
|           |           | NT-CTC        | 100% | 94%  | 108%    | 87%  | 49%  | 180% | 82%   | 62%  |
|           | 2001-2003 | CTC           | 134% | 107% | 115%    | 96%  | 47%  | 222% | 120%  | 68%  |
|           |           | NT-CTC        | 116% | 95%  | 104%    | 84%  | 47%  | 196% | 95%   | 60%  |
|           | 2004-2006 | CTC           | 128% | 108% | 109%    | 90%  | 44%  | 185% | 117%  | 68%  |
|           |           | NT-CTC        | 112% | 97%  | 99%     | 80%  | 44%  | 173% | 99%   | 61%  |
|           | 2007-2009 | CTC           | 113% | 105% | 101%    | 79%  | 33%  | 142% | 108%  | 58%  |
|           |           | NT-CTC        | 99%  | 95%  | 92%     | 69%  | 33%  | 134% | 93%   | 51%  |
| NC        | 1998-2000 | CTC           | 476% | 486% | 474%    | 444% | 280% | 210% | 488%  | 292% |
|           |           | NT-CTC        |      | 266% | 297%    | 234% | 180% | 157% | 250%  | 178% |
|           | 2001-2003 | CTC           | 415% | 390% | 362%    | 313% | 222% | 209% | 415%  | 219% |
|           |           | NT-CTC        | 365% | 318% | 331%    | 267% | 196% | 176% | 290%  | 191% |
|           | 2004-2006 | CTC           | 354% | 345% | 401%    | 249% | 185% | 170% | 379%  | 185% |
|           |           | NT-CTC        | 319% | 308% | 364%    | 229% | 173% | 157% | 321%  | 171% |
|           | 2007-2009 | CTC           | 213% | 300% | 268%    | 181% | 142% | 127% | 283%  | 156% |
|           |           | NT-CTC        | 190% | 274% | 251%    | 167% | 134% | 127% | 247%  | 147% |
| SOUTH     | 1998-2000 | CTC           | 275% | 155% | 161%    | 149% | 122% | 488% | 130%  | 118% |
|           |           | NT-CTC        | 131% | 97%  | 110%    | 97%  | 82%  | 250% | 60%   | 76%  |
|           | 2001-2003 | CTC           | 267% | 156% | 156%    | 147% | 120% | 415% | 145%  | 114% |
|           |           | NT-CTC        | 195% | 116% | 121%    | 112% | 95%  | 290% | 102%  | 87%  |
|           | 2004-2006 | CTC           | 232% | 152% | 158%    | 144% | 117% | 379% | 141%  | 113% |
|           |           | NT-CTC        | 182% | 120% | 132%    | 118% | 99%  | 321% | 108%  | 93%  |
|           | 2007-2009 | CTC           | 207% | 153% | 147%    | 133% | 108% | 283% | 135%  | 109% |
|           |           | NT-CTC        | 166% | 124% | 125%    | 110% | 93%  | 247% | 110%  | 92%  |
| USA       | 1998-2000 | CTC           | 149% | 80%  | 97%     | 71%  | 70%  | 292% | 118%  |      |
|           |           | NT-CTC        | 129% | 67%  | 88%     | 59%  | 62%  | 178% | 76%   |      |
|           | 2001-2003 | CTC           | 139% | 81%  | 96%     | 70%  | 68%  | 219% | 114%  |      |
|           |           | NT-CTC        | 113% | 70%  | 88%     | 60%  | 60%  | 191% | 87%   |      |
|           | 2004-2006 | CTC           | 119% | 82%  | 93%     | 68%  | 68%  | 185% | 113%  |      |
|           |           | NT-CTC        | 97%  | 72%  | 86%     | 59%  | 61%  | 171% | 93%   |      |
|           | 2007-2009 | CTC           | 94%  | 86%  | 89%     | 62%  | 58%  | 156% | 109%  |      |
|           |           | NT-CTC        | 76%  | 77%  | 84%     | 53%  | 51%  | 147% | 92%   |      |