

D. Estimating the benefits of the Trade Facilitation Agreement

This section provides quantification of the various channels through which trade facilitation reform, and in particular implementation of the Trade Facilitation Agreement (TFA), can benefit the global economy. First of all, estimates of how much the implementation of the TFA could reduce trade costs are provided, and the group of countries and regions that may see the biggest reductions is identified. Further, estimates of the effects of the TFA on exports, export diversification and GDP, calculated using standard economic approaches, are presented. In order to provide a range of estimates, various implementation scenarios are considered. The differentiated impact of trade facilitation is analysed in order to provide insights on how the aggregate benefits of TFA implementation are distributed across country groups (developed, developing and least-developed countries), enterprises and product groups. Finally, the induced effects of trade facilitation on foreign direct investment, border revenue collection and reduction in trade-related and other forms of corruption are examined.

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Some key facts and findings

- Trade costs are high, particularly in developing countries. Full implementation of the Trade Facilitation Agreement (TFA) will reduce global trade costs by an average of 14.3 per cent. African countries and least-developed countries (LDCs) are expected to see the biggest average reduction in trade costs.
- Trade costs are among the fundamental factors shaping the evolution of trade. Any meaningful reduction in these costs will reduce the drag acting on global trade at present and has the potential to raise its future trajectory.
- Computable general equilibrium (CGE) simulations predict export gains from the TFA of between US\$ 750 billion and well over US\$ 1 trillion dollars per annum, depending on the implementation time-frame and coverage. Over the 2015-30 horizon, implementation of the TFA will add around 2.7 per cent per year to world export growth and more than half a per cent per year to world GDP growth.
- Gravity model estimates suggest that the trade gains from the TFA could be even larger, with increases in global exports of between US\$ 1.1 trillion and US\$ 3.6 trillion depending on the extent to which the provisions of the TFA are implemented.
- Developing countries have the most to gain from swift and full implementation of the TFA, as both exports and GDP growth will rise more than in developed countries.
- Implementing the TFA should create significant export diversification gains for developing countries, and particularly for LDCs. It should increase the opportunity for implementing developing countries to participate in global value chains. Furthermore, there is statistical evidence to show that, with trade facilitation reform, micro, small and medium-sized firms are more likely to export and to increase their export shares than large firms. Developing countries and LDCs implementing the TFA should also attract more foreign direct investment while improving their revenue collection and reducing the incidence of corruption.

1. Reduction in trade costs

(a) Measuring trade costs

As discussed in Section C, trade costs include all costs incurred in getting a good to the final user, other than the cost of production itself (Anderson and van Wincoop, 2004). Trade costs include transportation costs, tariffs and non-tariff measures, information costs, customs fees and charges, the cost of time, etc. Some trade costs are easy to measure (e.g. fees and charges for customs processing) but others are more difficult (e.g. the cost of delays in customs clearance).

There are two principal ways of measuring trade costs: directly and indirectly. An example of measuring trade costs directly is the collection of data on customs fees or transportation charges. In contrast, indirect methods infer the magnitude of trade costs from the volume of trade flows or price differences across borders. The direct approach to measuring trade costs

and their components might seem preferable but is plagued by data limitations. For example, information on transportation costs for all possible routes are difficult to obtain from rail, shipping and airline companies. Furthermore, the quality of this type of data can be poor (Hummels, 2001). The advantage of the indirect method is the greater availability of the data – for example trade flows – which are the raw material used to infer trade costs. This allows estimates of trade costs to be made to cover more countries and years. The indirect method requires the use of a well-grounded economic model, which in this case is provided by the gravity model¹ as extended by Anderson and van Wincoop (2003), Novy (2011), and Chen and Novy (2011). The gravity model is the modern workhorse of empirical trade economics (Head and Mayer, 2014) and all the estimates of trade costs in the rest of this section rely on studies using it. The methodology for deducing the magnitude of trade costs using the gravity model is described in greater detail in Box D.1.

Box D.1: Deriving trade costs from trade flows

Given the difficulties involved in directly measuring trade costs, researchers have turned to indirect methods to infer trade costs by comparing the levels of trade flows. The basic idea behind the approach is that if trade between two countries is high, trade costs between those two countries must be relatively low, all things being the same.

Novy (2011) builds on this idea and derives a ratio of “domestic” and international trade in a given sector. Domestic trade refers to goods traded across different regions of the same country and is used as a benchmark for borderless trade. In contrast, exports from one country to another are subject to all the possible frictions that could act on international trade. The derivation of this ratio captures anything that might restrict trade between two partners, over and above the effect of intranational barriers.

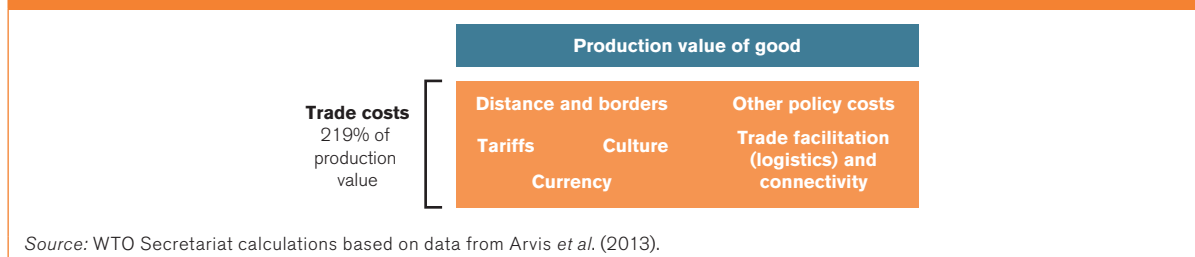
The following equation summarizes the approach and yields trade costs in *ad valorem* tariff equivalents, i.e. as a percentage of the price:

$$\text{Trade costs}_{ij} = \left(\frac{\text{Domestic trade}_{ii} \text{Domestic trade}_{jj}}{\text{Exports}_{ij} \text{Exports}_{ji}} \right)^{\gamma} - 1$$

The subscript ij indicates a flow from country i to j , and γ is a parameter accounting for the heterogeneity of products. For example, in the year 2000, Novy (2011) estimates that trade costs between the United States and Germany were equivalent to a 70 per cent tariff on average, whereas they amounted to a 25 per cent tariff between the United States and Canada. These costs come from distance, quotas, freight costs, cultural differences and anything else that could discourage international trade. In fact, this measure even captures the effect of home bias in consumer preferences. The tariff equivalent is actually the average of trade costs in both directions, meaning that any change is hard to attribute to an action by either one of the partners. There is also no distinction between import and export costs for each country.

The equation is able to provide estimates of international trade costs, essentially all costs incurred in moving a good from the border of i to the border of j . However, as noted earlier, it does not include intranational trade costs – the costs involved in moving the good from the site of production in country i to its border or the cost of moving the good from the border of j to the final consumption site. These costs reflect a variety of causes, including lack of competition in distribution as well as poor infrastructure. These intranational trade costs may be quite high, even in developed countries. Agnosteva *et al.* (2014) estimate the intranational trade costs of manufactured goods in Canada to be equivalent to applying an *ad valorem* tax of 109 per cent. Atkin and Davidson (2014) estimate that the costs of intranational trade are approximately four to five times higher in some sub-Saharan African countries than in developed countries.

Figure D.1: Composition of trade costs in developing countries



Based on the available evidence, trade costs remain high. Based on the Arvis *et al.* (2013) database, trade costs in developing countries in 2010 were equivalent to applying a 219 per cent *ad valorem* tariff on international trade.² This implies that for each dollar it costs to manufacture a product, another US\$ 2.19 will be added in the form of trade costs. Even in high-income countries, trade costs are high, as the same product would face an additional US\$ 1.34 in cost.³

Figure D.1 illustrates the magnitude of trade costs in developing countries and highlights their main components. The size of the trade cost rectangle is drawn so that it is proportional to the production cost of the good. Along with the geographical features of the countries (e.g. how distant they are from major markets), policy-related barriers including trade facilitation (logistics) account for most of the variance in trade costs. The importance of these various components of trade cost is indicated by their font size: the bigger the font size the greater the contribution of that component to trade cost.

(b) Sectoral patterns of trade costs

The aggregate estimates of trade costs discussed above conceal large differences across sectors and regions. This sectoral and regional variation in trade costs means that implementation of the TFA is likely to have a bigger trade effect on some product sectors and regions than on others.

(i) Agriculture and manufacturing

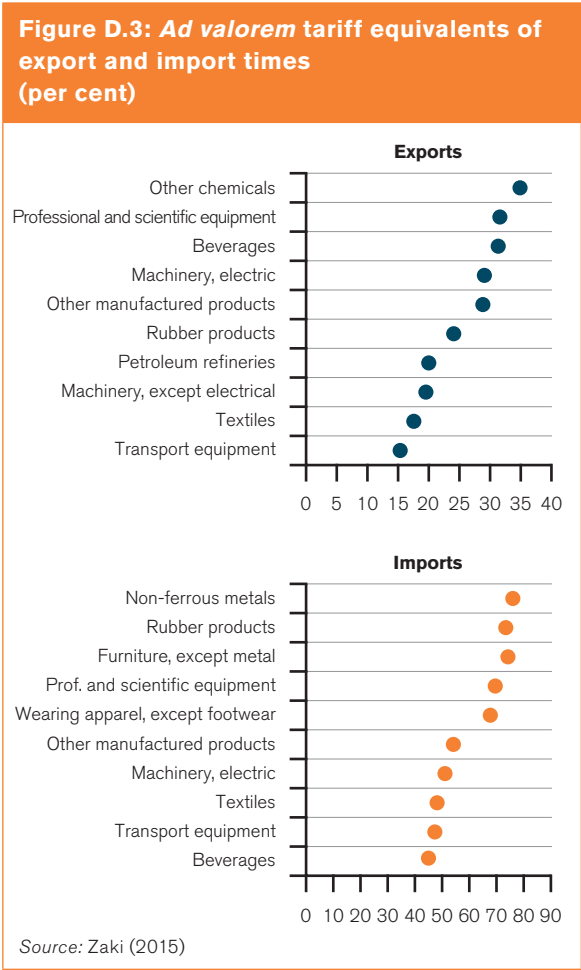
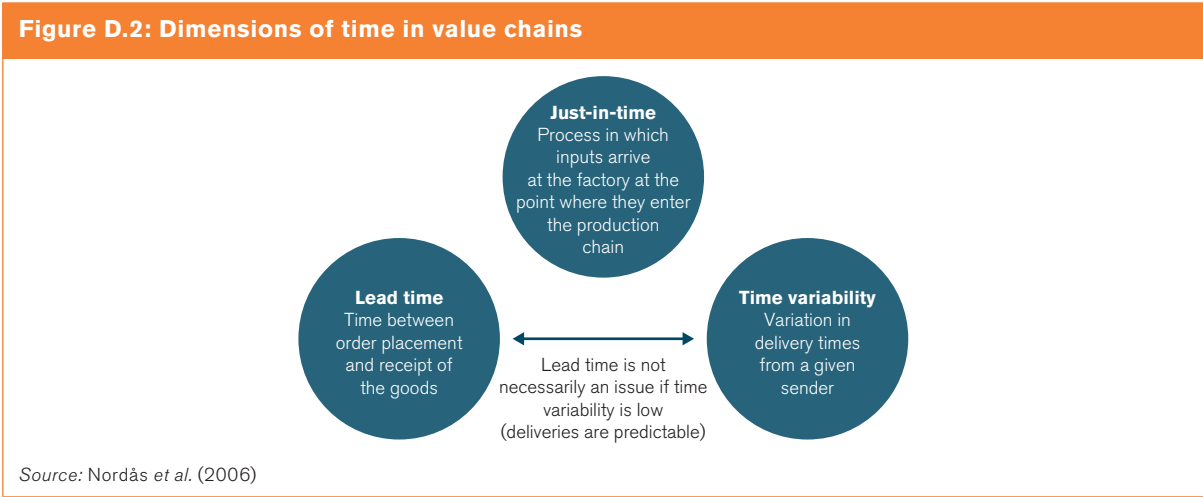
In 2012, *ad valorem* trade costs in agriculture were 68 per cent higher than in manufacturing.⁴ However, a lack of trade facilitation appears to be more damaging to trade in manufactured goods than to trade in agricultural goods. Part of this may be explained by the fact that agricultural goods are traded in bulk and transported using slower moving carriers, so traders can adjust to delays in customs clearance. The one exception is fresh agricultural products, which have higher sensitivity to time and are increasingly transported by air. By speeding up the clearance of goods across borders, trade facilitation could prove a boon for trade in perishable goods.

Trade costs also differ among manufactured goods, as per Chen and Novy (2011), who calculate *ad valorem* trade costs for different industries using EU member data. Goods with a high weight-to-value ratio, such as bricks (with an *ad valorem* trade cost of 30,000 per cent) or plaster (800 per cent), face extraordinarily high trade costs. Those goods are expensive to transport – transit is often charged by the kilogramme – but have a low market value. Bread and pastry products are perishable and so face high trade costs (43 per cent). Finally, Chen and Novy find that high tech industries such as aircraft and spacecraft face lower trade costs (1.44 per cent).

(ii) Goods within value chains and the cost of time

Time is a critical factor in the operation of global value chains (GVCs). In 2013, the Fourth Global Review of Aid for Trade pointed to customs procedures, transportation costs and delays as the biggest factors blocking developing countries from integrating value chains (WTO, 2014). Figure D.2 identifies the different dimensions of time that are critical to the success of disaggregated production structures, where just-in-time production is the order of the day. They include lead time, which refers to the time between when an order is made and when the goods are delivered, and variability in delivery time.

Zaki (2015) confirms that intermediate goods that feature prominently in GVCs are particularly time-sensitive, as these goods are more adversely affected by delays. He derives the *ad valorem* tariff equivalent of time for different product sectors. This is an overall measure of the effect of delays and red tape in each sector. Moreover, for each type of product, the cost of time is described separately for export and import procedures. Figure D.3 shows the 10 industries that suffer the most from delays in delivery time. On average, the cost of time is higher on the import side than on the export side. Import procedures may take longer than export procedures because imports are often a revenue source, and because of the greater heterogeneity of imports, given that countries typically import a broader range of goods than they export. On both the import



and export sides, goods destined for use in value chains (electrical machinery and equipment, transport equipment, and apparel and textiles) are particularly time-sensitive.

(c) Geographical patterns of trade costs

This subsection presents the geographical pattern of trade costs. These tariff equivalents capture all types of

trade impediments and are bilateral averages of costs in both directions, for each pair of countries. These *ad valorem* equivalents include the costs of both export and import procedures. The data come from Arvis *et al.* (2013) and describe trade costs for 178 economies from 1995 to 2012.

Figure D.4 shows the world map of trade costs. The 10 economies with the lowest trade costs are all located in Western Europe or North America. At the other end of the spectrum, the 10 economies with the highest trade costs are either from Africa or small island developing states, such as Comoros, Kiribati and Vanuatu.

As shown in Figure D.5, trade costs are decreasing in income levels. By region, Africa has the highest trade costs at over 260 *ad valorem* tariff equivalent. The isolation of landlocked countries in the continent is even starker, as they incur an additional trade cost of 40 per cent, not applicable to coastal African countries, although policy factors may also be a contributing factor (Borchert *et al.*, 2012).

(d) Estimates of trade cost reductions from trade facilitation

This subsection reviews estimates of the reduction in trade costs that could be achieved if all countries fully implement the provisions of the TFA. The first study, by Hillberry and Zhang (2015), looks at the impact of full implementation on the time required to import and export in each country, measured in days. The second study, by Moïsé and Sorescu (2013), is more comprehensive in scope and estimates reductions in total trade costs from full implementation of the Agreement. The estimated reduction in trade costs derived by Moïsé and Sorescu (2013) will be used in the latter part of Section D to simulate the trade and income effects of implementing the TFA.

Figure D.4: *Ad valorem* tariff equivalents of trade costs with the main world importers, 2010 or latest available year (per cent)

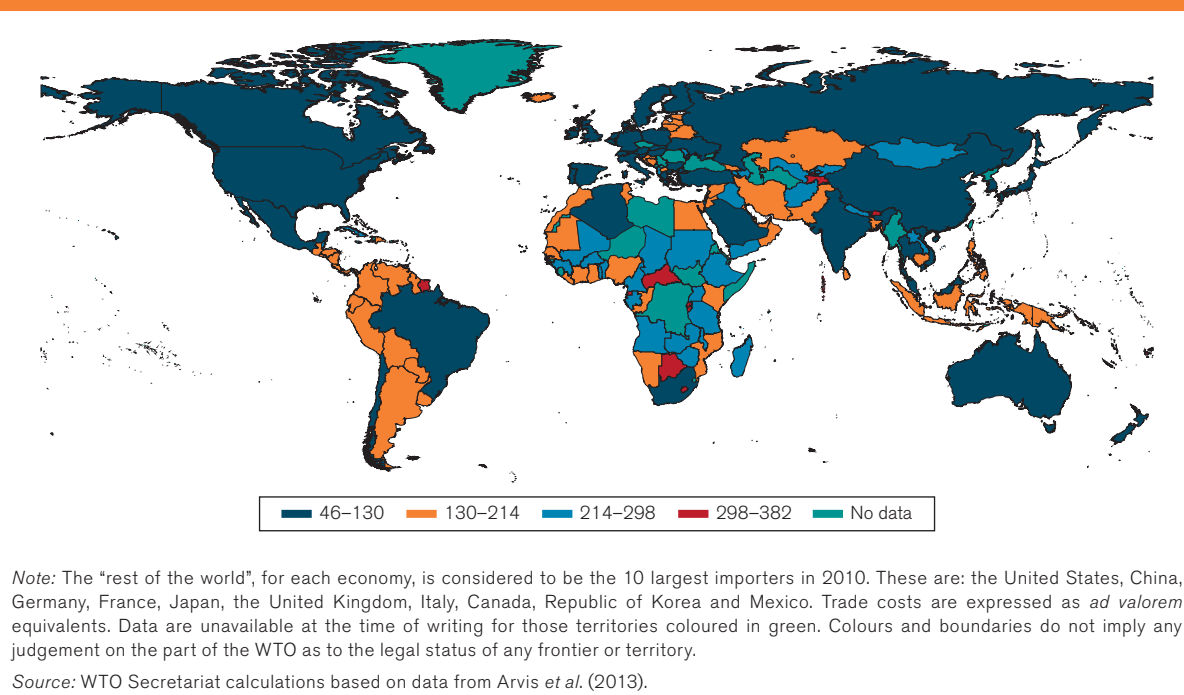
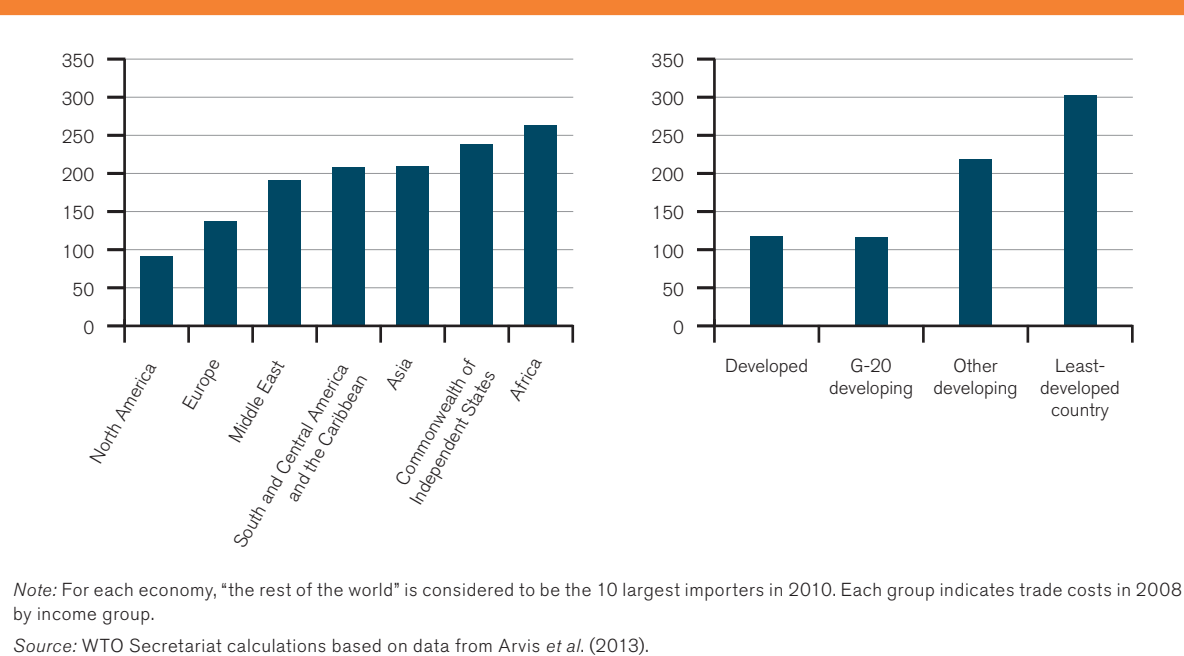


Figure D.5: *Ad valorem* tariff equivalents of trade costs by region and level of development, 2008 (per cent)



Both studies employ the OECD's Trade Facilitation Indicators (TFIs), which were discussed in Section C, to simulate full implementation of the TFA. This assumes that all economies reach best practice standards of trade facilitation, as measured by twelve different

OECD TFIs. As detailed in Section C, each indicator is scored from zero to two, with two being the highest value. In the full implementation scenario, it is assumed that each economy achieves the maximum score of two in each of the 12 OECD TFIs.

(i) Reduction in time to import and export

One of the questions Hillberry and Zhang (2015) examine is the effect of trade facilitation on the time required to import and export. They find that full implementation of the TFA has the potential to reduce time to import by over a day and a half (a 47 per cent reduction) and time to export by almost two days (a 91 per cent reduction), for WTO members. Time to export is found to be more sensitive to trade facilitation. The authors note that export procedures are usually concentrated in a subset of products, and are simpler, whereas import procedures are inherently more complicated because of the heterogeneity of incoming goods. As noted earlier, countries typically export a narrower range of goods than they import, and imports are often a source of customs revenues.

In terms of individual trade facilitation provisions, Hillberry and Zhang (2015) find that governance and automation are the most time-saving reforms. Governance, for example, accounts for 37 per cent of the reduction in the time to import. Automation is responsible for about 30 per cent of the reduction in time to import, which is understandable, since automation covers some of trade facilitation's key areas, such as the electronic exchange of documents and the application of risk management procedures.

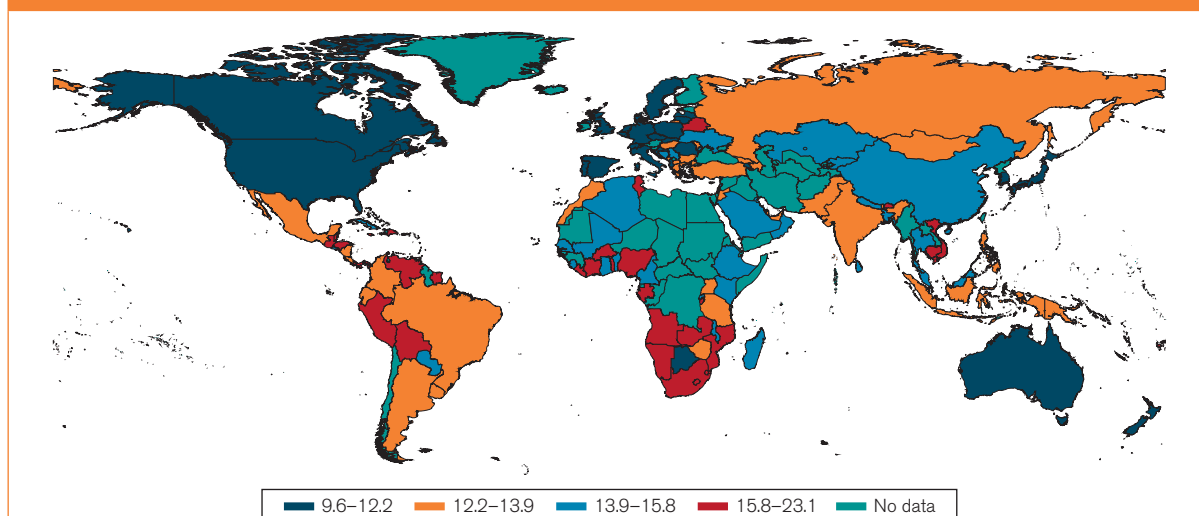
(ii) Reduction in total trade costs

Turning now to the study of Moisé and Sorescu, Figure D.6 shows the estimated trade cost reduction

across the globe from full implementation of the TFA. The reduction in trade costs is in the range of 9.6 to 23.1 per cent with the average reduction being equal to 14.5 per cent. Not surprisingly, economies with the biggest pre-implementation deficiencies in trade facilitation standards are set to reap the greatest reductions. Even the smallest estimate of trade cost reduction implies that full implementation of the TFA will have an even bigger impact on trade costs than reducing all most-favoured nation tariffs (currently estimated to average around 9 per cent) to zero – recall that the estimated *ad valorem* estimate of trade costs in developing countries is 219 per cent, and is 134 per cent in high-income countries. Even if one takes the smallest estimate of a 9.6 per cent reduction in trade costs, this is equivalent to reducing the *ad valorem* equivalent of trade costs in developing countries by 21 percentage points (from 219 per cent to 198 per cent) and by 13 percentage points in high-income countries (from 134 per cent to 121 per cent).

Overall, the average trade cost reduction for all merchandise goods is 14.3 per cent, with the average decrease in trade costs for manufactured goods at 18 per cent, against 10.4 per cent for agricultural goods. Figure D.7 shows that all regions are expected to experience reductions in trade costs, with Africa (16.5 per cent) benefitting the most. Comparisons of the anticipated impact of TFA implementation on different income groups suggest that least-developed countries (LDCs) will see the biggest reduction in trade costs (16.73 per cent).

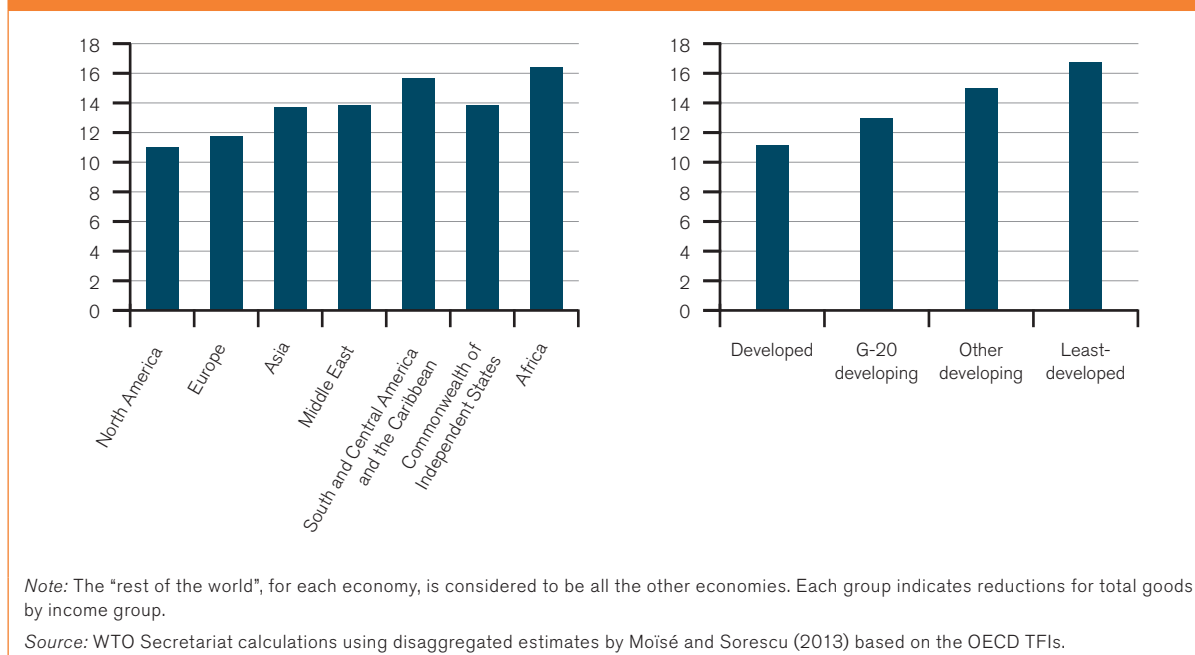
Figure D.6: Estimated reductions in *ad valorem* tariff equivalent trade costs due to TFA implementation (percentage change)



Note: Data are unavailable at the time of writing for those territories coloured in green. Colours and boundaries do not imply any judgement on the part of the WTO as to the legal status of any frontier or territory.

Source: WTO Secretariat calculations using disaggregated estimates from Moisé and Sorescu (2013) based on the OECD TFIs.

Figure D.7: Estimated reductions in *ad valorem* tariff equivalent trade costs due to TFA implementation by region and level of development (per cent)



2. Increased trade flows and GDP

The two most commonly used economic approaches to estimating the trade impact of trade facilitation reform are gravity and computable general equilibrium (CGE) models. This report employs estimates from these two methodologies to ensure that results are consistent and to provide complementary perspectives on the benefits of implementing the TFA. Before considering the results of a range of such studies, this subsection provides a short summary of these two methodologies (Piermartini and Teh (2005) and WTO and UN (2012)).

CGE models are "ex-ante" (i.e., an analysis of prospective results) computer-based simulations of changes in trade policy, designed to answer "what if" types of questions. They allow policy-makers to adjust the value of a variable, for example trade procedures, and obtain numerical values of the expected effects on economic variables, either in a static or dynamic perspective. In contrast to partial equilibrium models, CGE models take into account the interdependence of nations, markets and economic actors, typically households and firms. They make assumptions about the market structure, production technology, consumer preferences and the substitutability between foreign and domestic product varieties. The model is first calibrated to reproduce exactly the observed data for a reference year, which is used as the baseline. To produce the counterfactual scenario, the policy change of interest is introduced to the model and the model is then solved by setting

prices in such a way that, in equilibrium, consumers maximize their welfare, and firms their profits, under the constraints imposed by the available resources and policies. The difference in trade and GDP (or any other economic variables of interest) between the counterfactual and baseline scenarios constitutes the causal effect of the policy change.

Gravity models are econometric models of trade that use historical data to determine the effect of past policy on trade flows. While they are "ex-post" models — based on an analysis of past outcomes — they can be used after estimation to simulate the effect of policies "ex-ante", provided that these policies are implemented in comparable circumstances. Their name comes from the similarity with the Newtonian theory of gravity, since the main feature of the model is that volume of trade between any two countries is positively related to the size of their economies (usually measured by GDP) and inversely related to the trade costs between them. In addition, for any two countries, the level of trade not only depends on their bilateral trade costs, but also on the barriers that they face as well as impose on the rest of the world — the so-called multilateral resistance terms (Anderson and van Wincoop, 2003).

The high explanatory power of the gravity approach makes it a common choice in the empirical trade literature, although this is not its only virtue. It has been shown to be consistent with many models of international trade including Ricardian comparative

advantage and Krugman's new trade theory (Head and Mayer, 2014). In much of the trade literature, simulations undertaken with the gravity model are interpreted as partial equilibrium analysis since the changes in trade from the simulations do not feed back to GDP and thus only the trade effects can be determined.

A number of recent studies have estimated the trade effects of trade facilitation, using gravity, CGE or a mix of the two models (see Table D.1 for a compact representation of the results). Hufbauer and Schott (2013) perform a "thought experiment" in which countries improve their trade facilitation measures halfway to the region's top performer in each category.⁵ They estimate an increase in total merchandise exports

of US\$ 1 trillion per annum, with developing countries' trade rising by US\$ 569 billion (a 9.9 per cent increase) and developed countries' total exports rising by US\$ 475 billion (a 4.5 per cent increase). These estimates are larger than in an earlier study (Hufbauer *et al.*, 2010), which drew on trade facilitation proxies by Wilson *et al.* (2005) and found increases in exports of US\$ 47.3 billion and US\$ 39.5 billion for developing and developed countries, respectively.

Hoekman and Nicita (2011) estimate that the percentage increase in exports (imports) of low-income countries that would result from a combined convergence of the World Bank Group's "Doing Business" cost-of-trading indicator and of the World

Table D.1: Selected studies on the effect of trade facilitation on trade flows

Study	Model	Assumption	Variable	Developed	Developing	World
Decreux and Fontagné (2009)	CGE	50 per cent reduction in AVE cost of time at the border, soft and hard infrastructure.	Export	n.a.	n.a.	+bUS\$ 383
Iwanow and Kirkpatrick (2009)	Gravity	10 per cent improvement in trade facilitation index.	Export (manufacturing)	n.a.	Africa: +6%	+2.1%
Hufbauer <i>et al.</i> (2010)	Other	Improve measures of customs and regulatory environment halfway to global average.	Export	+bUS\$ 39.5	+bUS\$ 47.3	+bUS\$ 86.8
Decreux and Fontagné (2011)	CGE	50 per cent reduction in AVE cost of time at the border, soft infrastructure.	Export	n.a.	n.a.	+bUS\$ 359 (1.9%)
Dennis and Shepherd (2011)	Gravity	10 per cent reduction in costs of (1) exporting (2) international transport (3) market entry.	Export variety	n.a.	n.a.	(1) +3% (2) +4% (3) +1%
Hoekman and Nicita (2011)	Gravity	Improve trade facilitation to middle-income countries average.	Export Import	n.a. n.a.	+17% +13.5%	n.a. n.a.
Portugal-Perez and Wilson (2012)	Gravity	Improve border and transport efficiency halfway to top performer in the region.	Export	Positive effect decreasing with income.	Chad: +17% Mongolia: +3% Kazakhstan: +23% Venezuela: +4%	Positive and significant
Ferrantino and Tsigas (2013)	Gravity and CGE	Countries improve trade facilitation halfway to global best practice.	Export	n.a.	n.a.	bUS\$ 1,584 (14.5%)
		Countries improve trade facilitation halfway to regional best practice.				bUS\$ 1,030 (9.4%)
Hufbauer and Schott (2013)	Gravity	Improve trade facilitation halfway to the region's top performer in each category.	Export	+bUS\$ 475 (4.5%)	+bUS\$ 569 (+9.9%)	+bUS\$ 1,043
Persson (2013)	Gravity	1 per cent reduction in number of days needed to export.	Export variety	n.a.	n.a.	HG: +0.3% DG: +0.6%
Feenstra and Ma (2014)	Gravity	10 per cent improvement in bilateral port efficiency.	Export variety	n.a.	n.a.	+1.5% to +3.4%
Zaki (2014)	Gravity and CGE (two steps)	50 per cent reduction in AVE cost of time to import and export.	Export	EU: +10.6% US: +3.9 Japan: +2.1%	SSA: +22.3% Asia: +16.2% LAC: +16.2%	n.a.
Mevel <i>et al.</i> (forthcoming)	CGE	25 per cent reduction in AVE cost of time to import and export. Effect of trade facilitation post-CFTA implementation.	Export	EU: +bUS\$ 164.5 US: +bUS\$ 121.8	NA: +bUS\$ 11.5 MENA: +bUS\$ 36.4 RoA: +bUS\$ 38.4	+bUS\$ 1,224

Notes: AVE = *ad valorem* equivalent; CFTA = Continental Free Trade Area in Africa; DG = differentiated good; HG = Homogeneous goods; LAC = Latin America and the Caribbean; NA = North Africa; RoA = Rest of Africa; MENA = Middle East and North African countries; SSA = Sub-Saharan Africa.

Bank's Logistics Performance Index (LPI) score to the average of middle-income countries would be 17 per cent (13.5 per cent).

Decreux and Fontagné (2011) and Zaki (2014) provide two recent CGE estimates of the trade impact of trade facilitation. Decreux and Fontagné represent trade costs as the *ad valorem* equivalent of the time at the frontier (customs procedures and time at the port), using information from the "Doing Business" indicators and estimates by Minor and Tsigas (2008). Trade facilitation reform is represented by a 50 per cent reduction in these costs. Using the MIRAGE (Modelling International Relationships in Applied General Equilibrium) CGE model, they calculate an expansion in global trade of around 2 per cent or US\$ 359 billion. This result should be considered more conservative than Decreux and Fontagné (2009), who include infrastructure variables going beyond the coverage of the TFA. In this previous study, they estimate an increase in export in the same range at US\$ 383 billion and find that gains from trade facilitation would almost only arise for developing countries, in particular in Sub-Saharan Africa.

Zaki adopts a two-step approach, using a gravity model to first calculate the *ad valorem* equivalents of the time to export and import. In a second step he assumes that trade facilitation reform will lead to a 50 per cent reduction in these *ad valorem* trade costs, and also uses the MIRAGE CGE model to simulate the trade impact. He finds that developing countries tend to see the largest increases in both exports and imports. Sub-Saharan African, Asian, Latin American and Middle Eastern exports increase by 22.3 per cent, 16.2 per cent, 16.2 per cent, and 13.8 per cent, respectively, following trade facilitation reform. Imports are increased by almost the same magnitude.

Mervel *et al.* (forthcoming) study the long-run yearly impact of the African Continental Free Trade Area (CFTA) and the TFA using a dynamic version of the MIRAGE CGE model covering 29 manufacturing sectors in all North African countries and the rest of the world by sub-groups. They measure trade facilitation using the same indicator as Decreux and Fontagné, but only consider a 25 per cent reduction in the estimated *ad valorem* cost to export by 2017. The extra increase in exports brought by the TFA is measured at US\$ 11.5 billion, US\$ 36.4 billion, US\$ 38.4 billion, US\$ 164.5 billion and US\$ 121.8 billion for North Africa, the Middle East, the rest of Africa, the European Union and the United States, respectively. Including the rest of the world, this amounts to an increase of US\$ 1,224 billion in global trade.

The rest of this subsection will present new estimates using indicators of trade facilitation that more

closely reflect the TFA, developing more realistic implementation scenarios and using both econometric approaches (subsections D.2(b) and (c)) and CGE simulations (subsection D.2(d)). It begins with a description of the data used and with details on the construction of the implementation scenarios.

(a) Data and TFA implementation scenarios

In the following scenarios, the OECD TFIs (average TFI(a) – TFI(l)) are used as a proxy for trade facilitation.⁶ As discussed in Section C, the OECD TFIs closely reflect the WTO's TFA. The OECD TFIs used in this report cover 133 economies. The trade data used in the gravity estimation cover the years 2003 to 2011, are disaggregated by importing country, exporting country and HS6⁷ sub-headings, and come from the CEPII BACI dataset (i.e. the international trade database of the *Centre d'études et d'informations internationales*).

The following three implementation scenarios of the TFA are used in the simulations:

1. Conservative scenario

This scenario takes into account notifications of TFA Category A⁸ commitments received by the WTO from 52 developing countries as of early January 2015.⁹

For the group of 52 notifying developing countries, the commitments, by article of the TFA, are translated into OECD TFIs using the correspondence between these indicators and the TFA. If a country commits to at least 95 per cent of the articles that belong to each indicator, this indicator is set to its maximum value of 2. The new average TFI value is calculated accordingly.

For the group of 35 developed countries, it is assumed that they will fully implement the TFA and hence their TFI scores are set to the maximum value of 2.

Finally, for the group of non-notifying developing countries, the new level of TFI is predicted "out-of-sample". The procedure is as follows: a regression with the TFI as dependent variable, using the level of GDP per capita and WTO regions as explanatory variables, is estimated on the sample of the 52 notifying developing countries and 35 developed countries. The estimated coefficients from the regression are then used to fit predicted TFI values to the non-notifying developing countries.

2. Liberal scenario

This scenario is constructed in a similar way to the conservative scenario – with the only difference being that the threshold in commitments used to assign a

Table D.2: Estimated trade and GDP impacts of TFA implementation

Units		Range of values	
I. Gravity model			
Exports	Billion current US\$	1,133	3,565
	Percentage change	9.1	28.7
II. Dynamic computable general equilibrium model			
Exports	Billion constant (2007) US\$	750	1,045
	Addition to average annual percentage growth, 2015-30	2.06	2.73
GDP	Billion constant (2007) US\$	345	555
	Addition to average annual percentage growth, 2015-30	0.34	0.54

Source: WTO Secretariat and Fontagné *et al.* (2015).

value of 2 to the relevant TFI indicator is lower, and equal to 75 per cent.

3. Full implementation scenario

In this scenario, the TFI is set to its maximum value of 2 for all countries.

To assist the reader through the discussion of all the simulation results, Table D.2 provides a summary of the estimated impact on exports and GDP of implementing the TFA using the two methodological approaches used in this report.

(b) Increase in export flows

This subsection estimates the impact of trade facilitation on the intensive margins of trade, i.e. on total exports, where, in order to smooth out fluctuations in the series, data on average export flows for the years 2003-11 are used.

The effect of trade facilitation on total exports is positive and significant, as shown in Appendix Table D.1.¹⁰ In the table, Column (1) uses the (natural logarithm of) TFI of the exporting country as a measure of trade facilitation, controlling for importer fixed effects. Column (2) uses a measure of bilateral trade facilitation, TFI_{ij} , equal to the geometric average of the exporter's (country *i*) and importer's (country *j*) TFI, as in Moïse and Sorescu (2013). These columns, too, include importer fixed effects. Although coefficients cannot be compared directly across different regressions, bilateral trade facilitation is associated with a bigger effect on trade.

Based on the estimation results of Appendix Table D.1, a series of counterfactual analyses were conducted, to estimate the percentage increase in the value of total exports as well as the actual dollar increases under the scenarios outlined above. The results, averaged across income groups, are presented in Table D.3. It shows that

the increase in exports is generally higher in the TFI_{ij} scenarios, which is not surprising as this corresponds to a multilateral increase in both the exporter's TFI_i and the importer's TFI_j . Starting with the first two scenarios, "conservative" and "liberal", the estimated increases in exports range from 7 per cent to 18 per cent. Perhaps not surprisingly, the biggest increase occurs under the "full" implementation scenario with export gains of up to 36 per cent for LDCs. The corresponding changes in export values, measured in billions of US dollars, are also shown in Table D.3. Globally, the estimated increase in exports ranges from US\$ 1,132.6 billion in the "conservative" scenario to US\$ 3,564.87 billion in the "full" implementation scenario.

A possible concern with these simulations is that they are based on the average effect of trade facilitation, estimated to be equal for countries that implement the TFA and countries that do not in the relevant scenario. The effects could be non-linear within the sample. For instance, the effect of trade facilitation could be higher for low values of trade facilitation as opposed to high values of trade facilitation. A number of different approaches were explored to address these issues.¹¹ The overall conclusion from exploring these different approaches is that the results presented in Appendix Table D.1 and used for the simulations are largely unaffected.

It is important to emphasize that the gravity-based simulations conducted here are of a partial equilibrium nature, since they only include the direct effects of the policy experiment (implementation of the TFA). Conditional general equilibrium analysis would include secondary effects through the multilateral resistance terms. The literature on the trade effects of preferential trade arrangements (PTAs) has found that the partial equilibrium results overstate the conditional general equilibrium outcome. In particular, Anderson *et al.* (2014) have shown that in the case of the North American Free Trade Agreement (NAFTA), the difference is a factor of around two.

Table D.3: Estimated increases in exports by level of development under various TFA implementation scenarios from regression-based simulations (percentage change and billion current US\$ increase)

	TFI _i		TFI _{ij}	
	Percentage change	bUS\$	Percentage change	bUS\$
"Conservative" scenario				
Developed	10	697.11	16	1,453.77
G-20 developing	7	264.86	12	601.66
LDCs	13	11.15	10	16.67
Other developing	9	159.44	12	320.59
Total		1,132.6		2,392.7
"Liberal" scenario				
Developed	10	697.11	18	1,514.70
G-20 developing	9	387.86	15	778.05
LDCs	13	12.06	12	19.21
Other developing	11	207.64	15	404.96
Total		1,304.7		2,716.9
"Full" scenario				
Developed	10	697.11	26	1,664.71
G-20 developing	12	629.20	27	1,168.48
LDCs	35	40.06	36	47.44
Other developing	20	421.95	31	684.23
Total		1,788.32		3,564.87

Source: WTO Secretariat.

However, discriminatory trade liberalization, as embodied by the formation of a PTA, is different from trade facilitation. In a PTA, bilateral trade costs are only reduced for the partners. This means that non-members become more "distant" from members. This mutes the partial equilibrium trade expansion effects through the multilateral resistance terms. However, in the case of trade facilitation, bilateral trade costs are reduced for all possible pairs of countries. Therefore, they all maintain the same relative "distance" to one another. This implies that there may not be a big difference between the partial equilibrium and conditional general equilibrium results. The results of CGE simulations, discussed in subsection D.2(d), produce, in fact, comparable results at the lower end of the estimates, yielding estimates of trade expansion between US\$ 750 billion and US\$ 1 trillion.

(c) Export diversification: new markets and new products

Trade facilitation is likely to impact both variable and fixed trade costs of exporting. The formalities and requirements of a country's customs have to be met each time a shipment crosses a border. There are also, however, one-time costs, such as those incurred by a firm to acquire information on border procedures. The number and complexity of the documents required for

clearance can also be seen as a fixed cost. Traders have the one-time cost that involves learning how to fill in the forms. They may also have to purchase specialist IT systems and search for dedicated staff who will deal with customs matters (Grainger, 2008). As the WTO TFA contains provisions requiring countries to publish and make available information on border procedures, as well as to decrease and simplify documentation requirements, it should reduce fixed costs and create new trading opportunities. Firms that did not export before may be able to do so now, since their revenues could cover the lower fixed costs of exporting (Melitz, 2003). Trade facilitation can, therefore, lead to export diversification.

The empirical evidence on the export diversification effects of trade facilitation is quite limited when compared to the literature on its effects on existing trade flows. Nordås *et al.* (2006) were among the first to show the negative effects of time to export on the probability to export. Dennis and Shepherd (2011) estimate the impact of various World Bank Group's "Doing Business" indicators on the number of products that developing countries export to and import from the European Union. They find that poor trade facilitation has a negative impact on developing country export diversification. Another approach is taken by Feenstra and Ma (2014). They associate trade facilitation with port efficiency and estimate its impact

on export variety, showing the positive and significant effects of port efficiency on export variety. Finally, Persson (2013) distinguishes between the effects of trade facilitation (measured using the number of days needed to export, from the World Bank Group's "Doing Business" indicators) on homogeneous and differentiated products. She finds that trade facilitation has a higher impact on differentiated products. Reducing export transaction costs increases the number of differentiated products by 0.7 per cent and by 0.4 per cent for homogeneous products.

This subsection presents evidence of the impact of the TFA on export diversification, based on the methodology outlined in Beverelli *et al.* (2015). Two indicators of export diversification are considered: the number of exported products by destination and the number of export destinations by product. The number of exported products, npd_{ij} , counts how many Harmonized System (HS) sub-headings (six-digit HS codes) a country i exports to destination j . In the HS2002 classification used for this exercise, there are 5,224 sub-headings. For each country pair, npd_{ij} can therefore theoretically range between 0 (no trade) and 5,224 (country i exports all products to destination j).¹² The number of export destinations, ndp_{ik} , counts how many destinations are served by country i 's exports of product k . The number of export destinations is bound by the number of countries included in the CEPII BACI dataset, which is the source of the trade data.

Descriptive statistics for npd_{ij} and ndp_{ik} for groups of countries at different stages of economic development are presented in Table D.4. The table shows that the level of diversification in G-20 developing countries

is comparable to the diversification of developed countries. Other developing countries lag behind. This is especially the case for LDCs, which, on average, export only 23 out of the possible 4,795 products to a given destination and serve one destination market out of the possible 202 for a given product.

Econometric estimates of the impact of exporter's trade facilitation on the number of exported products by destination, and on the number of export destinations by product, are presented in Appendix Table D.2. Trade facilitation has a positive and significant effect on the number of exported products by destination and the number of export destinations by product.

The results shown in Appendix Table D.2 have been used to conduct counterfactual analysis aimed at providing insights into the potential export diversification benefits of TFA implementation. The percentage increases in the number of export destinations and in the number of exported products have been estimated under the three scenarios described in subsection D.2(a).¹³ Table D.5 presents the results for the number of products by destination, based on the estimations in columns (1)-(2) of Appendix Table D.2. Table D.6 presents the results for the number of destinations by product, based on the estimations in columns (3)-(4) of Appendix Table D.2. All results are aggregated by development level in these tables.¹⁴

The effect of trade facilitation reform on export diversification is estimated to be substantial for developing countries, in particular for LDCs. These gains are shown in Table D.5. The first column presents "Baseline" estimations where the dependent variable (the number of HS6 products exported) is constructed

Table D.4: Descriptive statistics on export diversification by level of development

Development status	Average	Median	Standard deviation	Maximum
Panel (a): Number of exported products by destination (npd_{ij})				
Developed	717	233	1,009.4	4,795
G-20 developing	672	250	900.1	4,320
LDC	19	1	60.7	1,109
Other developing	101	6	297.0	4,144
Total	271	13	650.1	4,795
Panel (b): Number of export destinations by product (ndp_{ik})				
Developed	25	11	32.6	202
G-20 developing	24	10	32.8	193
LDC	1	0	3.0	104
Other developing	4	0	9.9	177
Total	10	1	21.9	202

Notes: Descriptive statistics in Panel (a) obtained from the sample of column (1) of Appendix Table D.2.

Descriptive statistics in Panel (b) obtained from the sample of column (3) of Appendix Table D.2.

Source: WTO Secretariat.

Table D.5: Estimated increases in the number of products by destination due to TFA implementation by level of development (percentage change)

	Baseline	New HS6
"Conservative" scenario		
Developed	9.1	9.8
G-20 developing	6.2	6.7
LDCs	11.8	12.8
Other developing	8.4	9.1
"Liberal" scenario		
Developed	9.1	9.8
G-20 developing	8.4	9.1
LDCs	12.1	13.1
Other developing	10.5	11.3
"Full" scenario		
Developed	9.1	9.8
G-20 developing	10.7	11.6
LDCs	32.9	35.6
Other developing	18.4	20.0

Notes: The numbers indicate percentage change in npd_{ij} (number of exported products by destination) under the relevant scenario. The first column presents "Baseline" estimations where the dependent variable (the number of HS6 products exported) is constructed using trade data for 2009. The second column uses only the number of HS6 products that were not exported before 2008 ("New HS6") in the construction of the dependent variable. This is intended to address reverse causality concerns, in other words, the possibility that the number of products exported by a country causes changes to trade facilitation. By using only the number of new HS6 products, this possibility of reverse causation is reduced if not entirely eliminated. "Baseline" results are based on column (1) of Appendix Table D.2. "New HS6" results are based on column (2) of Appendix Table D.2.

Source: WTO Secretariat.

using trade data for 2009. The second column uses only the number of HS6 products that were not exported before 2008 ("New HS6") in the construction of the dependent variable. This is intended to address reverse causality concerns, in other words, the possibility that the number of products exported by a country causes changes to trade facilitation. By using only the number of new HS6 products, this possibility of reverse causation is reduced if not entirely eliminated.

As shown in Table D.5, under the "conservative" scenario of partial implementation of the TFA, LDCs stand to increase the number of products exported by destination by 11.8 to 12.8 per cent, on average. The gains become much larger under the full implementation scenario, with gains of 32.9 to 35.6 per cent. Other developing countries also stand to experience big gains, with an estimated increase in the number of products exported by destination ranging from 8.4 to 9.1 per cent ("conservative" partial implementation scenario) to between 18.4 and 20 per cent (full implementation scenario).

A similar pattern emerges for the number of destinations by product (see Table D.6). Other developing countries and (to a larger extent) LDCs stand to gain the most. The first column presents "Baseline" estimations where

the dependent variable (the number of destinations exported to) is constructed using trade data for 2009. The second column uses only the number of destinations that were not served before 2008 ("New destinations") in the construction of the dependent variable. As explained above, this is intended to address reverse causality concerns that the number of destinations that a country exports to causes changes to trade facilitation. By using only the number of new destinations, this possibility of reverse causation is reduced if not entirely eliminated.

Consider again the "conservative" scenario of partial implementation of the TFA. The percentage increase in the number of destinations by product ranges from 10 to 15.1 per cent for other developing countries and from 14.1 to 21.3 per cent for LDCs. Under full implementation, the gains are between 22 and 33.2 per cent for other developing countries and between 39.2 and 59.3 per cent for LDCs.

It is worth noting that the gains for G-20 developing countries are smaller, and comparable in size to the gains for developed countries. This is because, as shown in subsection C.2, they have, on average, levels of trade facilitation very similar to those of developed countries.

Table D.6: Estimated increases in the number of destinations by product due to TFA implementation by level of development (percentage change)

	Baseline	New destinations
"Conservative" scenario		
Developed	10.7	16.2
G-20 developing	7.4	11.2
LDCs	14.1	21.3
Other developing	10.0	15.1
"Liberal" scenario		
Developed	10.7	16.2
G-20 developing	10.0	15.1
LDCs	14.5	21.9
Other developing	12.5	18.8
"Full" scenario		
Developed	12.5	19.0
G-20 developing	12.8	19.4
LDCs	39.2	59.3
Other developing	22.0	33.2

Notes: The numbers indicate percentage change in ndp_{ik} (number of export destinations by product) under the relevant scenario. The first column presents "Baseline" estimations where the dependent variable (the number of destinations exported to) is constructed using trade data for 2009. The second column uses only the number of destinations that were not served before 2008 ("New destinations") in the construction of the dependent variable. This is intended to address reverse causality concerns, in other words, the possibility that the number of destinations to which a country exports causes changes to trade facilitation. By using only the number of new destinations, this possibility of reverse causation is reduced if not entirely eliminated. "Baseline" results are based on column (3) of Appendix Table D.2. "New destinations" results are based on column (4) of Appendix Table D.2.

Source: WTO Secretariat.

(d) Computable general equilibrium (CGE) simulations

Besides gravity-based estimations, CGE simulations have been employed in order to assess the economic and trade impact of trade facilitation. While the studies reviewed in the introduction are in line with the estimation results presented below, conducting its own CGE simulations offers this report a number of distinct advantages. First, unlike previous studies using more general measures of trade costs, one is able to isolate the impact of trade cost reductions that are specifically due to the TFA as reflected in disaggregated country and sector level estimates by Moisé and Sorescu (2013) using the OECD TFIs.¹⁵ Second, one can take into account various implementation scenarios in terms of both the coverage of provisions adopted by individual countries and the time frame within which commitments will be implemented. In this way, it is possible to illustrate the sensitivity of outcomes to various levels of "ambition". One is also able to apportion the gains to country groupings commonly used at the WTO. Third, one can employ a dynamic approach combining a macroeconomic baseline scenario (using the MaGE – Macroeconometrics of the Global Economy – model) with trade policy simulations in the context of a CGE framework (MIRAGE), following the set-up described

in Box D.2. This not only results in a fully traceable, internally consistent approach to long-term policy simulations, but also allows one to take into account the relationship between a changing economic environment and the impact of the TFA.

Table D.7 shows the principal results from the combined macroeconomic and trade simulations in terms of projected average annual growth rates of GDP and exports due to the TFA, which allows a comparison of results across scenarios despite their different time horizons. Depending on the implementation scenario (full, liberal, conservative) and time horizon (immediately, in five or in 10 years), the TFA adds between 0.34 and 0.54 per cent on average to global economic growth per year, with the higher figure corresponding to immediate, full implementation of the TFA and the lower bound resulting from a conservative implementation target to be achieved over the next 15 years.

This growth impact from the TFA implies that global GDP would be between 5.4 and 8.7 per cent higher in 2030, which translates into an additional US\$ 5.5 to 8.9 trillion (in constant 2007 dollars) for the world as a whole.¹⁶ The predicted effect of the TFA on annual export growth amounts to at least an additional 2 per cent expansion under any scenario, ranging from 2.06 per cent for the most conservative and slow

Box D.2: Main elements of MIRAGE

The latest version of the MIRAGE (Modelling International Relationships in Applied General Equilibrium) model, used here, is documented in Fontagné *et al.* (2013), the original model being fully described in Bchir *et al.* (2002) and Decreux and Valin (2007).

On the supply side, each sector in MIRAGE is modelled as a representative firm, which combines value-added and intermediate consumption in fixed shares. Value-added is a CES (“constant elasticity of substitution”) bundle of imperfectly substitutable primary factors (capital, skilled and unskilled labour, land and natural resources). Firms’ demand for production factors is organized as a CES aggregation of land, natural resources, unskilled labour, and a bundle of the remaining factors. This bundle is a nested CES aggregate of skilled labour and capital (that are considered as relatively more complementary).

MIRAGE assumes full employment of primary factors. Population, participation in the labour market and human capital evolve in each country (or region of the world economy) according to the demographics embedded in the macro projections. This determines the labour force as well as its skill composition (skilled/unskilled). Skilled and unskilled labour is perfectly mobile across sectors, but immobile between countries. Natural resources are sector-specific, while land is mobile between agricultural sectors. Natural resources for the mining sector and total land for agricultural sectors are set at their 2007 levels: prices adjust demand to this fixed supply. Natural resources for primary fossil fuel production sectors are calibrated as being constant. Installed capital is assumed to be immobile (sector-specific), while investments are allocated across sectors according to their rates of return.

The overall stock of capital evolves by combining capital formation and a constant depreciation rate of capital of 6 per cent that is the same as in the long-term growth models. Gross investment is determined by the combination of savings (the savings rate from the growth model, applied to the national income) and the current account. Finally, while total investment is savings-driven, its allocation is determined by the rate of return on investment in the various activities. For simplicity, and because reliable data on foreign direct investment (FDI) are lacking at country of origin, host and sectoral levels, international capital flows only appear through the current account imbalances, and are not explicitly modelled.

On the demand side, a representative consumer from each country/region maximizes instantaneous utility under a budget constraint and saves a part of its income, determined by saving rates projected in the first-step exercise. Expenditure is allocated to commodities and services according to a LES-CES (Linear Expenditure System – Constant Elasticity of Substitution) function. This implies that, above a minimum level of consumption of goods produced by each sector, consumption choices of goods produced by different sectors are made according to a CES function. This representation of preferences is flexible enough to deal with countries at different levels of development. Within each sector, goods are differentiated by their origin. A nested CES function allows for a particular status for domestic products according to the Armington hypothesis (Armington, 1969): consumers’ and firms’ choices are biased towards domestic production, and therefore domestic and foreign goods are imperfectly substitutable, using a CES specification. The Armington elasticities provided by the GTAP (Global Trade Analysis Project) database and estimated by Hertel *et al.* (2007) are used. Total demand is built from final consumption, intermediate consumption and investment in capital goods.

Dynamics in MIRAGE are of two kinds: the total factor productivity (TFP) is calibrated in a baseline exercise, while production factors dynamics are set exogenously. Both are built in MIRAGE using macroeconomic projections from the MaGE model documented in Fouré *et al.* (2013).

TFP is based on the combination of three mechanisms. First, agricultural productivity is projected separately, as detailed in Fontagné *et al.* (2013). Second, a 2 percentage point growth difference between TFP in manufactures and services is assumed (as in van den Mensbrugghe (2005)). Third, the aggregate country-level TFP is calibrated in the baseline exercise in order to match both production factors and GDP projections from the aggregate growth model, given the exogenous agricultural productivity and the productivity gap between manufacturing and services. Dynamics in MIRAGE are implemented in a sequentially recursive way: that is, the equilibrium can be solved successively for each period, given the exogenous trajectory for sector-specific TFP, if calibrated as described above, as well as the accumulation of production factors – savings, current accounts, active population and skill level – coming from the growth model. Simulations extend up to 2030. Finally, MIRAGE is calibrated on the GTAP dataset version 8.1, with 2007 as a base year.

Table D.7: Addition to annual export and GDP growth due to TFA implementation, by scenario (annual percentage change)

	Exports	GDP
"Conservative" scenario		
Immediate	2.09	0.36
5 years	2.08	0.35
10 years	2.06	0.34
"Liberal" scenario		
Immediate	2.33	0.43
5 years	2.31	0.41
10 years	2.29	0.40
"Full" scenario		
Immediate	2.73	0.54
5 years	2.71	0.52
10 years	2.67	0.50

Source: Fontagné *et al.* (2015).

implementation plan to almost 2.75 per cent in the most ambitious case.

Interesting patterns emerge when these figures are separated out for developed and developing countries respectively. In terms of the TFA's contribution to average annual GDP growth, developing countries' gains exceed those of developed countries, but only under a scenario of full or fairly ambitious ("liberal") implementation. In the case of full and immediate implementation, the TFA would augment average economic growth in developing countries by almost 0.9 per cent annually, while it would add about 0.25 per cent to GDP growth in developed countries. If, on the other hand, implementation is less ambitious ("conservative"), the picture is reversed, with developing countries' growth receiving a boost of barely 0.25 per cent and developed countries' growth increasing by almost 0.5 cent.

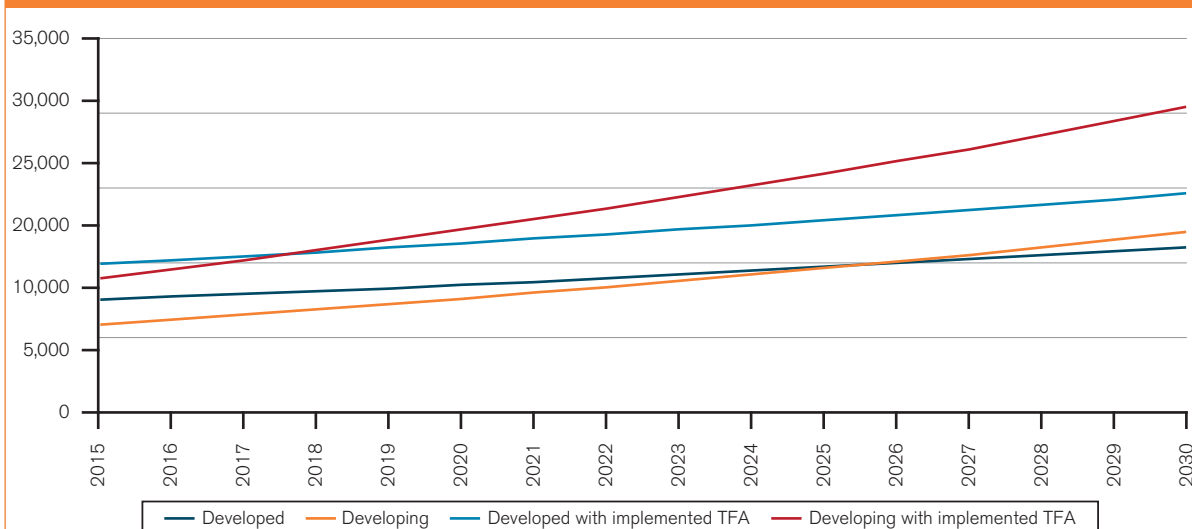
For both country groups, quick implementation of the TFA is more beneficial in terms of its economic impact compared to an implementation process stretching over several years, with the difference amounting to up to 0.1 per cent of annual GDP growth. For exports, the picture is similar, albeit more extreme. Developing countries reap much larger export gains from the TFA but only in the case of an ambitious implementation schedule. In such a scenario, developing countries would see their exports rise by over 3.5 per cent per annum, while developed countries' exports would increase by about 1.8 per cent per year owing to implementation of the TFA. For the less ambitious scenarios considered here, developed countries' export increases exceed those of developing countries, with the former achieving an additional boost to exports of between 2.7 and over 3 per cent per annum and exports in the latter increasing by only between about 1 and 2 per cent.

In previous studies the impact of trade facilitation has also been expressed in terms of the absolute amount added to world GDP and exports. Adopting a similar approach, the report finds that the TFA has the potential to add between US\$ 345 billion and US\$ 555 billion (in constant 2007 dollars) to global GDP per year, with faster and fuller implementation of the TFA resulting in GDP gains that are larger by over US\$ 200 billion.¹⁷ Similarly, exports would increase by between US\$ 750 billion and over US\$ 1 trillion.

Again, when looked at separately for different country groups, these numbers underscore the high stakes for developing countries in implementing the TFA: Figure D.8 shows the projected increases in exports over the next 15 years under the baseline macroeconomic scenario for both developed and developing countries (solid lines). Exports of the former are currently larger than those of the latter, but developing countries' exports are expected to exceed those of the developed countries by the year 2026. An ambitious implementation of the TFA could advance this "cross-over" point to the year 2018 (dashed lines), i.e. developing countries' exports would account for more than half of world trade already three years down the road owing to implementation of the TFA alone.

As can be seen from Table D.1 above, the estimates of the impact of the TFA are at the upper bound of existing studies, confirming the oft-quoted "US\$ 1 trillion" figure by Hufbauer and Schott (2013), even when using more precise data on TFA indicators and implementation scenarios and a more elaborate methodology. The results presented here are larger than, for instance, the ones generated in another recent study by the World Economic Forum (WEF) (2013), which finds an overall positive impact of trade facilitation of plus 4.7 per cent

**Figure D.8: Projected exports 2015-30, by country group
(billion constant 2007 US\$)**



Source: Fontagné et al. (2015).

for GDP in their most ambitious scenario, that is, almost one per cent less than the 2030 GDP expansion that is obtained in the most conservative scenario in this report.¹⁸

As different studies are often difficult to compare, another possible point of reference for the TFA results is a different policy reform baseline within the same CGE model. This report has therefore simulated a hypothetical situation in which tariffs would be completely eliminated. Up until 2030, this would result in an 11 per cent higher level in exports and a 0.8 per cent higher level of GDP. While the effect of trade facilitation on exports is larger than the one from tariff elimination (in fact, in the “static” WEF exercise, they are of the same order of magnitude), the difference is particularly stark for GDP, where the impact of the TFA exceeds the one of tariffs by a factor of more than 10 (about 6.5 in WEF, 2013). This is, of course, related to the fact that trade facilitation reduces efficiency losses, i.e. saves on economic resources that would otherwise have been wasted. In contrast, tariff reduction or elimination produces smaller efficiency gains because part of it simply redistributes revenues from government to consumers.¹⁹

Finally, the simulations provide a number of insights at the sectoral and regional level. Sectors where GVCs are prominent, such as electronics and textiles and clothing, would be among those enjoying the biggest impact of the TFA, but only if the TFA were to be implemented promptly and with all its provisions. In such a case, exports in these sectors would increase at an additional average rate of almost 4 per cent per annum. At the regional level, the importance for developing

countries of ambitious TFA implementation is borne out even more forcefully, with Sub-Saharan Africa and parts of Asia realizing significant increases in exports only under a far-reaching implementation scenario. By the same token, some developed countries may realize slightly higher growth in certain export sectors under a more conservative scenario, as they would be less exposed to competition from developing countries when TFA-related trade cost reductions are less substantial.

Overall, the simulations confirm that the trade gains from speedy and comprehensive implementation of the TFA are likely to be in the trillion dollar range, contributing up to almost one per cent to annual GDP growth in some countries. At the same time, more is at stake for certain countries, notably in the developing world, than for others, and the impact of the TFA may be largest in some of the most dynamic sectors if the TFA is implemented soon and in full. As compared to the substantial benefits that the TFA can deliver according to these projections, existing estimates of the costs of implementation reviewed in subsection E.2 appear to be relatively small, but may vary across countries and necessitate different forms of implementation assistance and support, as will be further discussed in Section E.²⁰

3. Differentiated impact of trade facilitation

While the previous analysis has largely concentrated on the overall trade impact of implementing the TFA, further insights into its effects could be gleaned by looking at specific sectors or players in international

trade. Trade facilitation can boost bilateral trade, export diversification, and economic welfare. Although trade facilitation can be expected to have significant positive effects in aggregate terms, there is a question as to how those gains are distributed across and within nations. Among the questions that will be raised in this subsection are the following: is the beneficial impact of trade facilitation going to be uniform across all goods or are certain products (e.g. fresh produce, intermediate inputs used in GVCs) going to benefit more? Could trade facilitation expand the mix of firms engaged in international trade, allowing small and medium-sized enterprises (SMEs) to enter? Will implementation of the TFA also benefit the poor within countries?

(a) Sectoral effects

A major dimension of the cost of complex border procedure is time to export. All transactions leaving or entering a country must be processed by their customs agencies and this processing takes time. Customs clearance delays can be substantial and significantly reduce trade. Even when national averages are low, there can be substantial variability of export time at the transaction level. Volpe *et al.* (2015) report export processing times ranging between one and 31 days for Uruguay.

Long export times do not need to be a problem if demand is stable and delivery time is predictable. However, if there is uncertainty about future demand, long lead time (the time between initiation and execution) is costly even when the customer knows exactly when the merchandise will arrive. If future demand has been underestimated, running out of stock has costs in terms of foregone sales and the possibility of losing customers. If future demand has been overestimated, excess supply must be sold at a discount. Similarly, the more variable the delivery time, the larger the buffer stocks needed. Thus, even if the average lead time is low, a high rate of variability can render a supplier uncompetitive and can be more damaging than having long, but predictable lead times.

Long export times or uncertain delivery time can affect trade differently depending on the nature of the traded good. Time costs, for example, represent a significant obstacle to trading intermediate goods. Timeliness matters for trade in intermediate goods because it is essential to the management of the production chain. Delays in delivery increase the costs of holding stocks, impede rapid responses to changes in customers' orders and limit the ability to rapidly detect, fix and replace defective components. In support of this argument, using information on firms' transport modal choice between exporting goods by air or ocean, Hummels and Schaur (2013) estimate a higher value of time for trade

in parts and components than total trade. That is, firms are more willing to pay the premium for air shipping on intermediate goods trade. Saslavsky and Shepherd (2014) show that goods traded within GVCs tend to be more sensitive to improvements in trade facilitation than other types of goods. Using a gravity model with trade in machinery parts and components as a proxy for goods traded within GVCs and using the World Bank's Logistics Performance Indicators, they find that intra-GVC trade is more sensitive to improvements in logistics performance – another important aspect of trade facilitation – than trade in other types of goods. Indeed, the link between logistics performance (trade facilitation) and trade in GVC products is about 50 per cent stronger than for other goods. Trade facilitation is thus particularly important in the case of GVCs.

Long export times or uncertain delivery time can represent a significant obstacle to trade in time-sensitive goods (perishable goods in agriculture and goods with a high propensity to be exported by plane in manufacturing).

Djankov *et al.* (2010) find that delays have a relatively greater impact on exports of time-sensitive agricultural and manufacturing goods. They find that a 10 per cent increase in export time reduces exports of time-sensitive agricultural products by about 3.5 per cent and of time-sensitive manufacturing goods by more than 4 per cent, all else being equal.

Focusing on African agricultural exports, Freund and Rocha (2010) show that trade costs affect exports of time-sensitive goods and time-insensitive goods differently; time is more critical for trade in perishable products than for trade in preserved goods such as tinned food. Most importantly, they find inland transit time (the time it takes for the merchandise to be moved from the principal city to the port of exit) rather than document time (the time it takes for an exporter to complete all documentation activities), custom time (the time necessary to realize the technical controls of the merchandise) and port time (terminal handling times) to have the strongest impact on the composition of trade, preventing countries from exporting time-sensitive agricultural goods. They explain this finding on the basis that transit times are more uncertain.

Focusing on customs delays (that is, the time required for the customs to carry out verifications, excluding time required for document, inland transport and port or airport handling), a recent study by Volpe *et al.* (2015) on Uruguay transactions finds that a 10 per cent increase in customs delay results in a 3.8 per cent decline in exports. But time matters particularly for food and textile and clothing – goods that quickly lose value because they are perishable or are subject to rapid fashion cycles.

In a broader sense, trade facilitation also includes improvements of transport and communication infrastructures. Some studies show that the provision of these infrastructures also affects the volume and the composition of trade. Yeaple and Golub (2007) show that the increased provision of infrastructure tends to raise total factor productivity (TFP) in most sectors, with road networks having a particularly strong effect on TFP. Specifically, they show that road connection raises the TFP of most industries (food, textiles, wood, paper, chemicals, metals, machinery, electronics, transport), whereas improved telephone lines raise the TFP of transport and scientific instruments industries, and an improved electrical generating capacity raises the TFP of food and chemicals industries. Fink *et al.* (2005) also show that a good quality telecommunications infrastructure boosts trade in differentiated goods. They find that the importers of telecommunications prices have a substantially larger impact on trade in differentiated products than trade in reference priced products and homogenous products.

(b) Greater participation of SMEs in trade

Even though the definition of SMEs is different among countries and institutions, and it is therefore difficult to measure their incidence across countries, existing estimates suggest that the contribution of SMEs to the world economy is significant. One study estimates that SMEs account for more than 95 per cent of firms in most economies and a significant amount of employment – between 50 and 85 per cent of total employment (Kuwayama *et al.*, 2005).

Yet, SMEs account for a relatively small share of international trade. This is because there are fixed costs to enter a foreign market that impinge particularly on the profits of small firms. Firms decide whether or not to enter a certain export market before they decide how much to export. Due to cross-border trade costs, only a few firms in each country actually export. Exporting firms tend to be larger and more productive than non-exporting firms. This is because only the most productive firms are able to make profit withstanding the additional costs associated with exporting. Less productive ones cannot do so, and only produce for the domestic market.

Burdensome trade procedures, customs and trade regulation are often mentioned as major obstacles to SMEs' export participation. Large firms, especially multinational firms, can be better equipped to deal with a complex environment and therefore, perceive this as less relevant obstacle to trade. Using the World Bank Enterprise Survey database, Table D.8 shows that the highest percentage of firms indicating that customs and trade regulations are major or very severe obstacles to trade are indeed SMEs.

Table D.8: Evaluation of customs and trade regulations as obstacles to trade, by size of exporter

Type of firm	Percentage of replies
Large firm (100+)	16.9
Medium-sized firm (20-99)	18.4
Small firm (5-20)	19.4

Note: Figures indicate the percentage of firms that replied that customs and trade regulations are a major or very severe obstacle to trade.

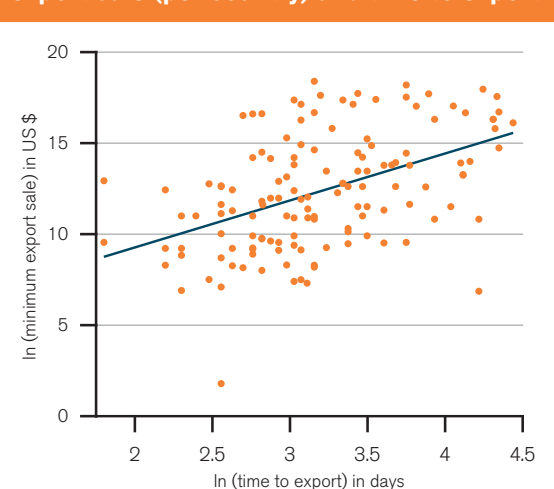
Source: World Bank Enterprise Survey.

Implementation of the TFA can boost SMEs' participation in trade. As trade costs fall, more and more less productive firms will start to export. Trade facilitation can, therefore, potentially promote the entry of SMEs into export markets. The simple correlation between the minimum size of exporting firms by country and export time support this possibility. As shown in Figure D.9, the lowest times to export are associated with smaller exporting firms.

An issue discussed in the literature is, however, the risk that small firms may actually not reap the potential benefits of trade facilitation. The concern relates to how gains occurring through trade facilitating reforms are distributed within GVCs. One concern is that these gains are mainly appropriated by the "lead" firms – generally large multinational firms with market power over their suppliers. The issue as to whether small or large firms gain more is therefore an empirical question.

Existing econometric studies on the impact of trade facilitation on exports at the firm level support the view that it is not just large firms that benefit from

Figure D.9: Relationship between minimum export sale (per country) and time to export



Source: World Bank Enterprise Survey, "World Bank" Doing Business Indicator.

trade facilitation, but also small firms. In addition, some aspects of trade facilitation can benefit small firms more than large firms. One pioneer study on Asian countries finds that SMEs (defined in the study as firms with less than 100 employees) benefit mainly from improvements in the “soft” part of trade facilitation (in their study identified with a more transparent and predictable policy), whereas large firms benefit more from improvements in transport and information technology infrastructures (Li and Wilson, 2009). A more recent study by Hoekman and Shepherd (2013) distinguishes four types of firms: micro (less than 10 employees) small (between 10 and 50 employees), medium (between 50 and 250 employees) and large firms (greater than 250 employees). This study finds that firms of all sizes benefit from a reduction in the average time taken to export a good, as recorded by each firm, and that this effect is independent of a firm's size.

However, these studies present several drawbacks. First, data quality is clearly an issue. They use the World Bank's Enterprise Surveys (2013 standardized version), which include data for firms in 119 developing countries and 11 manufacturing sectors over the period 2006-11. Although the database has broad country coverage, data are subject to strong limitations. Since they are collected by private contractors with no enforcement power in the case of misstatement, they may present quality issues. In addition, data coverage is subject to firms' willingness to reply. This contrasts with the situation when firm-level surveys are conducted by national authorities (such as customs data). Second, the database only covers firms in the formal sector with at least five employees. In the developing country context, it therefore probably over-samples large firms. Third, although the World Bank Enterprise Surveys database collects information at the firm level on a number of firms' characteristics, such as their size, exports, and their reported time to export, some firm-specific characteristics are missing when the firm does not export. For example, a firm that does not export typically does not report its export time. It follows that an analysis of the impact of export time on trade will typically exclude non-exporting firms. But long time delays may be the very reason why firms do not export. By dropping non-exporting firms from the sample, results on the impact of export time on trade will be biased.

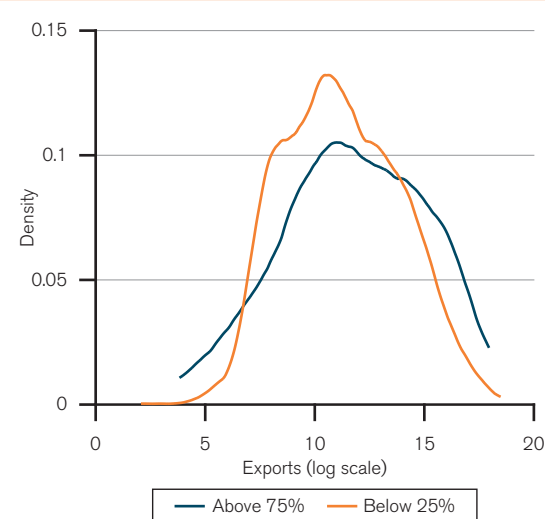
To address these limitations, this report has complemented existing firm-level analysis with three additional studies. Their general finding is that some types of trade facilitation improvements profit small firms more than large firms. One study looks at the impact of time to export on trade margins. Using the World Bank Enterprise Surveys database and the same

specification as Hoekman and Shepherd (2013), the study shows that when all firms in a country are taken into account (at least all those replying to the survey) rather than just the sub-sample of exporting firms, the effect of improved trade facilitation (measured as a lower number of days to export) on trade does depend on a firm's size.²¹ Micro, small and medium-sized firms profit more than large firms from lower time to export. Smaller firms are more likely to export and will increase their export shares more than large firms (Hyoungmin and Piermartini, 2015).

Using customs data for Colombian firms in the agricultural sector and data on transport costs to the port at the regional level, another study shows that lower domestic transport costs to the port particularly benefit small firms. Figure D.10 shows the plot of Colombian firms' export size in regions with high (above 75th percentile) and low (below 25th percentile) transport costs, respectively. Low transport costs are associated with a shift to the left of the distribution: that is, exporting firms tend to be smaller when transport costs to the port are low. Given the importance that the agricultural sector has for employment and for poverty reduction, this finding stresses the potential opportunity that improvements in trade facilitation may represent for poverty reduction (Espitia *et al.*, 2015).

The third study explores how the differential effect of trade facilitation reforms on small and large firms change across types of reforms. Using the firm-level customs data of French exports, and looking at the effects on a firm's export of improving trade facilitation

Figure D.10: Size distribution of exporting Colombian firms in agriculture, by level of transport costs to port



Source: Espitia *et al.*, (2015)

in the importing country rather than in the exporting country, Fontagné *et al.* (2015) show that, while in general all exporting firms gain from improved trade facilitation in the importing country, the relative effects on small and large firms vary by type of trade facilitation measure. The study analyses the effect of improving trade facilitation on several aspects of trade: the number of products exported, the volume of exports at the firm level, as well as the number of exporting firms. In particular, following the structure of the OECD TFIs, the study explores the differential effect of eight types of trade facilitation measures. These are:

1. information availability – an indicator of transparency of government rules and regulations;
2. advance ruling – an indicator of certainty of trading condition;
3. appeal procedure – a measure of quality of judicial institutions;
4. fees and charges – an index of transparency and its pecuniary effects on trading;
5. formalities and documents – an index of the complexity of document requirements and time to trade;
6. formalities and automation – an index of the use of information technology by the public administration;
7. formalities procedures – an index of efficiency and user-friendliness of controls at the border;
8. border agency (internal and external) – an index of coordination among different agencies within a country involved with trade and an index of integration with neighbouring countries.

The study finds that small firms profit relatively more when trade facilitation improvements relate to information availability, advance ruling and appeal procedures. Large firms profit relatively more when the importing countries facilitation reforms relate to formalities (documents, automation and procedures).

(c) The poor also gain from trade facilitation

It has been shown so far that trade facilitation measures can affect countries differently. Developing countries have potentially more to gain from improving trade facilitation because they face higher trade facilitation-related barriers, because they tend to have a comparative advantage in agriculture and perishable goods, which are often more time-sensitive than

manufacturing goods,²² and because their firms tend to be small.

Trade facilitation can also have redistributive effects within a country. Although research on the effects of trade facilitation on the poor within a country is limited, existing studies suggest that trade facilitation may be particularly beneficial to the poor. Nguyen (2013) finds that countries requiring a large number of documents for imports and more time for imports and exports are more likely to have a higher poverty rate. At a poverty line of US\$ 1.25 PPP (i.e. purchasing power parity) per day, one additional document for imports is associated with a 0.77 percentage point increase in the poverty rate. One additional day in the time needed for exports or imports is associated with an increase of approximately 0.5 percentage points in the poverty rate.²³ Using household data for the Republic of Moldova in 2002, Porto (2005) shows that the removal of informal barriers (including the cost of doing business) in this country would increase the average real income of Moldovan families. In his simulations, he models informal trade barriers as export taxes. The Republic of Moldova mainly exports processed agricultural products, and the majority of the population works in the fields, providing agricultural inputs to manufacturing firms, or in agro and food-processing industries. Thus, a removal of informal barriers increases domestic food prices, to the advantage of those working in the food industry. Poverty declines, lifting between 100,000 and 180,000 Moldovan citizens out of poverty.

In general, one can argue that cumbersome customs procedure – delays and uncertainty of timely delivery – may matter most for the rural poor because of the products they export, which tend to be perishable. Therefore, improvements in trade facilitation can be a powerful tool to raise the living standards of poor households working in export-oriented, time-sensitive agricultural products in developing countries. In addition, trade facilitation also entails regulatory simplification – e.g. consolidating multiple documents required for import/export clearance. These measures can lower the incidence of corruption and significantly enhance the efficiency of controls at the border (e.g., through risk management techniques and enhanced regional border coordination). This, in turn, has significant potential benefits for small/informal/women traders, who often do not have the necessary capacity or resources to deal with complex documentation requirements. Also, they do not have the financial means to pay trade-related fees and charges and may be subject to additional inspections at the border (due to the lack of rich track records with customs authorities).²⁴

4. Induced effects from implementing trade facilitation

(a) Attracting more foreign direct investment

The relationship between trade facilitation and FDI is, in principle, ambiguous. Trade facilitation could be seen by foreign investors as a proxy for a country's investment climate, which would thus mean more FDI for the country if it improves trade facilitation (Dollar *et al.*, 2006). According to Engman (2009), inefficient trade procedures result in higher trade costs which are then factored in the cost-benefit analysis used by companies to make foreign investment decisions. Some limited empirical evidence (Olofsdotter and Persson, 2013; Portugal-Perez and Wilson, 2015) suggests that countries with more inefficient trade procedures receive less FDI.

The size of the FDI-receiving economy affects the nature of the FDI it receives (horizontal or vertical) as well as the relationship between trade facilitation and FDI. Horizontal FDI is positively affected by market size and, as shown by Kinda (2014), by the pervasiveness of trade regulations. In this case, trade facilitation by reducing unnecessary trade regulations would decrease the probability of a firm choosing FDI over exports (Persson, 2012; Olofsdotter and Persson, 2013). Vertical FDI and trade are complementary activities, arising (among others) from comparative advantage. As much as it increases trade, trade facilitation would thus increase the probability of vertical FDI (Persson, 2012).

Since the type of FDI flowing into poor countries is mostly vertical, one would expect to find some evidence of a positive relationship between trade facilitation and FDI at lower levels of GDP.²⁵ The relationship should become progressively weaker and may even turn negative for large economies, where a relevant part of inward FDI is of the horizontal type. There is limited empirical evidence suggesting that countries with more inefficient trade procedures receive less FDI with the effect being smaller in economically large countries (Olofsdotter and Persson, 2013). The explanation is that larger economies attract more market-seeking investments, which in turn are expected to be less sensitive to trade procedures.

To shed new light on the question of whether trade facilitation leads to greater inward FDI, and whether this effect depends on the size of the FDI-receiving economy, a formal or econometric test was conducted. The results shown in Box D.3 confirm that the relationship between trade facilitation and FDI is conditional on the size of the economy. Bigger market size induces multinational firms to jump the additional trade costs due to poor trade facilitation, and invest directly in a country to get market access. In other words, bigger markets may attract more foreign investment if the lack of trade facilitation acts as a barrier to trade. However, insufficient trade facilitation is expected to discourage FDI in smaller economies. This is because their domestic markets are not large enough to mitigate the additional cost due to insufficient trade facilitation.

As FDI corresponds to higher domestic investment in developing countries and is resilient to financial crises

Box D.3: Trade facilitation, FDI and market size

To examine whether trade facilitation leads to greater inward FDI and whether this effect depends on the size of the FDI-receiving economy, the following econometric specification was estimated by ordinary least squares (OLS).

$$\ln(\text{inward FDI}_{it}) = \alpha_i + \theta_t + \beta_1 \text{TF}_{it} + \beta_2 (\text{TF}_{it} * \ln \text{GDP}_{it}) + \beta_3 \ln \text{GDP}_{it} + \varepsilon_{it} \quad (1)$$

The data used in the estimation covers 141 countries over a ten year period (2004-13). The dependent variable is the log of inward FDI in country *i* at time *t*. The main explanatory variable of interest is the interaction term between trade facilitation and market size, proxied by GDP. Two different measures of trade facilitation are used: the number of documents to import and the time to import, both from the World Bank's "Doing Business" dataset.²⁶ The results are reported in Appendix Table D.5.

For a given level of trade facilitation, market size is positively correlated with inward FDI. Conversely, for a given level of market size, trade facilitation is negatively correlated with inward FDI. The interaction between the two variables is positive and statistically significant. The negative effects of trade facilitation on inward FDI only occur for low levels of GDP. In particular, for the estimation with the number of documents to import (Column (1)), the threshold of GDP after which one additional document to import starts having a positive effect on GDP is estimated at US\$ 1.1 billion – which is slightly below the 25th percentile of the sample distribution of GDP. For the estimation of the number of days to import, this threshold rises to US\$ 8.9 billion – which is around the 70th percentile of the sample distribution of GDP. For market size above these thresholds, trade facilitation is positively correlated with inward FDI.

(Bosworth and Collins, 1999; Loungani and Razin, 2001), there seems to be a particular case for improving trade facilitation in smaller economies. Moreover, the results presented above should allay the fear that improving inefficient customs systems may put additional demands on the limited resources of developing countries (OECD, 2005). The resource-enhancing capacity of trade facilitation, through increased capital inflow, could help in mitigating the cost of investing resources in customs-related infrastructure.

(b) Better collection of government revenues

Revenue collected by customs and other border agencies remains an important source of government income for developing countries and LDCs. According to a World Customs Organization (WCO) survey on 34 LDCs (WCO, 2014), the total of duties and other taxes collected at the border still accounts for 45 per cent of government tax revenue, of which 19 per cent are customs duties.

Given the high reliance of some developing countries on border revenues, good customs administration is a key objective. According to the OECD (Moisé and Sorescu, 2013), inefficient border procedures may be the source of large foregone revenues in African countries of up to 5 per cent of GDP. Trade facilitation-related reforms designed and implemented in conformity with international principles are consistent with the objective of maximizing customs revenues. Engman (2009) mentions cases in which the introduction of modern single-window automation systems (e.g. in Ghana and Singapore) helped substantially increase customs revenue. Actually, revenue enhancement may be one of the main motives for trade facilitation and customs reforms. The principles for “effective customs administration modernization”²⁷ promoted by the WCO aim to foster voluntary compliance, reduce transaction costs and increase revenue (Yasui, 2010; Zaki, 2014). In this framework, the WCO (2014) assesses that the TFA could improve customs revenue in three different ways: by increasing trade flows, by improving traders’ compliance, and by helping to recover revenue losses from customs fraud.

With respect to increasing trade flows, at any given level of trade taxes and VAT rates, customs revenues are likely to increase as cross-border merchandise trade expands – the main variable being the actual expansion of trade due to TFA reform. Greater trade should therefore increase the tax base for concerned governments (see subsection D.2).

With respect to improving traders’ compliance, for any given level of imports, trade facilitation reforms

would improve tax returns by enabling a more effective collection of duties and taxes through increased compliance. Lesser and Moisé-Leeman (2009) show that by simplifying customs procedures, trade facilitation encourages compliance, reduces informal trade and increases the likelihood of duties being paid. The WCO provides examples of simplifying measures having a positive impact on administrative and tax compliance, such as the system of authorized operators, which trusts registered traders and their representatives to comply on a voluntary, declarative basis, but strengthens penalties against false declaration. The system is described to have fostered tax compliance (WCO, 2014). The New Zealand Customs Service (2014) reported that 97.3 per cent of imports transactions in 2013 were deemed compliant with very limited physical or documentary inspections since it has introduced this system.

With respect to helping to recover revenue losses from customs fraud, trade facilitation should improve trade tax receipts through better detection of customs fraud and corruption. Customs fraud may take many forms, including mis-invoicing, non-filling of declarations, voluntary misclassification, transit and origin fraud. Regardless of its form, customs fraud can have significant economic consequences on developing economies when government revenues are reliant on border taxes. For example, Global Financial Integrity (Kar and Spanjers, 2014) estimated the potential customs annual tax loss due to mis-invoicing at between 7 and 13 per cent of the government revenue in five economies (Ghana, Kenya, Mozambique, Tanzania and Uganda). The Post-Clearance Audit process (PCA), in particular, can contribute to reducing duty and tax evasion. For instance, following the establishment of PCA, Chinese Taipei customs were able to recover more than US\$ 26 million in revenue in the form of evaded duties and fines in the fiscal year 2010-11, that is, 10 times the cost of PCA implementation.²⁸ In addition, the lack of transparency or even availability of trade rules creates opportunities for the inappropriate exercise of official discretion, for collusion between customs officials and traders where agents extract rent from traders (ADB and UNESCAP, 2013).

Djankov and Sequeira (2009) showed there was a negative correlation between the payment of bribes and the collection of tariff revenue. Revenue leakages through corruption in customs administrations can be expected to decline as procedures and clearance process become more transparent and simplified (Ferreira *et al.*, 2007). In an attempt to penalize corruption and poor practices observed, the “integrity action plan” introduced by Cameroon’s customs is worth mentioning. Building on previous reforms, Cameroon customs implemented in 2010 a system of

performance contracts between customs leaders and frontline officers. Since then revenue collection has increased – revenues per container increased by 12 per cent between 2009 and 2010 – and clearance times have been shortened (Cantens, 2010).

Concerns have been expressed regarding any possible negative effects of trade facilitation measures on developing countries' revenue. According to WCO (2014), any negative impact should be negligible, or outweighed by the increase in revenue resulting from the uniform implementation of the TFA. The potential for revenue losses may come from the introduction of a *de minimis* system in which no duties and taxes will be collected for shipments whose value falls below a certain threshold. Still, the revenue impact would depend on the threshold value and on the implementation of the measure. To alleviate this concern, the TFA actually

allows its signatories to determine their respective threshold amount. To further diminish the potential for revenue loss, the WCO (2014) recommends that governments in developing countries first implement the revenue-enhancing measures of the TFA, under its special and differential treatment provisions, and thus, only when the tax base is firmed up, implement measures that could pose a threat to established revenue collection channels, or cost extra to be implemented properly. In conclusion, customs reforms, trade facilitation and revenue collection should be regarded as complementary objectives. This "possible trinity" is further illustrated in Box D.4, which focuses on the role of the Automated System for Customs Data (ASYCUDA) programme of the United Nations Conference on Trade and Development (UNCTAD) system in trade facilitation and its impact on customs revenue collection.

Box D.4: ASYCUDA and the impact of customs performance measurement

Customs authorities are essential for facilitating trade flows, improving compliance and minimizing fraud. However, despite their key role for government tax collection, many customs administrations fall short of being efficient and effective.

Information communication technology (ICT) and the automation of customs management has been, and remains, one of the most important tools to facilitate trade and achieve improvements in timeliness, cost, reliability, compliance, and revenue collection (OECD, 2005). The example of ASYCUDA is illustrative. The latest version, ASYCUDA World, allows traders to handle most documents online, and interact at all stages in the process, including requirements related to pre-shipment, clearance process and checking, up until release. For governments, the automated revenue collection process ensures that customs duties and other taxes are accounted for in a timely manner. Implemented in 94 countries worldwide – including 40 LDCs – it has become the reference for customs computerization in developing countries.

In addition to the evident benefits of computerized systems, the underlying databases record each transaction by customs agents and allow for detailed performance measures in order to enhance effectiveness, compliance and revenue collection. One of the first exploiting this potential was the Cameroon customs, which decided to collaborate and diagnose inefficiencies with the help of ASYCUDA data, in cooperation with the World Bank and WCO. The Cameroon customs reform focused primarily on data mining (a computational process of extracting useful knowledge from large data sets) and addressing performance issues by signing specific contracts between customs headquarters and frontline officials (Cantens, 2010).

Several quantifiable indicators showed a significant impact on performance: one indicator related to processing times showed that inspectors tended to first assess a declaration but then to decide to delay further clearance on grounds of document controls (the so called "yellow channel"). After implementation of the performance measures, delayed entry of customs assessments fell on average by 49 per cent in the observed customs offices (see Table D.9, from Bilangna and Djeuwo (2012)).

Other measures showed similar improvements after implementing the performance measures: the share of declarations registered and assessed on the same day increased to above 90 per cent, and revenues from disputed claims – an area where corruption had been widespread – increased by 17 per cent in the larger customs offices and by 322 per cent in the smaller customs offices (Cantens, 2010). The example of performance measurement at Cameroon's customs shows how collection and benchmarking of indicators can reduce the asymmetry of information between customs head offices and field officers, and help to fight bad practices and corruption.

Box D.4: ASYCUDA and the impact of customs performance measurement (continued)

Table D.9: Delayed entry of customs assessments

Customs office	Number of entries			Decrease from 2009 to 2011	
	2009	2010	2011	Number	Per cent
Douala International airport	2,605	2,469	2,162	-443	-17
Douala Port I	2,854	2,357	487	-2,367	-83
Douala Port V	1,876	1,519	751	-1,125	-60
Douala external warehouse	875	781	787	-88	-10
Total	8,210	7,126	4,187	-4,023	-49

Source: Bilangna and Djeuwo (2012).

Based on experiences in Cameroon and to further promote customs integrity and performance, the ASYCUDA SYstem for Performance Management (ASYPM) module was developed in 2013 by UNCTAD and the WCO. The module measures and tracks the performance of individual officers and facilitates data mining for customs managers by providing up to 29 indicators by empirical evidence and objective measurement (UNCTAD, 2014). The system has recently been implemented by Liberia's customs; although it is too early to show significant results, the performance indicators already managed to identify some inefficient practices (Bolognesi *et al.*, 2014).

(c) Reduction in trade-related corruption

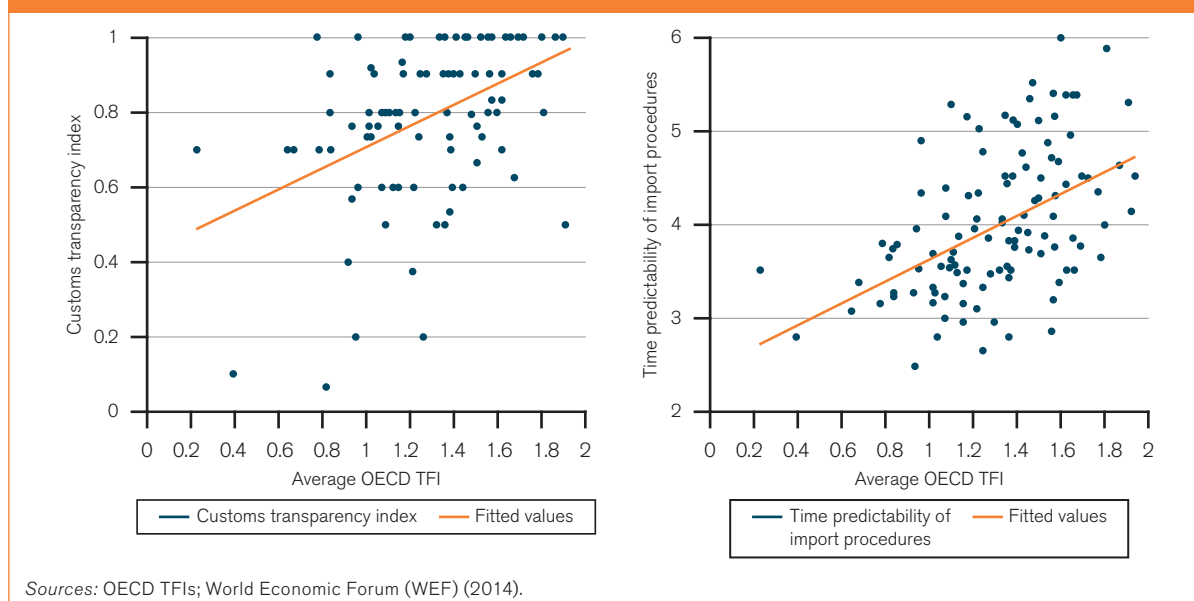
This subsection will consider the impact of trade facilitation on various forms of rent-seeking, in particular trade-related corruption. Economic theory purports two mechanisms through which corruption affects the economy at large. The "corruption as grease" theory argues that if bribes are set according to the time preferences of private agents, corruption can be efficiency-enhancing, reducing delays for public services (Leff, 1964; Lui, 1985). An alternative view suggests that bribes are set according to the strategic preference of the bureaucrats, representing a "distortionary transfer tax" (Krueger, 1974; Shleifer and Vishny, 1997; Rose-Ackerman, 1978).

The literature on corruption and trade has argued that corruption in trading networks increases the cost of trade (Yang, 2008; Clarke and Xu, 2004; Abe and Wilson, 2008; Djankov and Sequeira, 2009). The effect of corruption, however, is likely to depend on the institutional setting of a country. For example, Dutt and Traca (2010) show that while corruption impedes trade in a low-tariff environment, it could have trade-enhancing effects when tariffs are high.

Corruption and other illegal activities are intrinsically difficult to measure in a reliable way. An approach commonly used in the trade literature (Fisman and Wei, 2004; Javorcik and Narciso, 2008; Rotunno and Vézina, 2012) is to look at differences between the merchandise declared by exporting countries (called FOB or free-on-board) and the same merchandise declared by the importing country (called CIF or cost-insurance-freight). Carrère and Grigoriou (2014)

investigate whether this "mirror data" method can indeed help to measure "informal" international trade. In particular, their empirical strategy considers orphan imports, i.e. incoming flows recorded by importing countries that have no corresponding export flows. Using the World Bank's Country Policy and Institutional Assessment "transparency, accountability, and corruption in the public sector" rating to measure corruption, and controlling for a number of country characteristics, they find that corruption indeed increases the probability of observing orphan imports. They also find that more corruption is correlated with a higher ratio of reported imports over reported exports (CIF/FOB ratio), suggesting that corruption may indeed be used by importers to fraudulently under-report incoming flows of merchandise.

Trade-related corruption is positively affected by the time spent to clear customs procedures. Shepherd (2010) shows that a 10 per cent increase in trade time leads to a 14.5 per cent fall in bilateral trade in a low-corruption country, and to a 15.3 per cent fall in a country with high levels of corruption. By reducing the time required to move goods across borders, trade facilitation is therefore a useful instrument for anti-corruption efforts at the border. Evidence of a positive correlation between trade facilitation (measured by the OECD TFIs) and two measures of transparency (customs transparency and time predictability of import procedures) is provided in Figure D.11.²⁹ This positive correlation is significant after conditioning for GDP per capita, as shown in Appendix Table D.6. Econometric evidence of a causal effect of trade facilitation on corruption has, however, remained quite elusive.

Figure D.11: Correlation between TFIs, customs transparency and time predictability of import procedures

Some evidence that custom agencies that control corruption are better able to avoid import fraud is provided by Jean and Mitaritonna (2010). Using the gap between the declarations of trading partners as a proxy for tariff evasion, they evaluate the effect of three specific trade facilitation measures: pre-shipment inspections, the 1979 Agreement on Implementation of Article VII of the GATT (also known as the Customs Valuation Agreement) and the ASYCUDA system. All these transparency-enhancing measures decrease the discretion of customs officials when reporting trade flows. The authors find no statistically significant effect of pre-shipment inspections on corruption in the overall sample. Pre-shipment inspections, however, tend to be more effective for countries with relatively better institutions.

This ambiguous net effect of pre-shipment inspections on fraud is consistent with the findings of Anson *et al.* (2006), who show greatly different effects depending on the country considered. In the case of the Customs Valuation Agreement, the harmonization of valuation practices is found to have lowered the tariff evasion elasticity in the ratifying countries under analysis (12 countries between 2001 and 2004), although the result is not very robust. There is more encouraging news in the case of ASYCUDA. The improvement in accuracy and efficiency of custom clearance generated a substantial reduction in the tariff evasion elasticity with the estimation results appearing to be quite robust.

World-wide import revenue losses due to custom-related corruption are estimated to amount to US\$ 2 billion (Michael *et al.*, 2012). A thorough discussion of

how trade facilitation can lead to better collection of government revenues is presented in subsection D.4(b).

Summing up, the literature has shown that custom agencies that control corruption are better able to avoid import fraud. Moreover, the incentives to engage in fraudulent practices at the border are larger, the longer the trading times. Trade facilitation has the potential to reduce trade-related corruption both directly (reducing the scope for import fraud) and indirectly (shortening trading times).

5. Conclusions

This section has documented how developing countries have a lot to gain from implementation of the TFA.

First, improving trade facilitation can give a more powerful boost to developing countries exports because they have high trade costs, a large part of which are due to lack of trade facilitation. Delays at customs and cumbersome procedures are far more frequently encountered in developing countries and LDCs. The gravity- and CGE-based simulations in this section accordingly indicate large potential gains from trade facilitation reform for developing countries and LDCs in terms of increased export flows, export diversification and higher GDP growth.

The impact of trade facilitation may depend on the sectoral composition of traded goods. The trade-hindering effect of lengthy procedures for exporting and importing is particularly acute for time-sensitive products. A number of studies show that fresh produce

and perishable goods tend to be more time-sensitive. This implies that developing countries (especially sub-Saharan countries) that have a comparative advantage in food exports are likely to gain the most from implementing trade facilitation. Other studies show that sectors characterized by rapid changes in taste (fashion), constant innovation (electronic products) and just-in-time production (intermediate goods in supply chains) are also time-sensitive. In this case, too, developing countries stand to reap large benefits.

Another dimension of importance for traders is the certainty of delivery. Uncertainty in delivery times, particularly in value chains, increases trade costs. Since uncertainty in delivery time tends to be higher in lower-income countries, especially transit countries, improvements in trade facilitation which result in increased certainty of delivery time are likely to have the largest impact in low-income countries. Importantly, through this channel, many low-income countries are likely to see greater participation in global value chains.

Another channel through which trade facilitation may affect countries differently is the size distribution of their enterprises. As discussed in this section, empirical evidence suggests that small firms' exports tend to be more responsive to trade facilitation. Therefore, to the extent that some countries have a larger SME sector they may gain relatively more from trade facilitation.

Two more channels, highlighted in this section, also point to relatively large gains for developing countries from implementing trade facilitation reform. First, trade facilitation increases FDI in small economies – which are relatively more dependent than large ones on this channel for investment. Second, trade facilitation reforms help to increase government revenues and to reduce customs fraud and corruption. This is important in those developing countries where customs revenues represent a relatively large fraction of government revenues and that are relatively more vulnerable to rent-seeking at the border.

Endnotes

- 1 Although the gravity model long predated the paper by Anderson and van Wincoop (2003), their seminal paper transformed it into the modern workhorse of empirical trade economics. Starting from a theoretical model of intra-industry trade, they were able to derive the gravity model for the bilateral trade between any two countries, where the trade between them depends on their gross domestic products (GDPs) and their relative trade costs. In particular, they showed that for any two countries A and B, A's imports from B depend not only on their bilateral trade costs, but also on the overall level of barriers that exports of country B face in the rest of the world, and the overall level of restriction to imports that country A imposes on the rest of the world (the so-called multilateral resistance terms).
- 2 The database on trade costs prepared by Arvis *et al.* (2013) is made up of bilateral trade costs for each pair of countries in the sample: one reporter and one partner country. The figures, computed according to the methodology outlined in Box D.1, are the mean costs in both directions. To compute the average trade costs for developing countries in 2010, only a subset of the dataset with developing country reporters was used. This way, the estimate accounts for the cost each developing country faces, with all countries in the sample. The year 2010 was chosen instead of a more recent year because it had a far larger number of observations.
- 3 For this figure, trade costs are calculated according to the method described in Box D.1. For each country, the rest of the world is considered to be all other countries for which bilateral cost estimates are available. Developing countries include G-20 developing, other developing and least-developed countries.
- 4 The Arvis *et al.* (2013) database on trade costs supplies figures for overall trade, manufacturing and agriculture. However, there are many missing observations. To compare costs in agriculture and manufacturing, only those observations where there were data for both sectors were included. For this analysis, the year 2012 was chosen both because it was recent and because it had a relatively large number of observations.
- 5 The calculations by Hufbauer and Schott (2013) use the estimates from the work by Portugal-Perez and Wilson (2012). Using a gravity model, Portugal-Perez and Wilson conclude that trade facilitation reforms improve the export performance of developing countries. However, they do not provide estimates of the increase in trade arising from these reforms. Instead, they calculate the *ad valorem* tariff liberalization that would generate the same increase in trade as trade facilitation.
- 6 For a description of OECD TFIs and the sub-components, see subsection C.4 and Table C.4 in particular.
- 7 HS6 is a Harmonized System code. The World Customs Organization's Harmonized System (HS) uses code numbers to define products. A code with a low number of digits defines broad categories of products; additional digits indicate sub-divisions into more detailed definitions. Six-digit codes are the most detailed definitions that are used as standard.
- 8 Per the TFA, Articles 14, "Category A contains provisions that a developing country Member or a least-developed country Member designates for implementation upon entry into force of this Agreement, or in the case of a least-developed country Member within one year after entry into force".
- 9 The list of 52 developing economies consists of: Albania; Botswana; Brazil; Brunei Darussalam; Chile; China; Chinese Taipei; Colombia; Congo; Costa Rica; Côte d'Ivoire; Dominican Republic; Ecuador; Egypt; El Salvador; Gabon; Guatemala; Honduras; Hong Kong, China; Indonesia; Israel; Jordan; Republic of Korea; State of Kuwait; Kyrgyz Republic; Macao, China; Malaysia; Mauritius; Mexico; Republic of Moldova; Mongolia; Montenegro; Morocco; Nicaragua; Nigeria; Oman; Panama; Paraguay; Peru; Philippines; Qatar;

- Kingdom of Saudi Arabia; Senegal; Singapore; Sri Lanka; Tajikistan; Thailand; Tunisia; Turkey; Ukraine; Uruguay; and Viet Nam.
- 10 Appendix Table D.1 shows the results of pseudo-Poisson maximum likelihood estimation.
 - 11 First, regressions with splines and, in an alternative specification, with fractional polynomials were estimated. Second, the coefficient on trade facilitation was estimated separately for those countries above the regional/global median. This coefficient was then applied to the "reforming" countries that move to the regional/global median. In the first case, no significant results were obtained. In the second case, the results were similar to the ones presented in Appendix Table D.1, with slightly larger coefficients.
 - 12 In the CEPII BACI (the international trade database of the *Centre d'études et d'informations internationales*) dataset used, however, the maximum number of HS6 sub-headings is lower, and equal to 4,795.
 - 13 It is important to note that results of counterfactual analysis have to be taken cautiously, because they are only as good as the underlying econometric model. Although the report has taken care to address omitted variable and reverse causality biases, it cannot control for every possible country-specific variable correlated with trade facilitation and one cannot completely exclude the endogenous co-determination of trade outcomes and trade facilitation infrastructure.
 - 14 Results aggregated by region are available in Appendix Tables D.3 and D.4.
 - 15 Trade cost estimates by the OECD follow the methodology set out in Chen and Novy (2009) and the trade cost reductions due to the TFA are then bilateralized as further explained in Fontagné *et al.* (2015).
 - 16 Besides increases in GDP, which may be considered a reasonably telling indicator of economic gains, CGE models also allow for the calculation of welfare impacts. In the present exercise, these are in the same ballpark, ranging from 4.6 to 6.6 per cent higher levels of welfare for the world as a whole by 2030. Of course, it must be noted that the type of welfare measure commonly used in these models, namely the so-called "equivalent variation" in real income – i.e. the increase in agents' income that would have been necessary to obtain the new level of agents' utility, with prices remaining unchanged – is insufficient in itself in that it does not take into account a range of other factors affecting welfare, such as environmental externalities or income disparities.
 - 17 The absolute, annualized increases for GDP and export volumes were calculated by subtracting the actual 2014 figure from the simulated figure for the year 2030 (simulation time horizon), distributing the difference across 16 equal instalments per year and further reducing this annualized number by the average annual increase in GDP (respectively, exports) in the baseline scenario, i.e. the increases that are projected to occur even in the absence of a TFA.
 - 18 The reasons for these disparities are related to different modelling approaches, scenarios and data used. The WEF study employs the much broader sub-indices of the Enabling Trade Index (ETI) (see subsection C.4), including transport and communications infrastructure, and fairly rough trade facilitation scenarios (halfway to global/regional best practice). But in terms of methodology, only the static GTAP model is used, which for instance does not take into account the dynamic gains that result from an increased efficiency of factor allocation owing to trade facilitation. Other methodological differences also make a comparison difficult. Notably, the WEF study does not shock actual transaction costs contained in the model, but imposes exogenous trade flows coming from a gravity estimation on the CGE framework, which constitutes a drastically different modelling choice from that followed in this report.
 - 19 See subsections C.2 and C.3, where it was explained that the gains from trade facilitation are in the form of "rectangles" and "trapezoids" while the gains from tariff reductions correspond to Harberger "triangles".
 - 20 A fuller discussion of results, also at a more disaggregated level, as well as of further methodological refinements, notably in relation to certain cost aspects, will be provided in the forthcoming paper by Fontagné *et al.* (2015).
 - 21 In order to consider the full sample of firms, assumptions had to be made as to the expected export time facing the non-exporting firm. This study assumes that domestic firms that decide not to export take this decision, using as expected time to export the average export time of firms producing in the same sector and in the same country.
 - 22 Freund and Rocha (2010); Djankov *et al.* (2010).
 - 23 By admission of the same author, these results have to be taken with caution. They indicate a conditional correlation rather than a causal effect of trade facilitation.
 - 24 For an extensive discussion of these effects see World Bank Group and WTO (2015).
 - 25 Along similar lines, Ndonga (2013) argues that inefficient border procedures have a negative impact on vertical FDI flows in Africa. The implementation of single window systems would therefore constitute an investment facilitation tool.
 - 26 In this subsection, FDI data is from UNCTAD and GDP data is from the IMF's World Economic Outlook. The OECD TFI indicators are not used in this context because they do not vary over time. Therefore, they would not allow the estimation of panel regressions that control for country fixed effects. As discussed in subsection D.1, time to import and time to export from the World Bank "Doing Business" indicators are negatively correlated with the OECD TFI indicators. This justifies their use in this analysis. Results for cost to import are not reported because they are not statistically significant.
 - 27 The Revised Kyoto Convention's governing principles are regarded as the international blueprint for effective and modern customs clearance procedures, chief among these are: the application of customs procedures in a predictable and transparent environment, the adoption of modern customs techniques (e.g. risk management, audit-based controls and the optimal use of information technology), an effective partnership with the private sector and other stakeholders, and a readily accessible system of appeals (*Preamble of the Text of the Revised Kyoto Convention*, available at www.wcoomd.org/en/topics/facilitation/instrument-and-tools/conventions/pf_revised_kyoto_conv/kyoto_new.aspx).
 - 28 "Post-Clearance Audit", a paper submitted by the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu for the July 2012 WTO Symposium on Trade Facilitation. Available at https://www.wto.org/english/tratop_e/tradfa_e/case_studies_e/pca_tpk_m_e.doc
 - 29 Both the customs transparency index and the time predictability of import procedures are sourced from WEF (2014). The data are for the year 2013.

Appendix tables

Appendix Table D.1: Intensive margin: regression results

	(1)	(2) Total-trade _{ij}
Log (TFI _i)	0.254* [0.138]	
TFI _{ij}		0.399* [0.211]
Log (GDP _j)	0.858*** [0.023]	0.857*** [0.023]
Log (market access _j)	-0.310*** [0.102]	-0.311*** [0.101]
Number of PTAs _i	-0.006** [0.002]	-0.006** [0.002]
Log(area _i)	-0.069*** [0.016]	-0.068*** [0.016]
Landlocked _i	-0.377*** [0.125]	-0.379*** [0.125]
PTA _{ij}	0.336*** [0.083]	0.334*** [0.084]
Log (distance _{ij})	-0.715*** [0.054]	-0.715*** [0.055]
Common border _{ij}	0.434*** [0.130]	0.434*** [0.130]
Common language _{ij}	0.017 [0.083]	0.016 [0.083]
Colony _{ij}	0.413** [0.184]	0.412** [0.184]
Observations	16,238	16,238
Log pseudolikelihood	-2.760e+09	-2.760e+09
Partner (j) FE	Yes	Yes
Number of id (j countries)	129	129

Notes: Robust (clustered on id variable) standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1, where the p's indicate levels of statistical significance: ***p is less than 1%, **p is less than 5% and *p is less than 10%.

Partner *j* fixed effects and multilateral resistance controls included in both regressions.

Source: WTO Secretariat.

Appendix Table D.2: Extensive margin: regression results

	(1)	(2)	(3)	(4)
	Number of exported products by destination (npd_{ij})		Number of export destinations by product (ndp_{ik})	
	Baseline	New HS6	Baseline	New destinations
TFI	0.236*** [0.026]	0.255*** [0.025]	0.281*** [0.006]	0.425*** [0.006]
Log (GDP per capita)	0.171*** [0.014]	0.038*** [0.014]	0.372*** [0.002]	0.248*** [0.002]
Log (market access)	0.311*** [0.008]	0.236*** [0.008]	0.471*** [0.003]	0.306*** [0.002]
Number of PTAs	0.002*** [0.000]	0.001*** [0.000]	0.005*** [0.000]	0.005*** [0.000]
Log (area)	0.016** [0.007]	0.013** [0.006]	0.310*** [0.001]	0.211*** [0.001]
Landlocked	-0.032* [0.018]	-0.152*** [0.014]	-0.371*** [0.004]	-0.353*** [0.004]
Weighted partners' TFI	-0.718*** [0.183]	-0.160 [0.151]		
Log (bilateral GDP)	0.393*** [0.018]	0.376*** [0.013]		
PTA dummy	0.069** [0.033]	0.035 [0.030]		
Log (distance)	-0.497*** [0.030]	-0.316*** [0.030]		
Contiguity	-0.220*** [0.074]	-0.511*** [0.146]		
Common language	0.368*** [0.040]	0.326*** [0.036]		
Colony	0.527*** [0.109]	0.333** [0.165]		
Log (remoteness)			-1.271*** [0.007]	-0.712*** [0.006]
Observations	22,910	22,910	667,776	667,904
Number of id (partners)	180	180		
Number of id (HS6)			5,217	5,218

Notes: Bootstrap standard errors (100 replications) in parentheses. Bootstrapping is a statistical procedure which involves using data from the drawn sample at hand as a "surrogate" for the true population. By taking repeated samples with replacement from this surrogate population, one can approximate the sampling distribution of the statistic of interest, in this case the coefficient estimates. See Efron (1979) and Efron and Tibshirani (1993).

***p<0.01, **p<0.05, *p<0.1, where the p's indicate levels of statistical significance: ***p is less than 1%, **p is less than 5% and *p is less than 10%.

Partner j fixed effects, region dummies and multilateral resistance controls included in columns (1)-(2).

Product (HS6) fixed effects, region dummies and a measure for remoteness included in columns (3)-(4).

Variable "Weighted partners' TFI" uses inverse bilateral distance as weights.

Appendix Table D.2 uses negative binomial regressions, as detailed in Beverelli *et al.* (2015). Columns (1) and (3) present "Baseline" estimations, with the dependent variable constructed using trade data for 2009. Columns (2) and (4) respectively use "New HS6" products and "New destinations" in the construction of the dependent variable, to address reverse causality concerns. To compute "New HS6" products, the procedure is as follows: when computing how many products country i exported to country j in 2009, the report only includes the subset of products for which: (i) there were no exports from i to j (zero or missing) recorded in any of the years between 2003 and 2007; and (ii) there were positive exports from i to j recorded in at least one year between 2008 and 2010. In this case, npd_{ij} is the count of new HS6 products that were not traded before 2008. The procedure for "New destinations" is very similar. When computing how many destination countries were served by country i in exporting product k in 2009, the report only includes the subset of destinations for which: (i) there were no exports of product k (zero or missing) recorded in any of the years between 2003 and 2007; (ii) there were positive exports of product k recorded in at least one year between 2008 and 2010. In this case, therefore, ndp_{ik} becomes the count of new destinations that were not served before 2008. The use of "new products" and "new destinations" has the additional advantage that one does not necessarily exclude products (respectively, destinations) where country i ceased to export to country j (respectively, in product k) during the big trade collapse of 2009.

Source: WTO Secretariat.

II. SPEEDING UP TRADE: BENEFITS AND CHALLENGES OF IMPLEMENTING THE WTO TRADE FACILITATION AGREEMENT

Appendix Table D.3: Estimated increases in the number of products by destination due to TFA implementation by geographic region (percentage change)

	Baseline	New HS6
"Conservative" scenario		
Africa	8.9	9.6
Asia	5.6	6.0
Commonwealth of Independent States	11.2	12.1
Europe	8.6	9.3
Middle East	6.5	7.0
North America	6.9	7.5
South and Central America and the Caribbean	12.6	13.6
"Liberal" scenario		
Africa	8.7	9.4
Asia	7.3	7.9
Commonwealth of Independent States	11.3	12.2
Europe	9.0	9.7
Middle East	10.0	10.9
North America	6.9	7.5
South and Central America and the Caribbean	15.4	16.7
"Full" scenario		
Africa	30.3	32.8
Asia	12.8	13.9
Commonwealth of Independent States	15.4	16.7
Europe	9.5	10.3
Middle East	19.6	21.2
North America	6.9	7.5
South and Central America and the Caribbean	20.8	22.6

Notes: The numbers indicate percentage change in npd_{ij} (number of exported products by destination) under the relevant scenario.

"Baseline" results are based on column (1) of Appendix Table D.2.

"New HS6" results are based on column (2) of Appendix Table D.2.

Source: WTO Secretariat.

Appendix Table D.4: Estimated increases in the number of destinations by product due to TFA implementation by geographic region (percentage change)

	Baseline	New destinations
"Conservative" scenario		
Africa	10.5	15.9
Asia	6.6	10.0
Commonwealth of Independent States	13.3	20.1
Europe	10.2	15.5
Middle East	7.7	11.7
North America	8.3	12.5
South and Central America and the Caribbean	15.0	22.6
"Liberal" scenario		
Africa	10.3	15.6
Asia	8.7	13.1
Commonwealth of Independent States	13.5	20.4
Europe	10.7	16.1
Middle East	12.0	18.1
North America	8.3	12.5
South and Central America and the Caribbean	18.4	27.7
"Full" scenario		
Africa	34.9	52.7
Asia	15.3	23.1
Commonwealth of Independent States	18.4	27.8
Europe	11.3	17.1
Middle East	23.4	35.4
North America	8.3	12.5
South and Central America and the Caribbean	24.9	37.6

Notes: The numbers indicate percentage change in ndp_{ijk} (number of export destinations by product) under the relevant scenario.

"Baseline" results are based on column (3) of Appendix Table D.2.

"New destinations" results are based on column (4) of Appendix Table D.2.

Source: WTO Secretariat.

II. SPEEDING UP TRADE: BENEFITS AND CHALLENGES OF IMPLEMENTING THE WTO TRADE FACILITATION AGREEMENT

Appendix Table D.5: Foreign direct investment and trade facilitation regression results

	(1)	(2)
Documents to import	-0.272*** (0.084)	
Documents to import # log (gdp)	0.043*** (0.012)	
Time to import		-0.085*** (0.031)
Time to import # log(gdp)		0.012** (0.005)
log(gdp)	1.545*** (0.314)	1.455*** (0.329)
Observations	1,048	1,048
R-squared	0.160	0.160
Number of countries	141	141

Notes: Dependent variable: log(inward FDI).

Robust standard errors in parentheses.

***p<0.01, ** p<0.05, * p<0.1, where the p's indicate levels of statistical significance: ***p is less than 1%, **p is less than 5% and

*p is less than 10%.

Country fixed effects and time dummies included.

Source: WTO Secretariat.

Appendix Table D.6: TFI, customs transparency and time predictability of import procedures regression results

	(1)	(2)	(3)	(4)
	Customs transparency Index		Time predictability of import procedures	
	OLS	GLM	OLS	Poisson
TFI	0.163** (0.066)	0.938** (0.419)	0.524** (0.231)	0.139** (0.056)
Log(pc gdp)	0.055*** (0.013)	0.340*** (0.082)	0.288*** (0.047)	0.073*** (0.011)
Observations	103	103	114	114
R-squared	0.284		0.419	

Notes: Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1, where the p's indicate levels of statistical significance: ***p is less than 1%, **p is less than 5% and

*p is less than 10%.

OLS = ordinary least squares; GLM = general linear model; Poisson = Poisson regression model.

Source: WTO Secretariat.