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Export Diversification Effects of the WTO Trade Facilitation Agreement

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Summary. — We estimate the effects of trade facilitation on export diversification, as measured by two extensive margins: the number of products exported by destination and the number of export destinations served by product. To address causality we use only exports of new products, or exports to new destinations. We find a positive impact of trade facilitation on the extensive margins of trade. The results are robust to alternative definitions of extensive margins, different sets of controls, and various estimation methods. Simulation results suggest substantial extensive margin gains from trade facilitation reform in Sub-Saharan Africa and in Latin America and the Caribbean.

Key words — trade facilitation, export diversification, international trade agreements, WTO

1. INTRODUCTION

Beginning with the work by Anderson and van Wincoop (2004), trade economists have realized both the magnitude of trade costs and the need to bring them down. Even for a "representative rich country", they estimated that the ad valorem equivalent of trade costs could be as high as 170%. Trade costs appear to be even higher for developing countries with the ad valorem equivalent for the average developing nation estimated to equal 219% by Arvis, Duval, Shepherd, and Utoktham (2013). Furthermore, their research suggests that customs formalities and trade procedures that result in unnecessary delays or complexities to traders constitute an important component of trade costs. Recognizing this, the WTO 1996 Ministerial Conference in Singapore agreed "to undertake exploratory and analytical work" on this issue. The simplification of the trade procedures has been part of the WTO's negotiating agenda since August 2004. In December 2013, WTO members concluded negotiations on a Trade Facilitation Agreement at the Bali Ministerial Conference. The new agreement will enter into force and become an integral part of the WTO Agreement once two-thirds of WTO members complete their domestic ratification process.

The type of problems faced by traders at the border include the numerous documents that need to be completed, inspections conducted by different agencies (to address concerns related to national security, quarantine, trafficking of contraband, etc.), customs formalities, and fees and charges. Trade procedures may be opaque and decisions taken by border authorities not subject to appeal. All these problems at the border result in delays and increased costs for exporters and importers. For landlocked economies, the difficulties are compounded because of the need to complete the same cumbersome procedures in the transit nation.

The WTO's Trade Facilitation Agreement contains obligations and disciplines on transparency, formalities, appeals procedures, fees and charges, customs cooperation and transit that address many of these issues. An example of how trade facilitation simplifies trade procedures and make them more transparent can be taken from the Lao People's Democratic Republic, a nation which became a WTO member in 2013. An online portal for trade has been operative since 2012. [1] On this website, all trade-related laws, regulations, measures, restrictions, licensing requirements and tariffs are indexed, cross-referenced, and made searchable by commodity code. The website also includes detailed process maps of business procedures for importing and exporting; full listings of national standards for products; procedures for clearing goods at the border; downloadable forms; and e-alerts which traders can customize to receive information.

The importance of achieving success in the WTO negotiations on trade facilitation has been underlined by a fair amount of empirical work. Various approaches for measuring the benefit of a multilateral agreement on trade facilitation have been pursued, including how much it will reduce trade costs, how much it will increase trade, as well as the positive impact on jobs and on GDP. One effect that seems not to have been explored in sufficient depth is the effect on export diversification. A firm considering exporting for the first time will have to acquire information on trade procedures in the foreign market. It may also have to purchase specialist IT systems and search for dedicated staff who will deal with customs matters (Granger, 2008). These are all examples of fixed costs—costs that have to be incurred up front before the firm even sells a single unit of its output in the export market. To the extent that trade and customs procedures act like fixed costs, they prevent exporters from entering new markets or selling a wider array of products. The benefit of export diversification over selling more of the same product or selling more to the same market is the resulting reduction in risk from idiosyncratic shocks to international trade. Exporters with diversified export baskets or destinations are likely to be better insulated from shocks to specific markets or sectors than others.

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There are various approaches taken in the literature to measure trade facilitation. Several studies use the World Bank's Logistics Performance Index (LPI) and Doing Business indicators as proxies. The LPI is based on a worldwide survey of operators on the ground, providing feedback on the logistics "friendliness" of the countries in which they operate and those with which they trade. In addition, survey data are supplemented with quantitative data on the performance of key components of the logistics chain in a given nation. This includes the quality of trade and transport infrastructure. The Doing Business indicators use data on the time and cost (excluding tariffs) associated with exporting and importing a standardized cargo of goods by sea transport. The time and cost necessary to complete every official procedure for exporting and importing the goods are included as well.

An important innovation in our paper with respect to previous work is that we use the OECD Trade Facilitation Indicators (TFIs) as the measure of trade facilitation. These indicators are more policy relevant than other indicators used in the literature since they correspond to the provisions of the Trade Facilitation Agreement that members of the WTO will have to implement. The OECD TFIs can be readily mapped to the provisions of the WTO Trade Facilitation Agreement such as—Information availability, Involvement of the trade community, Advance Rulings, Appeal Procedures, Fees and charges, Formalities, Cooperation, Consularization, Governance and Impartiality and Transit proceedings—see Appendix Table 12.

Using the OECD TFIs, we estimate the impact of trade facilitation on export diversification as measured by extensive margins of trade. In the baseline estimations, we consider two types of extensive margins: the number of products (HS sub-headings) by export destination, and the number of export destinations by product. We also consider theory-based extensive margins: the bilateral extensive margin suggested by Hummels and Klenow (2005), and an exporter-product extensive margin that, to the best of our knowledge, has not previously been explored in the literature.

While we are not the first to study the extensive-margin effects of trade facilitation, we are the first to do so using the OECD TFIs which are more policy relevant since they closely mirror the Trade Facilitation Agreement. Moreover, we add to the existing literature by considering an exporter-product dimension of trade margins, not only a bilateral one. A third novel contribution of this paper is the quantification of the effect of implementing trade facilitation under two realistic scenarios: (i) trade facilitation reform that moves countries that are below the median of their region to that benchmark; and (ii) reform that moves countries that are below the global median to that level.

Throughout this study, we focus on trade facilitation in the exporting nation. When analyzing the number of destinations by product, this is the only viable option. When analyzing the number of products by destination, we are aware that increases in importers' trade facilitation are likely to have a positive effect. The empirical question of interest, however, concerns the effects of a nation's own trade facilitation for given levels of trade facilitation in destination markets (which we control for).

The remainder of this paper is organized as follows. The next section provides an overview of the literature on trade facilitation. Section 3 discusses the empirical methodology to estimate the effect of trade facilitation on trade margins. We first define the indicators for the different trade margins used in the empirical analysis. Next, we specify the econometric model. In Section 4, we present the empirical results. Section 5 presents estimations that use alternative measurements of trade margins and of trade facilitation. It also discusses various methodologies employed to test whether the effects are heterogeneous across counties and sectors. Section 6 includes the results of simulations under the two scenarios of convergence to the regional median and convergence to the global median. Section 7 concludes.

2. LITERATURE

There is no single definition of trade facilitation. Nevertheless, it is possible to categorize the way the term has been used in the economic literature and by international organizations along at least three dimensions—whether the scope of measures is narrow or broad, whether it includes soft or hard infrastructure and whether it involves modification of trade procedures or only more efficient implementation of existing procedures. Narrow definitions of trade facilitation focus on border procedures and on the logistics of moving goods across frontiers. Broader definitions include any measure that expands trade, even behind the border measures such as product standards and expanding access of small and medium enterprises to trade finance. Greater transparency is an example of soft infrastructure while the building of ports and railways involve hard infrastructure. The simplification, harmonization, or standardization of trade procedures implies modification of existing procedures. In this paper, by trade facilitation we mean the provisions contained in the WTO's Trade Facilitation Agreement. It is thus narrow in scope, focused on soft rather than hard infrastructure, and involves the modification of existing trade procedures.

Trade facilitation has a significant potential to reduce trade costs. This effect has been quantified by a series of empirical studies that follow the methodology of Novy (2013) to infer trade costs from the observed pattern of production and trade across countries. Chen and Novy (2009) estimate that technical barriers to trade, taken as a whole, explain 4.5% of the variation in trade costs across 11 European Union member countries during 1999–2003. [2] Arvis *et al.* (2013) estimate trade costs in agriculture and manufactured goods in 178 countries for the 1995–2010 period. They find that a one standard deviation improvement in the World Bank's LPI is associated with a trade cost reduction of 0.2–0.5 standard deviations. Using the OECD TFIs as a measure of trade facilitation, Moïsé, Orliac, and Minor (2011) estimate a cost reduction potential of around 10% of overall trade costs. In a follow-up study, Moïsé and Sorescu (2013) disaggregate the cost-reduction potential across income groups. They estimate this potential to be 14.5% in low-income countries, 15.5% in lower middle-income countries and 13.2% in upper middle-income countries.

Trade facilitation is likely to reduce both variable and fixed trade costs. The formalities and requirements of a nation's customs have to be met each time a shipment crosses a border. There are, however, also 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 a one-time cost of learning how to fill in the forms. As the WTO Trade Facilitation Agreement 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 are less productive and did not export before will be able to do so now since the revenues from

selling in foreign markets should allow them to cover the now lower fixed costs of exporting (Melitz, 2003). They are able to expand production to serve the export market by competing away resources (capital, labor, etc.) from less productive firms. Trade facilitation can therefore both expand existing trade flows (intensive margin effect) and create new trade flows (extensive margin effect).

Empirical evidence on the intensive margin effects is provided by several authors. Iwanow and Kirkpatrick (2009) find that trade facilitation positively contributes to bilateral exports of manufactured products. More recently, Moïsé and Sorescu (2013) estimate a positive effect on bilateral trade flows of bilateral measures of trade facilitation constructed from the OECD TFIs. A related literature highlights the importance of time for trade. Since trade facilitation is likely to reduce the time it takes for products to cross borders, this literature is also relevant in this context. In a recent contribution, Zaki (2014) shows that the time to import (export) is equivalent to a mean ad valorem tax of 34.2% (17.6%) for developing countries. A study by Hummels and Schaur (2013) shows that each day in transit is worth 0.6–2% of the value of the good and that time is particularly important for intermediate goods. However, Freund and Rocha (2011) find that when comparing the effects of transit, documentation, and ports and customs delays on trade, the most significant effect comes from inland transit delays. Each additional day that a product is delayed prior to being shipped reduces trade by at least 1%, as found by Djankov, Freund, and Pham (2010). A result which combines the effects of time and costs is obtained by Hausman, Lee, and Subramanian (2013). In their study, a 1% reduction in processing costs/time leads to 0.49–0.37% of increased bilateral trade. There is also firm-level evidence showing the adverse effect of customs delays on trade. Using a sample of Uruguayan firms, Volpe Martincus, Carballo, and Graziano (2013) show that an increase by two days in the duration of export inspections reduces exports by 16.4%. Moreover, exports would be 5.9% larger if all exports could be processed within one day. [3]

Some studies in this literature use econometric results from gravity equations to perform counterfactual analysis. Hoekman and Nicita (2011) simulate the effect of policy convergence by low-income countries to the average of middle-income countries. The percentage increase in exports (imports) of low-income countries that would result from a combined convergence of the Doing Business "cost of trading" indicator and of the LPI score to the average of middle-income countries would be 17% (13.5%). [4] Portugal-Perez and Wilson (2012) simulate the effects of improving trade facilitation (broadly encompassing physical infrastructure, information and communications technology, border and transport efficiency as well as business and regulatory environment). Their benchmark is an improvement half-way to the level of the top performing nation in the region. The ad valorem tariff-cut equivalents they estimate are heterogeneous across regions, with investment in physical infrastructure generally resulting in the largest trade gains. Hufbauer, Schott, Cimino, and Muir (2013) perform a thought experiment in which countries lift their trade facilitation halfway to the region's top performer in each category. They estimate an increase in total merchandise exports of developing countries of $569 billion (9.9%) and an increase in total exports of developed countries of $475 billion (4.5%).

The empirical evidence on the extensive margins effects of trade facilitation is more limited than the one on the intensive margins. Nordås, Pinali, and Geloso Grosso (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 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 nation export diversification. Another approach is taken by Feenstra and Ma (2014). They proxy trade facilitation with port efficiency and estimate its impact on export variety, a theory-based measure of the extensive margin. They show a positive and significant effect 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'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% and by 0.4% for homogeneous products.

3. EMPIRICAL METHODOLOGY

In this section, we define trade facilitation indicators and trade margins. Next, we outline the econometric approach.

(a) *Trade facilitation indicators*

An important innovation in the paper, which argues strongly for its policy relevance, is the use of the OECD Trade Facilitation Indicators. As explained in Moïsé, Orliac, and Minor (2011) and Moïsé and Sorescu (2013), these indicators (there are a total of 16 of them) were constructed based on the relevant provisions of the WTO Trade Facilitation Agreement (TFA). These 16 indicators are in turn further broken down into some 97 variables whose values are drawn from questionnaire replies as well as publicly available data. The variables reflect the regulatory framework in the surveyed nation and the state of implementation of the trade facilitation measures. Each of these variables follows a scoring system where a score of 2 corresponds to the best performance, 0 corresponds to the worst performance, and a score of 1 to performance that lies in between. The OECD TFIs include data on 133 countries—26 of them OECD members and 107 of them non-OECD members. One drawback to the OECD TFIs is that data are available only for the year 2009, the year of the great trade collapse. This can, in principle, constitute a problem for our empirical strategy. The great trade collapse, however, was highly synchronized across countries, thus it had a level, rather than a composition effect on the margins of trade. [5]

The sample used for the regressions includes data for 133 countries for which OECD TFIs are available on the exporting side. [6] Table 1 presents summary statistics for the variable TFI. This is the simple average of the nation-specific indicators $TFI_i^A, TFI_i^B, \ldots, TFI_i^L$. [7] The average is unweighted because there is no criterion in the WTO Trade Facilitation Agreement or in its previous drafts to rank different indicators in terms of their relevance. Since each sub-indicator ranges between 0 and 2, so does TFI. Among developing and emerging economies, the scores are lowest in Sub-Saharan Africa and highest in Europe and Central Asia. [8] There is however substantial variation within these regions, and especially within Sub-Saharan Africa (where the best-performing nation, Mauritius, has a score of 1.93). The fact that the best performer in Sub-Saharan Africa (the region with the lowest average of TFI) has the highest score in the data suggests that a scenario in which all countries in the region move to the best

Table 1. *Summary statistics, TFI, by World Bank region*

World Bank region	Mean	Median	Sd	Min	Max	*N*
Sub-Saharan Africa	1.04	1.02	0.36	0.22	1.93	32
East Asia and Pacific	1.36	1.35	0.31	0.81	1.90	15
Europe and Central Asia	1.39	1.43	0.29	0.77	1.91	24
Latin America and Caribbean	1.20	1.28	0.33	0.45	1.65	24
Middle East and North Africa	1.21	1.15	0.28	0.83	1.65	11
South Asia	1.23	1.29	0.17	1.01	1.38	6
Offshore	1.20	1.20	–	1.20	1.20	1
Industrial	1.50	1.54	0.19	1.13	1.86	20
Whole sample	1.26	1.30	0.33	0.22	1.93	133

performer's value is unlikely. We will take this into account in the simulations of Section 6.

(b) *Trade margins*

We consider the relationship between trade facilitation and two indicators of trade margins: the number of exported products by destination and the number of export destinations by product.

The number of exported products by destination, npd_{ij}, counts how many products nation i exports to destination j. We define "products" as HS sub-headings (6 digit HS codes). In the HS 2002 classification that we use, there are 5,224 sub-headings. For each ij pair, npd_{ij} can therefore theoretically range between 0 (no trade) and 5,224 (nation i exports all products to j). Panel (a) of Table 2 presents in-sample summary statistics for npd_{ij}. Overall, the variable varies between 0 and 4831 (the latter being $npd_{USA-CAN}$—the number of HS6 sub-headings exported by the United States to Canada). Disaggregating over World Bank regions (and excluding "Offshore" and "Industrial" to focus on developing and emerging economies), the mean of npd_{ij} varies between 43 for Sub-Saharan Africa to 501 for East Asia and Pacific. The incidence of zeros is also highest in Sub-Saharan Africa (32% of observations) and lowest in Asia (together with Middle East and North Africa). There is, however, considerably less variation across Sub-Saharan African countries than across countries from other regions.

In Section 4, we use a measure of npd_{ij} that is only based on "new products" (HS sub-headings). In the spirit of Freund and Rocha (2011) and Portugal-Perez and Wilson (2012), we proceed as follows: when computing how many products nation i exported to nation j in 2009 (the year used for estimations, as detailed in Section (c)), we only include the subset of products for which: (i) there were no exports from i to j (zero or missing) recorded in any of the years during 2002–07; and (ii) there were positive exports from i to j recorded in at least one year during 2008–10. Since npd_{ij} is, in this case, the count of new HS6 products that were not traded before 2008, it is less likely to be endogenous to trade facilitation than the indicator calculated using the set of products traded in 2009.

The use of "new products" has an additional advantage. We do not necessarily exclude products that dropped from a nation's bilateral export basket during the big trade collapse of 2009. As long as a product that was not exported in any year during 2002–07 started to be exported in any year before 2008 and 2010, it counts for the construction of npd_{ij}.

Table 2. *Summary statistics of npd_{ij} and ndp_{ik}, by World Bank region*

World Bank region	Mean	Median	Sd	Min	Max	*N*	% zeros
			Panel (a): npd_{ij}				
Sub-Saharan Africa	43	3	200.43	0	4,525	5,157	32%
East Asia and Pacific	501	111	793.09	0	4,224	2,254	17%
Europe and Central Asia	216	18	475.86	0	3,788	3,862	22%
Latin America and Caribbean	115	9	321.68	0	3,429	3,864	23%
Middle East and North Africa	121	20	280.25	0	3,443	1,772	17%
South Asia	283	53	548.43	0	3,740	967	17%
Offshore	14	2	64.62	0	780	161	34%
Industrial	946	489	1088.38	0	4,831	3,220	2%
Whole sample	290	18	655.92	0	4,831	21,257	20%
			Panel (b): ndp_{ik}				
Sub-Saharan Africa	1	0	4.87	0	128	167,008	68%
East Asia and Pacific	16	2	29.46	0	169	73,066	36%
Europe and Central Asia	7	1	13.49	0	135	125,256	39%
Latin America and Caribbean	4	1	9.12	0	137	125,256	50%
Middle East and North Africa	4	1	9.28	0	122	57,409	49%
South Asia	9	0	20.40	0	166	31,314	51%
Offshore	0	0	1.42	0	63	5,219	76%
Industrial	30	16	34.41	0	167	104,380	12%
Whole sample	9	1	21.16	0	169	688,908	45%

Descriptive statistics computed from the sample of column (7) of Table 4 for panel (a).
Descriptive statistics computed from the sample of column (7) of Table 5 for panel (b).

The number of destinations by product, ndp_{ik}, counts how many destinations are served by nation i's exports of product k. In this case, too, the baseline definition of "product" is an HS sub-heading. Panel (b) of Table 2 presents summary statistics for ndp_{ik}. Overall, the variable varies between 0 and 169 (the latter being the number of Chinese export destinations of HS sub-heading 392690—"Other Articles of Plastics"; HS sub-heading 830140—"Other locks of Base Metal"; and HS sub-heading 940320—"Other Metal Furniture"). Again, the disaggregation over World Bank regions reveals relatively low scores for Sub-Saharan Africa (with an average of 1 destination served by product), and relatively high scores for Asian countries (with an average of 16 and 9 destinations served by product by East Asia and Pacific and South Asia, respectively). The incidence of zeros is also highest in Sub-Saharan Africa (68% of observations). The same incidence ranges between 36% and 51% for other regions.

In Section 4, we use a measure of ndp_{ik} that is only based on "new destinations". The procedure is very similar in spirit to the one described above for npd_{ij}. When computing how many destination countries were served by nation i in exporting product k in 2009, we only include the subset of destinations for which: (i) there were no exports of product k (zero or missing) recorded in any of the years during 2002–07; (ii) there were positive exports of product k recorded in at least one year during 2008–10. In this case, therefore, ndp_{ik} becomes the count of new destinations that were not served before 2008.

Also in this case, the use of "new destinations" has the additional advantage that we do not necessarily exclude destinations that ceased to be served by nation i in sector k during the big trade collapse of 2009. As long as a destination that was not served in any year during 2002–07 started to get served in any year before 2008 and 2010, it counts for the construction of ndp_{ik}.

In the construction of npd_{ij} and of ndp_{ik}, we rely on mirror trade data to the extent possible because import data tend to be more complete than export data. We therefore measure exports of nation i in product k using the reported imports of nation j in the same product. For the few nation-years for which mirror data are not available, we rely on reported export data. [9]

(c) *Econometric model*

The TFI data do not vary over time. We therefore estimate cross-sectional regressions for the year 2009. We choose this year for two reasons. First, this is suggested by Moïsé and Sorescu (2013). Second, this allows us to construct measures for npd_{ij} and ndp_{ik} that are respectively based on new products and new destinations, to address endogeneity concerns (see Section 4). [10]

The theoretical underpinnings of our econometric approach are from a variety of papers that use the (Melitz, 2003) workhorse heterogeneous firm approach to derive implications on the intensive and extensive margin effects of trade liberalization. [11] Helpman, Melitz, and Rubinstein (2008) develop a model that allows for zero entries in the aggregate bilateral trade matrix. They show that trade frictions such as regulatory costs of firm entry affect the extensive margin of trade, by reducing the probability of observing a positive bilateral trade flow. Bernard, Redding, and Schott (2011) show that trade liberalization not only entails the Melitz-type effect of allowing new entrants into export markets. It also changes exports of multiproduct firms both on the intensive margin—higher quantities shipped of already exported products—and on the extensive margin—new exports of products not previously exported. [12] These results provide the justification for using, as dependent variables in the econometric analysis, the number of products exported by destination and the number of destinations served by product. [13]

(i) *ij regressions*

The *ij* regressions use, as dependent variable, the number of exported products, npd_{ij}. This is a bilateral measure of trade outcomes. It is therefore natural to employ a gravity framework, with the conditional mean of the dependent variable expressed as:

$$E\left[npd_{ij}|\mathbf{x}_{1i},\mathbf{r}_i,\mathbf{w}_{ij},\mathbf{m}_{ij},\mathbf{d}_j\right]=g\left(\mathbf{x}'_{1i}\beta+\mathbf{r}'_i\theta+\mathbf{w}'_{ij}\delta+\mathbf{m}'_{ij}\eta+\mathbf{d}'_j\gamma\right) \quad (3.1)$$

In Eqn. (3.1), $g(\cdot)$ is a function; $\mathbf{x}_{1i}$ is a vector of variables that only vary across exporters i's; $\mathbf{r}_i$ is a vector of exporter-specific region dummies; [14] $\mathbf{w}_{ij}$ is a vector of standard bilateral gravity variables; $\mathbf{m}_{ij}$ is a vector of multilateral resistance terms, constructed using the methodology outlined in Baier and Bergstrand (2009); [15] $\mathbf{d}_j$ is a vector of importer (j)-specific effects; β, θ, δ, η and γ are vectors of coefficients to be estimated. Appendix Table 14 provides a description of all the variables, including the data sources. [16] Table 3 presents summary statistics for all control variables.

As a first step, we estimate a linear fixed effects model by OLS, with the dependent variable in logs, conditioning on importer-specific effects. In this case, $g(\cdot)$ in (3.1) is the identity function. OLS has two major drawbacks. First, it drops all observations in which $npd_{ij}=0$, since the dependent variable is in logs. Second, it models the data-generating process quite poorly, since the dependent variable is a count variable. A model for count data is more appropriate, as it addresses both drawbacks (Dennis & Shepherd, 2011; Persson, 2013). Accordingly, we use conditional Poisson and Negative Binomial (NB) Maximum Likelihood estimations, with the dependent variable in levels (always conditioning on importer-specific effects). In this case, $g(\cdot)$ in (3.1) is the exponential function. [17]

Appendix Table 15 presents the in-sample correlations between all variables in the *ij* sample.

(ii) *ik regressions*

The *ik* regressions use, as dependent variable, the number of export destinations, ndp_{ik}. This measure of trade outcomes does not have any bilateral dimension, since it varies by exporting nation i and by product k. We express the conditional mean of the dependent variable as:

$$E[ndp_{ik}|\mathbf{x}_{2i},\mathbf{r}_i,\mathbf{h}_k]=g\left(\mathbf{x}'_{2i}\alpha+\mathbf{r}'_i\phi+\mathbf{h}'_k\lambda\right) \quad (3.2)$$

In Eqn. (3.2), $g(\cdot)$ is a function; $\mathbf{h}_k$ is a vector of product (k)-specific effects; α,ϕ and λ are vectors of coefficients to be estimated. The vectors $\mathbf{x}_{2i}$ and $\mathbf{x}_{1i}$ differ from one another in the following respects. $\mathbf{x}_{2i}$, but not $\mathbf{x}_{1i}$, contains the variable Log(remoteness)—a weighted average of partners' (j's) world GDP shares, with the inverse distance between i and j as weight (Head & Mayer, 2013). Further, $\mathbf{x}_{2i}$, as opposed to $\mathbf{x}_{1i}$, does not contain the variable Log(weighted j's TFI)—a weighted average of partners' (j's) TF indicators, with the inverse distance between i and j as weight. [18]

In this case, too, we present a fixed effect linear specification (OLS with dependent variable in logs) as a first step. $g(\cdot)$ in (3.2) is the identity function in this case. We then adopt conditional Poisson and Negative Binomial (NB) Maximum Likelihood estimations with the dependent variable in levels. $g(\cdot)$ in (3.2) is the exponential function in this case. We always condition on product-specific effects.

Table 3. *Summary statistics, control variables*

Variable	Mean	Median	Sd	Min	Max
Log(pcGDP)	8.49	8.51	1.46	5.38	11.27
Log(market access)	−2.43	−2.38	0.76	−5.37	−1.15
Number of PTAs	40.53	41.00	25.98	0	88
Log(area)	11.90	12.01	2.11	5.76	16.65
Landlocked	0.21	0.00	0.41	0	1
Log(weighted *j*'s TFI)	0.26	0.26	0.06	0.01	0.35
Log(remoteness)	8.50	8.62	0.50	7.18	9.36
Log(bilateral GDP)	7.46	7.41	3.08	−2.15	18.11
PTA	0.22	0.00	0.41	0	1
Log(distance)	8.73	8.92	0.78	4.74	9.89
Common border	0.02	0.00	0.14	0	1
Common language	0.14	0.00	0.35	0	1
Colony	0.01	0.00	0.09	0	1
MR PTA	0.25	−0.05	0.81	−0.18	7.29
MR Log(distance)	10.66	−3.39	46.88	−7.59	481.69
MR Common border	0.00	−0.05	0.15	−0.05	1.56
MR Common language	0.20	−0.07	1.32	−0.10	13.54
MR Colony	0.04	−0.01	0.22	−0.01	2.51

Descriptive statistics computed from the sample of column (7) of Table 4—except for Log(remoteness).
Descriptive statistics for Log(remoteness) computed from the sample of column (7) of Table 5.

Appendix Table 16 presents the in-sample correlations between all variables in the *ik* sample.

4. RESULTS

(a) *ij regressions*

The results of the *ij* regressions are in Table 4. In the OLS regressions, the dependent variable is in logs, while it is in levels in the Poisson and NB regressions. In both cases, however, the coefficients on the explanatory variables in logs can be interpreted as elasticities. [19]

The baseline results are in columns (1), (2) and (6), respectively for OLS, Poisson and NB regressions. The coefficient on the variable of interest, Log(TFI), is positive and statistically significant in all specifications. In the specification of column (6), the elasticity is 0.305, implying that a 1% increase in the average trade facilitation indicator is roughly associated with a 0.3% increase in the number of HS6 products exported by destination.

The coefficients on the control variables are correctly signed and statistically significant. Although the dependent variable is different, it is useful to compare the distance coefficients with the standard results from gravity studies. As reported in Table of 4 (Head & Mayer, 2013), the mean of the distance coefficient estimated in 159 papers ranges between −0.93 and −1.1, with a standard deviation of 0.40–0.41. The distance elasticity we obtain is in line with Table 4 of Head and Mayer (2013) for the OLS estimation. In the Poisson and NB model it is lower, but it is a well-established fact in the literature that the distance coefficient is lower when using count-data models. Moreover, our result is very similar to the one obtained by Persson (2013), which is the most comparable study to ours.

We see two possible concerns with the baseline estimations. First, and foremost, we cannot exclude reverse causation, that is the possibility that trade outcomes affect the incentives to invest in trade facilitation, and consequently the trade facilitation scores. We propose two ways of addressing this concern. The first one is to lead the dependent variable, based on the intuition that trade outcomes in the future are less likely to affect investments in trade facilitation today. In columns (3) and (7) of Table 4 we respectively show the results of Poisson and NB regressions in which the dependent variable, as well as all other explanatory variables, are measured in the year 2012, while the explanatory variable of interest, Log(TFI), is measured in year 2009. The results of the Poisson regression are very similar to the Poisson baseline column (3). The coefficient on Log(TFI) in the NB regression of column (7) is larger than the baseline NB coefficient of column (6), but still positive and statistically significant.

Our second, and preferred way of addressing reverse causality concerns is to use only "new products" (HS sub-headings) in the construction of the dependent variable, as described in Section 3(b). The results are in columns (3) and (7) of Table 4. The coefficients are slightly lower than in the baseline regressions (indicating the possibility of a small downward bias induced by reverse causality), but still positive and statistically significant.

The second possible concern with the baseline estimations of Table 4 relates to the measurement of trade facilitation. So far, we have used TFI—the unweighted average of the nation-specific OECD Trade Facilitation Indicators. As an alternative, we have created a trade facilitation indicator based on Principal Component Analysis (PCA). The results of Poisson estimations are in columns (4) and (5). They are very similar to the corresponding results of columns (2) and (3). [20]

(b) *ik regressions*

The results of *ik* regressions are in Table 5. The structure of the table is similar to that of Table 4.

The coefficient on Log(TFI) is positive and significant in all specifications. The estimated elasticity in column (6) is 0.383. This implies that a 1% increase in the average trade facilitation indicator is roughly associated with a 0.38% increase in the number of destinations to which an HS6 product is exported.

In columns (3) and (7) we address possible reverse causality concerns using only "new destinations" in the computation of the dependent variable, as described in Section 3(b). In the regressions with new destinations, the estimated coefficient

Table 4. *Number of products by destination (ij regressions). Dependent variable: log(npd_{ij}) (OLS regression); npd_{ij} (Poisson and NB regressions)*

	OLS	Poisson				NB		
	Baseline (1)	Baseline (2)	2012 variables (3)	New HS6 (4)	PCA for TFI (5)	Baseline (6)	2012 variables (7)	New HS6 (8)
Log(TFI)	0.290***	0.549***	0.536***	0.346***	0.319***	0.305***	0.406***	0.230***
	[0.038]	[0.057]	[0.049]	[0.078]	[0.081]	[0.027]	[0.034]	[0.028]
Log(pc GDP)	0.113***	0.097***	−0.056**	0.088***	0.090***	0.218***	0.124***	0.102***
	[0.018]	[0.025]	[0.022]	[0.030]	[0.030]	[0.017]	[0.020]	[0.020]
Log(market access)	0.433***	0.401***	0.425***	0.304***	0.304***	0.320***	0.346***	0.237***
	[0.013]	[0.018]	[0.017]	[0.021]	[0.021]	[0.011]	[0.012]	[0.009]
Number of PTAs	−0.002***	0.002***		0.001*	0.001	0.003***	0.003**	0.002***
	[0.001]	[0.001]		[0.001]	[0.001]	[0.000]	[0.001]	[0.000]
Log(area)	−0.058***	−0.048***	−0.115***	−0.021**	−0.020**	0.040***	−0.006	0.015*
	[0.007]	[0.009]	[0.008]	[0.009]	[0.009]	[0.008]	[0.009]	[0.008]
Landlocked	−0.248***	0.011	−0.017	−0.156***	−0.155***	−0.078***	−0.193***	−0.200***
	[0.024]	[0.028]	[0.024]	[0.027]	[0.027]	[0.020]	[0.020]	[0.013]
Log(weighted *j*'s TFI)	4.718***	1.657***	2.166***	1.082***	1.096***	0.718***	1.161***	0.708***
	[0.291]	[0.432]	[0.436]	[0.339]	[0.343]	[0.221]	[0.250]	[0.195]
Log(bilateral GDP)	0.788***	0.735***	0.766***	0.476***	0.475***	0.397***	0.415***	0.366***
	[0.014]	[0.021]	[0.020]	[0.027]	[0.026]	[0.021]	[0.024]	[0.016]
PTA	0.115***	0.054	0.113***	0.004	0.005	0.050*	0.136***	−0.002
	[0.041]	[0.039]	[0.039]	[0.033]	[0.033]	[0.030]	[0.028]	[0.028]
Log(distance)	−0.931***	−0.598***	−0.549***	−0.431***	−0.432***	−0.477***	−0.445***	−0.293***
	[0.036]	[0.041]	[0.041]	[0.035]	[0.035]	[0.031]	[0.031]	[0.032]
Common border	0.482***	−0.036	−0.074	−0.110	−0.109	−0.184**	−0.269***	−0.526***
	[0.116]	[0.086]	[0.083]	[0.103]	[0.103]	[0.073]	[0.068]	[0.123]
Common language	0.757***	0.391***	0.304***	0.422***	0.420***	0.365***	0.282***	0.306***
	[0.051]	[0.055]	[0.054]	[0.046]	[0.046]	[0.043]	[0.046]	[0.041]
Colony	0.777***	0.582***	0.573***	0.371***	0.374***	0.337***	0.353***	0.259*
	[0.135]	[0.106]	[0.093]	[0.108]	[0.108]	[0.103]	[0.090]	[0.133]
Observations	16,928	21,257	17,579	21,388	21,388	21,257	17,579	21,388
R-squared	0.740							
Log pseudolikelihood		−1.35e+06	−1.27e+06	−784,586	−784,897	−97,952	−87,150	−99,089
Number of id (*j*'s)	162	162	141	163	163	162	141	163

Robust (clustered on partner *j*) standard errors in parentheses in columns (1)–(5).
Bootstrap standard errors (1,000 replications) in parentheses in columns (6)–(8).
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Partner *j* fixed effects, region dummies and MR controls always included.

on Log(TFI) is slightly larger than the baseline coefficient, both in the Poisson and in the NB specifications.

In columns (5) and (5) we present the results of the regressions that use a measure of TFI based on Principal Component Analysis, rather than the simple mean across indicators. Again, the results do not change significantly. [21]

5. ROBUSTNESS

(a) *Hummels–Klenow trade margins*

In this section, we present econometric estimates using the theory-based "Hummels–Klenow extensive margins" as dependent variables. In the regressions with nation pairs, we use the following variable, directly from Hummels and Klenow (2005):

$$em_{ij} = \frac{\sum_{k \in K_{ij}} X_{wjk}}{\sum_{k \in K} X_{wjk}} \tag{5.1}$$

In Eqn. (5.1), K_{ij} is the set of goods which nation *i* exports to nation *j*; *w* is the reference nation that has positive exports to *j* in all products *k* (in the empirical implementation, it is the rest of the world); *K* is the set of all products; X_{wjk} are the exports of nation *w*to nation *j* in product *k*. em_{ij} is therefore the share of those exports to *j* only in goods *k* that nation *i*exports in total exports to nation *j*.

In the regressions with nation-product observations, we construct a similar measure (not previously used in the reviewed literature):

$$em_{ik} = \frac{\sum_{j \in J_{ik}} X_{wjk}}{\sum_{j \in J} X_{wjk}} \tag{5.2}$$

In Eqn. (5.2), J_{ik} is the set of destinations to which nation *i* exports product *k*; *w* is the reference nation that has positive exports of *k* to all destinations *j* (in the empirical implementation, it is the rest of the world); *J* is the set of all destinations; X_{wjk} are—as in Eqn. (5.2),—the exports of nation *w*to nation *j* in product *k*. em_{ik} is therefore the share of exports of *k* only to destinations *j* that nation *i* exports to in total exports of product *k* to all destinations. [22]

The summary statistics for the Hummels–Klenow extensive margins em_{ij} and em_{ik} are in Appendix Table 17. In the developing world, Hummels–Klenow extensive margins, and therefore export diversification, are lowest in Sub-Saharan Africa and highest in East Asia and Pacific. From a qualitative standpoint, these descriptive statistics are in line with the ones presented in Table 2 for npd_{ij} and ndp_{ik}. In fact, the sample

Table 5. *Number of destinations by product (ik regressions). Dependent variable: log(ndp_{ik}) (OLS regression); ndp_{ik} (Poisson and NB regressions)*

	OLS	Poisson				NB		
	Baseline	Baseline	2012 variables	New HS6	PCA for TFI & new HS6	Baseline	2012 variables	New HS6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(TFI)	0.345*	0.372***	0.377***	0.439***	0.438***	0.383***	0.413***	0.410***
	[0.200]	[0.007]	[0.007]	[0.005]	[0.005]	[0.005]	[0.006]	[0.005]
Log(pc GDP)	0.536***	0.662***	0.494***	0.475***	0.472***	0.576***	0.427***	0.493***
	[0.071]	[0.005]	[0.004]	[0.004]	[0.004]	[0.003]	[0.003]	[0.003]
Log(market access)	0.370***	0.491***	0.471***	0.338***	0.336***	0.522***	0.471***	0.374***
	[0.077]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]
Number of PTAs	0.001	0.004***	0.005***	0.003***	0.003***	0.002***	0.004***	0.003***
	[0.002]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Log(area)	0.313***	0.380***	0.349***	0.232***	0.232***	0.349***	0.329***	0.246***
	[0.025]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]
Landlocked	−0.238**	−0.331***	−0.381***	−0.369***	−0.370***	−0.394***	−0.462***	−0.383***
	[0.116]	[0.004]	[0.004]	[0.003]	[0.003]	[0.004]	[0.004]	[0.003]
Log(remote)	−1.185***	−1.237***	−1.341***	−0.591***	−0.595***	−1.326***	−1.449***	−0.684***
	[0.136]	[0.009]	[0.009]	[0.006]	[0.006]	[0.007]	[0.007]	[0.006]
Observations	376,095	688,908	682,248	689,172	689,172	688,908	682,248	689,172
R-squared	0.590							
Log pseudolikelihood		−2.62e+06	−2.72e+06	−1.42e+06	−1.42e+06	−1.43e+06	−1.45e+06	−1.24e+06
Number of id (HS6)	5,216	5,219	5,208	5,221	5,221	5,219	5,208	5,221

Two-way clustered (*ik*) standard errors in parentheses in column (1).
Robust (clustered on HS6 products) standard errors in parentheses in columns (2)–(6).
Bootstrap standard errors (1,000 replications) in parentheses in columns (7)–(9).
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.
Product (HS6) fixed effects and region dummies always included.

Table 6. *Hummels–Klenow extensive margins. Dependent variable: em_{ij} (ij regressions); em_{ik} (ik regressions)*

	ij regressions			*ik* regressions		
	Baseline	2012 variables	New HS6	Baseline	2012 variables	New dest.
	(1)	(2)	(3)	(4)	(5)	(6)
Log(TFI)	0.457***	0.504***	0.118	0.339***	0.280***	−0.180***
	[0.054]	[0.056]	[0.091]	[0.015]	[0.016]	[0.017]
Log(pc GDP)	0.249***	0.128***	0.134***	0.599***	0.454***	0.586***
	[0.023]	[0.021]	[0.041]	[0.008]	[0.007]	[0.006]
Log(market access)	0.285***	0.280***	0.155***	0.504***	0.467***	0.387***
	[0.019]	[0.020]	[0.030]	[0.006]	[0.006]	[0.006]
Number of PTAs	−0.001*	–	−0.001	0.004***	0.005***	0.003***
	[0.000]	–	[0.001]	[0.000]	[0.000]	[0.000]
Log(area)	−0.018**	−0.072***	−0.009	0.428***	0.399***	0.283***
	[0.008]	[0.009]	[0.012]	[0.002]	[0.002]	[0.002]
Landlocked	−0.087***	−0.117***	−0.200***	−0.172***	−0.183***	−0.202***
	[0.028]	[0.026]	[0.045]	[0.008]	[0.009]	[0.008]
Log(weighted *j*'s TFI)	0.592	0.711*	0.219			
	[0.386]	[0.365]	[0.658]			
Log(remote)				−1.608***	−1.719***	−0.932***
				[0.012]	[0.013]	[0.011]
Observations	16,881	14,146	18,478	370,035	322,539	407,097
Log pseudolikelihood	−3994.8	−3683.6	−2127.7	−118261.8	−115740.8	−94469.8

Generalized Linear Model (GLM) regressions in all columns.
Robust (clustered on partner *j*) standard errors in parentheses in columns (1)–(3).
Robust (clustered on HS6 products) standard errors in parentheses in columns (4)–(6).
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.
Partner *j* dummies, region dummies, pair and MR controls included in columns (1)–(3).
Product (HS6) and region dummies included in columns (4)–(6).

correlation between npd_{ij} and em_{ij} is equal to 0.89, while the sample correlation between ndp_{ik} and em_{ik} is equal to 0.83.[23]

Table 6 presents the results of *ij* and *ik* regressions using, as dependent variable, the Hummels–Klenow extensive margins em_{ij} and em_{ik}, respectively. The dependent variable ranges between zero and one. As suggested by Baum (2008), we use a Generalized Linear Model (GLM) with a logit transformation of the response variable and the binomial distribution.

Odd-numbered columns present baseline results, in which the respective trade margin is calculated using trade data from 2009. In even-numbered columns we address concerns related to reverse causality and construct the dependent variable using only the subset of new products (in the case of em_{ij}) or new destinations (in the case of em_{ik}).[24]

In the *ij* regressions, controlling for nation characteristics, partner *j* dummies, region dummies and bilateral control variables, the coefficient on Log(TFI) is positive in all columns, despite losing statistical significance in column (3). In the *ik* regressions, where we control for nation characteristics, product *k* dummies and region dummies, the coefficient on Log(TFI) is positive and significant in columns (4) and (5), but it becomes incorrectly signed (negative) and statistically significant in column (6). The counter-intuitive results of columns (3) and (6) also hold across a variety of different estimation techniques, including OLS, Poisson, Negative Binomial and Tobit. There is, however, no theoretical background in Hummels and Klenow (2005) that would justify computing extensive margins based on "new products" or "new destinations". The results of columns (3) and (6) of Table 6, therefore, should be taken with a grain of salt.

(b) *The elusive quest for heterogeneous effects*

Beyond the central results of Section 4, we also investigate possible heterogeneity in the impact of trade facilitation on the extensive margins of trade. An important potential source of heterogeneity is between nation pairs that have a PTA in place and nation pairs that do not have one. There is ample evidence that most PTAs include trade facilitation provisions (Neufeld, 2014), (see for instance). Maur (2011) argues that in areas such as product standards and technical regulations, trade facilitation through policies such as harmonization between PTA members has the potential to introduce discrimination *vis-à-vis* excluded countries. However, the aspects of trade facilitation such as transparency and simplification of rules and procedures (the narrow definition of trade facilitation that we use in this paper and that is reflected in the OECD TFIs), should be non-discriminatory in nature and therefore benefit all trading partners equally (see also WTO (2011) for a similar argument). If this is the case, one should not expect any heterogeneous effect of exporter's trade facilitation on the extensive margin of bilateral trade across PTA partners and non-PTA partners.

To test this prediction, we augment the *ij* regressions with an interaction term between the PTA dummy and Log(TFI). We do not obtain any consistent pattern in the results. In most regressions, the marginal effect when the PTA dummy is equal to one is not statistically different from the marginal effect when the PTA dummy is equal to zero.[25] The evidence that an exporting nation's trade facilitation does not have a higher impact on the bilateral extensive margin with importers with which it has a PTA provides indirect support for the idea that the trade facilitation provisions captured by the OECD TFIs (and disciplined by the WTO Trade Facilitation Agreement) are non-discriminatory. To put it differently, PTAs are building, rather than stumbling blocks when it comes to trade facilitation.

One might be concerned that our results might be driven by developed countries only. To rule this out, we split the *ij* sample in four subsamples: DD (both exporter *i* and importer *j* are developed); DG (*i* is developed, *j* is developing); GD (*i* is developing, *j* is developed); GG (both *i* and *j* are developing).[26] As shown in Table 7, the results are qualitatively similar across sub-samples, with a consistently positive and significant coefficient on Log(TFI) across all specifications in each sub-sample. Keeping in mind the limitations of a comparison of coefficients from different samples, we note that they are larger when the exporter is a developed nation (sub-samples DD and DG). However, since developing countries have, on average, lower TFI scores than developing ones, it will be shown in Section 6 that they are bound to experience, as a group, the largest gains from trade facilitation reform.

We further check whether the effect of trade facilitation on the extensive margins differs between final and intermediate products. Yi (2003) develops a model in which trade costs hamper vertically-specialized trade (i.e., trade along supply chains) relatively more than trade in final products.[27] Martinez-Zarzoso and Márquez-Ramos (2008) show that improvements in the Doing Business indicators "Number of days" and "Document required" to export/import have a relatively larger effect on technology-intensive goods and on differentiated products, as opposed to homogeneous ones. Marti, Puertas, and García (2014) argue that improvements in the LPI have an effect which is larger for goods that are relatively more complex to transport. In a more direct test of Yi (2003)'s hypothesis, Saslavsky and Shepherd (2012) show that trade in parts and components—which they assume takes place largely within production networks—is more sensitive to improvements in logistics performance than trade in final goods. These papers focus on the intensive margin of trade (bilateral trade value in a gravity framework). As discussed in Section 2, Persson (2013) applies similar ideas to the extensive margins of trade. She does not explicitly consider trade in intermediate products as her focus is on product differentiation. She finds that trade facilitation has a higher extensive margin impact on trade in differentiated products than on trade in homogeneous products.

In the spirit of this literature, we test for heterogeneous effects on the extensive margins of trade between intermediate and final products. We use two alternative definitions of intermediate products, a narrow one and a broad one. The narrow definition, adopted by WTO (2011), includes the HS sub-headings corresponding to codes 42 and 53 of the Broad Economic Categories (BEC) classification, supplemented with unfinished textile products in HS chapters 50–63. The broad definition includes the HS sub-headings corresponding to the intermediate goods of the BEC classification.

As a first step, we estimate the *ij* regressions in two sub-samples: one in which the dependent variable is computed across the subset of intermediate products; one in which the dependent variable is computed across the subset of all other products. We are not able to find any significant difference between estimated coefficients across these specifications. To test this result further, in the *ik* sample we augment the regressions with an interaction term between a dummy equal to one if the product is intermediate and the Log(TFI) variable. We do not find the coefficient of this interaction term to be significant in most specifications.[28] This leads us to conclude that the effect of trade facilitation on the extensive margin does not differ between intermediate and final products.

We see two possible explanations behind this finding. First, and foremost, the theoretical predictions concern the intensive rather than the extensive margin. The body of literature cited before confirms these predictions. When it comes to the extensive margins we consider, it is less clear how they should be affected differently by trade facilitation if the good is final or intermediate. This is especially the case for the variable ndp_{ik}, which measures the number of destinations a product is exported to. Since there is usually a limited number of countries within a given value chain (for instance, the iPhone

Table 7. *ij regressions with income group sub-samples. Dependent variable:* npd_{ij}

	Poisson			NB		
	Baseline (1)	2012 variables (2)	New HS6 (3)	Baseline (4)	2012 variables (5)	New dest. (6)
			DD subsample: i = developed, j = developed			
Log(TFI)	0.673***	0.647***	0.646***	1.011***	0.975***	0.678***
	[0.115]	[0.080]	[0.158]	[0.077]	[0.055]	[0.061]
Observations	1,888	1,578	1,961	1,888	1,578	1,961
Log pseudolikelihood	−170,386	−160,572	−68,510	−11,725	−10,300	−10,626
Number of id (*j*'s)	52	44	54	52	44	54
			DG subsample: i = developed, j = developing			
Log(TFI)	1.130***	0.834***	1.207***	1.188***	1.132***	1.142***
	[0.139]	[0.100]	[0.168]	[0.176]	[0.091]	[0.105]
Observations	4,366	3,544	4,366	4,366	3,544	4,366
Log pseudolikelihood	−404,128	−367,678	−214,606	−23,794	−20,439	−23,039
Number of id (*j*'s)	118	99	118	118	99	118
			GD subsample: i = developing, j = developed			
Log(TFI)	0.607***	0.738***	0.523***	0.463***	0.609***	0.436***
	[0.044]	[0.050]	[0.040]	[0.056]	[0.044]	[0.041]
Observations	4,940	4,020	5,130	4,940	4,020	5,130
Log pseudolikelihood	−201,656	−194,750	−112,015	−23,770	−21,070	−23,578
Number of id (*j*'s)	52	44	54	52	44	54
			GG subsample: i = developing, j = developing			
Log(TFI)	0.810***	0.788***	0.358***	0.313***	0.385***	0.223***
	[0.104]	[0.102]	[0.084]	[0.058]	[0.072]	[0.045]
Observations	11,119	8,685	11,119	11,119	8,685	11,119
Log pseudolikelihood	−476,924	−445,765	−331,029	−42,153	−35,783	−45,492
Number of id (*j*'s)	118	99	118	118	99	118

Robust (clustered on partner *j*) standard errors in parentheses in columns (1)–(3).
Bootstrap standard errors (1,000 replications) in parentheses in columns (4)–(6).
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
All additional regressors and controls of Table 4 included.

is produced with parts and components from five countries: China, Korea, Japan, Germany, and the US—see Xing & Detert, 2010), trade facilitation could even have a stronger effect on final goods than intermediate ones when it comes to this variable.[29] Second, the empirical literature cited above relies on broad measures of trade facilitation, which often encompass infrastructural quality, one of the main drivers of value chain participation (WTO, 2014). The narrow scope of the measure of trade facilitation used in this paper could contribute to explain why the effect of trade facilitation on the extensive margin does not differ between intermediate and final products. .

So far, we have relied on a compact TF indicator, constructed as the simple average of the nation-specific indicators $TFI_i^A, TFI_i^B, \ldots, TFI_i^L$. From a development policy perspective, it is however relevant to understand what aspect of trade facilitation is more likely to reduce the fixed cost of exporting and therefore to have a positive effect on export diversification. To this end, we have performed separate *ij* and *ik* regressions with each indicator A-L as the main explanatory variable.[30] The results of *ij* regressions are available in Table 8, while the results of *ik* regressions are available in Table 9.[31]

In the *ij* regressions of Table 8, most indicators have coefficients that are consistently positive and significant across all specifications. This is the case of indicators A (Information availability); B (Involvement of the trade community); E (Fees and charges); G (Formalities—Automation); H (Formalities—Procedures); J (Cooperation—External); K (Consularization); and L (Governance and Impartiality). The evidence is also overwhelmingly positive for indicator D (Appeal Procedures)—with the exception of a negative, but not significant coefficient in column (4). Improvements along these dimensions unambiguously increase export diversification, as measured by the number of products by destination. For indicators C (Advance Rulings) and F (Formalities—Documents) the evidence is mixed, with positive and negative coefficients, depending on the specification. There is one indicator, I (Cooperation—Internal), that has a consistently negative and significant coefficient. This result is mainly driven by the poor quality of information on internal border agency cooperation mentioned by Moïsé and Sorescu (2013), and it is broadly consistent with their results of intensive margin estimations, where the coefficient on TFI I is negative in most instances.

In the *ik* regressions of Table 8, ten of twelve indicators (A, B, C, D, E, F, G, H, K and L) have positive and significant coefficients across all regressions. Improvements along these dimensions, therefore, unambiguously increase export diversification in terms of the number of export destinations by product, The results are ambiguous for indicator J (Cooperation—External). As in the *ij* regressions, the coefficients on indicator I (Cooperation—Internal) are consistently negative.

6. SIMULATION RESULTS

In this section we present a counterfactual analysis aimed at providing insights into the economic significance of our results. We estimate the percentage increase in the number

Table 8. *ij regressions with TFI sub-indicators. Dependent variable: npd_{ij}. Each cell is a regression*

	Poisson			NB		
	Baseline (1)	2012 variables (2)	New HS6 (3)	Baseline (4)	2012 variables (5)	New HS6 (6)
log(TFI A)	0.324***	0.356***	0.248***	0.088***	0.137***	0.078***
	[0.033]	[0.028]	[0.037]	[0.017]	[0.018]	[0.017]
log(TFI B)	0.415***	0.352***	0.193***	0.301***	0.302***	0.133***
	[0.034]	[0.030]	[0.023]	[0.016]	[0.016]	[0.013]
log(TFI C)	0.161***	0.088***	0.173***	0.138***	0.095***	0.147***
	[0.022]	[0.020]	[0.028]	[0.020]	[0.019]	[0.020]
log(TFI D)	0.199***	0.282***	0.203***	0.125***	0.245***	0.134***
	[0.022]	[0.021]	[0.031]	[0.021]	[0.029]	[0.017]
log(TFI E)	0.172***	0.096***	0.083***	0.106***	0.063***	0.045***
	[0.020]	[0.019]	[0.026]	[0.015]	[0.014]	[0.011]
log(TFI F)	0.222***	0.287***	0.229***	0.166***	0.261***	0.217***
	[0.021]	[0.020]	[0.027]	[0.021]	[0.025]	[0.017]
log(TFI G)	0.285***	0.376***	0.211***	0.174***	0.270***	0.158***
	[0.027]	[0.027]	[0.027]	[0.010]	[0.013]	[0.014]
log(TFI H)	0.397***	0.368***	0.236***	0.275***	0.262***	0.182***
	[0.029]	[0.026]	[0.039]	[0.014]	[0.016]	[0.014]
log(TFI I)	−0.144***	−0.255***	−0.154***	−0.031**	−0.131***	−0.136***
	[0.024]	[0.024]	[0.021]	[0.015]	[0.016]	[0.015]
log(TFI J)	0.146***	−0.095**	0.015	0.171***	0.047**	0.009
	[0.041]	[0.038]	[0.039]	[0.021]	[0.023]	[0.017]
log(TFI K)	0.552***	0.615***	0.225**	0.243***	0.361***	0.179***
	[0.092]	[0.070]	[0.090]	[0.022]	[0.028]	[0.020]
log(TFI L)	0.431***	0.424***	0.372***	0.278***	0.337***	0.273***
	[0.030]	[0.025]	[0.033]	[0.021]	[0.024]	[0.015]

Robust (clustered on partner *j*) standard errors in parentheses in columns (1)–(3).
Bootstrap standard errors (250 replications) in parentheses in columns (4)–(6).
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
All additional regressors and controls of Table 4 included.

of export destinations and in the number of exported products under two different scenarios. The first scenario is one in which each nation with a TFI score below the median of the geographical region it belongs to increases its TFI to the regional median. The second scenario considers an increase to the global median. [32]

It is important to note that results of counterfactual analysis have to be taken cautiously. First, because they are only as good as the underlying econometric model. Although we have taken care in addressing omitted variable and reverse causality biases, we cannot control for every possible nation-specific variable correlated with trade facilitation and we cannot completely exclude the endogenous co-determination of trade outcomes and trade facilitation infrastructure. Second, the counter-factual analysis does not take into account that regional (global) median values would be affected by changes in trade facilitation occurring in all countries in the region (world).

With these caveats in mind, the baseline results, grouped by region in Panel (a) and by income group in Panel (b), are presented in Table 10 for *ij* regressions and Table 11 for *ik* regressions. [33] To remain on the conservative side, we have chosen to base the simulations on the Negative Binomial (NB) results, which generally yield smaller estimated coefficients on Log(TFI) than the coefficients of Poisson regressions. [34] We use both the baseline NB and the NB specifications with new products and new destinations. Since the estimates obtained in the latter specifications address the issue of reverse causality, we take them as our preferred results. We therefore discuss only the results of even-numbered columns.

For ease of interpretation, it is useful to keep in mind that the entries in Tables 10 and 11 represent the percentage change in the variable of interest (respectively, $npd_{ij}$and ndp_{ik}) that, based on the estimated regression coefficients, are predicted if nation *i* moves from below the regional (global) median to the relevant median. The results are then averaged across regions in Panel (a) or across income groups in Panel (b). All countries at, or above, the relevant median are dropped from the calculation of the regional average percentage increase in the trade margin. If in a given region there are 16 countries, 8 of which are below the regional median and 15 below the global median, the results under the regional median scenario are averaged over the 8 bottom countries in terms of TFI, while the results under the global median scenario are averaged over all countries with the exclusion of the top regional performer.

It is apparent from panels (a) of Tables 10 and 11 that the gains are largest in two regions, namely Sub-Saharan Africa and Latin America and the Caribbean. On average, Sub-Saharan countries with a level of TFI below the regional (global) median are bound to experience a 12.8% (15.7%) increase in the number of products exported by destination, and a 29.9% (34.9%) increase in the number of export destinations served by product. Countries in Latin America and the Caribbean with a level of TFI below the regional (global) median are bound to experience a 11.7% (12.2%) increase in the number of products exported by destination, and a 25.8% (26.9%) increase in the number of export destination served by product. The gains are smallest in Middle East and North Africa and in South Asia.

Panel (b) of Table 10 shows that, on average, developing countries stand to gain slightly more that developed countries from trade facilitation reform in terms of the number of products exported by destination. The difference becomes more marked if one considers a different aggregation, OECD *vs.* non-OECD, which includes fewer countries in the group of "developed". The estimated average percentage gains in npd_{ij}

Table 9. *ik regressions with TFI sub-indicators. Dependent variable: ndp_{ik}. Each cell is a regression*

	Poisson			NB		
	Baseline (1)	2012 variables (2)	New dest. (3)	Baseline (4)	2012 variables (5)	New dest. (6)
log(TFI A)	0.129***	0.073***	0.274***	0.295***	0.196***	0.290***
	[0.004]	[0.004]	[0.003]	[0.004]	[0.004]	[0.003]
log(TFI B)	0.531***	0.557***	0.260***	0.315***	0.365***	0.224***
	[0.004]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]
log(TFI C)	−0.068***	−0.127***	0.038***	0.027***	−0.057***	0.064***
	[0.004]	[0.004]	[0.003]	[0.003]	[0.004]	[0.003]
log(TFI D)	0.036***	0.052***	0.229***	−0.001	0.009***	0.197***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]
log(TFI E)	0.227***	0.166***	0.117***	0.185***	0.122***	0.106***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
log(TFI F)	−0.101***	−0.056***	0.130***	−0.062***	−0.029***	0.141***
	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
log(TFI G)	0.276***	0.341***	0.215***	0.221***	0.266***	0.211***
	[0.003]	[0.003]	[0.002]	[0.003]	[0.003]	[0.002]
log(TFI H)	0.108***	0.070***	0.105***	0.146***	0.130***	0.103***
	[0.003]	[0.003]	[0.003]	[0.002]	[0.002]	[0.003]
log(TFI I)	−0.059***	−0.059***	−0.090***	−0.038***	−0.010***	−0.060***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]
log(TFI J)	0.269***	0.210***	0.265***	0.280***	0.255***	0.254***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
log(TFI K)	1.191***	1.209***	0.619***	0.625***	0.686***	0.557***
	[0.011]	[0.012]	[0.007]	[0.006]	[0.006]	[0.005]
log(TFI L)	0.451***	0.448***	0.425***	0.484***	0.487***	0.402***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]	[0.003]

Robust (clustered on HS6 products) standard errors in parentheses in columns (1)–(3).
Bootstrap standard errors (250 replications) in parentheses in columns (4)–(6).
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.
All additional regressors and controls of Table 5 included.

Table 10. *Simulation results based on NB ij regressions*

	Regional median		Global median	
	Baseline (1)	New HS6 (2)	Baseline (3)	New HS6 (4)
Panel (a): Regional aggregation				
Sub-Saharan Africa	16.9%	12.8%	20.8%	15.7%
East Asia and Pacific	7.5%	5.7%	7.3%	5.5%
Europe and Central Asia	8.2%	6.2%	6.7%	5.1%
Latin America and Caribbean	15.5%	11.7%	16.2%	12.2%
Middle East and North Africa	6.1%	4.6%	8.7%	6.6%
South Asia	6.0%	4.5%	6.4%	4.8%
Panel (b): Income group aggregation				
Developed	11.0%	8.3%	12.6%	9.5%
Developing	12.1%	9.2%	14.8%	11.2%

Columns (1) and (3) based on column (7) of Table 4.
Columns (2) and (4) based on column (8) of Table 4.

for OECD countries is equal to 4.6% under the regional median scenario of column (2) and to 4.2% under the global median scenario of column(4). The corresponding percentage increases for non-OECD countries are 9.5 and 11.3%.

The results from the income group aggregation in panel (b) of Table 11 suggest slightly larger percentage increases in the number of destinations by product for developed countries relative to developing countries. It should be noted that this result is also sensitive to the income group aggregation. Using OECD membership as proxy for income status, we obtain significantly larger gains for developing countries than for developed countries. In particular. non-OECD countries stand to gain 21% (24.8%) in the regional (global) median scenario, while OECD countries only stand to gain 9.7% (9.2%) in the two respective scenarios.

7. CONCLUSIONS

This is the first paper to focus exclusively on, and to provide detailed estimates of, the prospective effect of the WTO Trade Facilitation Agreement on export diversification, as measured

Table 11. *Simulation results based on NB ik regressions*

	Regional median		Global median	
	Baseline (1)	New dest. (2)	Baseline (3)	New dest. (4)
Panel (a): Regional aggregation				
Sub-Saharan Africa	27.0%	29.9%	31.5%	34.9%
East Asia and Pacific	11.3%	12.5%	10.9%	12.1%
Europe and Central Asia	11.0%	12.2%	10.1%	11.1%
Latin America and Caribbean	23.3%	25.8%	24.3%	26.9%
Middle East and North Africa	9.1%	10.1%	13.1%	14.5%
South Asia	12.2%	13.5%	9.6%	10.7%
Panel (b): Income group aggregation				
Developed	21.1%	23.4%	21.9%	24.2%
Developing	16.1%	17.9%	21.5%	23.8%

Columns (1) and (3) based on column (7) of Table 5.
Columns (2) and (4) based on column (8) of Table 5.

by the extensive margins of trade. We do so by using direct measures of trade facilitation that map onto the obligations of the agreement, namely, the OECD Trade Facilitation Indicators. We explore a variety of measures of the extensive margins of trade—the number of products a nation exports to a given destination (npd_{ij}), the number of destinations to which a nation exports a given product (ndp_{ik}), the Hummels–Klenow measure of the bilateral extensive margin (em_{ij}) and a similar measure of the nation-product extensive margin (em_{ik}) that has not previously been explored in the literature.

The estimation results are convincing, with the coefficient on the trade facilitation variable being positive and statistically significant across almost all specifications. Using these estimates, we simulate the impact of implementing the agreement on developing countries' extensive margin of trade. Implementation of the agreement is measured using two alternative, realistic scenarios—convergence to the regional median and convergence to the global median. Developing countries are likely to experience a substantial increase in the number of products exported and of destination markets. For Sub-Saharan African countries, our simulations suggest they could see an increase of up to 15.7% in the number of products exported by destination and an increase of up to 34.9% in the number of export destinations by product. For countries in Latin America and the Caribbean, our simulations suggest they could see an increase of up to 12.2% in the number of products exported by destination and an increase of up to 26.9% in the number of export destinations by product. For the reasons outlined in Section 6, these numbers have to be treated with caution. Nonetheless, they imply potentially sizable impacts of the Trade Facilitation Agreement on extensive margins of export, and therefore on export diversification.

For developing countries—particularly those dependent on commodity and natural resource exports—who have long sought greater export diversification, the policy implication of these estimation and simulation results ought to be clear. They should make implementation of the agreement a central part of their trade policy priorities. While one must not understate the challenge to cash-strapped developing countries of implementing trade facilitation, the Trade Facilitation Agreement itself provides vital flexibility. It allows for staged rather than immediate implementation of the provisions of the agreement based on developing countries' level of capacity. It also foresees the delivery of technical and financial assistance by bilateral, regional and multilateral donors to developing countries. The WTO has established a facility that will help developing countries assess their implementation requirements, identify possible development partners to help them meet those needs, and disseminate best practice in implementation of trade facilitation measures.

We see two potential avenues for further research. First, simulations could be based on actual implementation schedules which will have to be notified by WTO members. Second, research should focus on the effect of trade facilitation on trade margins computed from firm-level, as opposed to sector-level data.

Finally, we emphasize that we make no claim about the welfare effects of implementing the WTO Trade Facilitation Agreement. This would require us to estimate not only the benefits but also the costs of implementing the agreement. Notwithstanding this qualification, we know from the available literature that the costs of implementation of trade facilitation initiatives are relatively small (OECD, 2009; UNECA, 2013). At the same time, our estimations do not capture several other potential benefits of the agreement. A proper welfare analysis would also factor in the value of locking in commitments in a multilateral agreement and other positive spillovers, such as, for instance, the reduction in the extent of rent-seeking behavior. These topics need to be investigated further to get a more comprehensive understanding of the effects of the WTO Trade Facilitation Agreement.

DISCLAIMER

The opinions expressed in this article should be attributed to its authors. They are not meant to represent the positions or opinions of the WTO and its Members and are without prejudice to Members' rights and obligations under the WTO. Any errors are attributable to the authors.

NOTES

1. See http://www.laotradeportal.gov.la.

2. Their preferred specification explains 80.8% of the variation in trade costs. 42.8% is attributable to the 3-digit industry fixed effects. Of the 38% that the remaining regressors explain, geography and transport costs alone are responsible for about 25%; policy variables explain 7.6%, with technical barriers to trade (TBTs) being the most important policy factor (4.5%). TBTs therefore explain 11.8% of the variation in trade costs not accounted for by unobservable industry characteristics.

3. See Fernandes and Hillberry (2014) for a similar firm-level study using Albanian customs data.

4. The LPI index alone has a higher effect than the Doing Business "cost of trading" indicator. This is because improvements in the LPI also capture improvements in the quality of a nation's infrastructure.

5. As explained in Sections 3(b) and 4, this issue is further addressed by constructing extensive margins only using "new products" or "new destinations" and by using data for 2012 for the dependent variable and control variables other than TFI.

6. The full list of countries by World Bank region group, with information on the date of WTO (GATT, where applicable) membership, is available in Appendix Table 13. On the importing side we use data for all countries that report imports.

7. We only have information on indicators A-L. As indicated in Appendix Table 12, all other indicators (M-P) refer to Article 11 of the TFA, "Freedom of Transit", which is therefore excluded from the definition of trade facilitation used in this study.

8. It is important to note that the latter region does not include industrialized OECD countries—see Table 13.

9. Mirror data are not available for the years 2010, 2011, and 2012 for the following countries with TFI information: Antigua and Barbuda, Brunei Darussalam, Cuba, The Gambia, Indonesia, Iran, Kuwait, Mali, Mongolia, Papua New Guinea, Qatar and Suriname.

10. The results with all time-varying variables averaged during 2002–10 are very similar to the ones presented here and are available upon request.

11. The exception is Eaton and Kortum (2002), who derive an aggregate gravity equation across heterogeneous Ricardian sectors in which the predicted trade volume reflects an extensive margin (number of sectors/goods traded) and an intensive margin (volume of trade per good/sector).

12. Bernard, Redding, and Schott (2011) focus on variable cost liberalization. As shown by Baldwin and Forslid (2010), however, in a Melitz-type model fixed-costs trade liberalization has qualitatively identical effects as variable-costs liberalization on the mass of produced varieties, the productivity cutoffs of domestic and exporting firms and the volume of trade.

13. Since we do not work with firm-level data but with trade data comparable across countries, the HS6 level of product disaggregation is the best we can do.

14. World Bank region dummies are included because in the simulations of Section 6 we average results over such regions.

15. In what Head and Mayer (2013) call the "structural" representation of the gravity model, the multilateral resistance terms are exporter and importer specific. In cross-section estimation, it is possible to incorporate these terms as importer and exporter fixed effects à *la* (Feenstra, 2003). But since our measure of trade facilitation, TFI, is exporter specific, it is impossible to take this approach. Instead, given that the multilateral resistance terms enter multiplicatively in the gravity equation, we incorporate them as a pair or dyadic variable and estimate just one coefficient that measures their combined effect on the number of exported products.

16. All variables listed in Appendix Table 14 are self-explanatory, with the exception of the Market Access Trade Restrictiveness Index (TRI). The TRI captures the trade policy distortions imposed by the trading partners on *i*'s export bundle. It measures the uniform tariff equivalent of the partner nation tariff and non-tariff barriers (NTB) that would generate the same level of *i*'s export value in a given year. The TRI index is constructed using applied tariffs.

17. Both the Poisson and the NB fixed effect estimators are consistent even in short panels. The NB fixed effect estimator yields more efficient estimation in the presence of overdispersion (Cameron & Trivedi, 2013, p. 357). However, it does not allow for cluster-robust estimation of the variance–covariance matrix. The results are not qualitatively affected by the methodology adopted.

18. We are grateful to Richard Baldwin for suggesting the use of this variable. It is absent from $\mathbf{x}_{2i}$ because there is no partner dimension in the *ik* regressions. Furthermore, the inclusion of the variable Log(remoteness) in $\mathbf{x}_{2i}$ is to control for the multilateral resistance terms that cannot be included in the *ik* regressions, since they vary across exporter-importer pairs.

19. See Cameron and Trivedi (2013, p. 346). The Poisson and NB regressions drop observations with $npd_{ij} = 0$ across all destinations, because they do not contribute to the conditional likelihoods.

20. We do not report NB results with TFI computed using PCA. They are similar to the results in columns (6) and (7) and available upon request.

21. NB results with TFI computed using PCA are available upon request.

22. We use the Stata module developed by Ansari (2013) to compute em_{ij} and em_{ik}.

23. Sample correlations computed from columns (1) and (3) of Table 6, respectively.

24. See Section 4(a) for details on the procedure.

25. The results are available upon request.

26. We consider "developed" countries classified by the World Bank as high-income. Upper-middle-income, low-income and lower-middle-income economies are considered "developing".

27. Yi (2003)'s model shows the magnifying trade effects of tariff reductions when vertically specialized goods cross multiple borders while they are being produced. He argues that reductions in transportation costs and trade reforms more general than tariff liberalization also have a

magnifying effect on trade. Ferrantino (2012) makes the link with trade facilitation explicit. He argues that non-tariff measures (NTMs) and trade facilitation can be compared using a common metric. Efforts to reduce NTMs and efforts to increase trade facilitation should both have larger effects on trade in complex supply chains that on trade in simple supply chains. See also U.S. Chamber of Commerce (2014) and UNECA (2013) for less formal expositions, respectively by the business community and by an international organization, of the idea that trade facilitation should matter most for intermediate goods trade.

28. The results are available upon request.

29. Indeed, we obtain limited econometric evidence that this is the case. This evidence is, however, not robust across various specifications.

30. We do not report results of regressions with all indicators A-L in the same specification, because they are subject to significant collinearity issues.

31. Each cell of these tables is a different regression which includes—but does not report—all the controls of Table 4 (*ij* regressions) or of Table 5 (*ik* regressions). Standard errors in NB regressions are based on 250 bootstrap replications.

32. As shown by the standard deviations in Table 1, there is wide variation in TFI scores across countries belonging to the same geographical region. This suggests that a scenario involving convergence to the top regional performer would be unrealistic. Such a scenario is, therefore, discarded a priori. .

33. The classification of developed and developing countries is the same as in Section 5(b).

34. The simulation results using the coefficients from Poisson regressions are available upon request.

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APPENDIX

Table 12. *Mapping of OECD TFIs into DCNT and TFA provisions.*

	Indicator	DCNT Rev. 18	TFA
A.	Information availability	Articles 1 and 2	Articles 1 and 2
B.	Involvement of the trade community	Article 2	Article 2
C.	Advance Rulings	Article 3	Article 3
D.	Appeal Procedures	Article 4	Article 4
E.	Fees and charges	Article 6.1 and 6.2	Article 6.1 and 6.2
F.	Formalities—Documents	Articles 7 and 10	Articles 7 and 10
G.	Formalities—Automation	Articles 7 and 10	Articles 7 and 10
H.	Formalities—Procedures	Articles 5, 7 and 10	Articles 5, 7 and 10
I.	Cooperation—Internal	Articles 9.1 and 12	Articles 8.1 and 12
J.	Cooperation—External	Articles 9.2 and 12	Articles 8.2 and 12
K.	Consularization	Article 8	–
L.	Governance and Impartiality	–	–
M.	Transit fees and charges	Article 11	Article 11
N.	Transit formalities	Article 11	Article 11
O.	Transit guarantees	Article 11	Article 11
P.	Transit agreements and cooperation	Article 11	Article 11

DCNT stands for (WTO's) "Draft Consolidated Negotiating Text".
TFA stands for (WTO's) "Trade Facilitation Agreement".
Source: Moïsé *et al.* (2011).

Table 13. *List of countries with OECD TFI data, by World Bank region*

		Sub-Saharan Africa	
Angola (1994)	Benin (1963)	Botswana (1987)	Burkina Faso (1963)
Burundi (1965)	Cameroon (1963)	Congo (1963)	Côte d'Ivoire (1963)
Ethiopia*	Gabon (1963)	Gambia (1965)	Ghana (1957)
Kenya (1964)	Lesotho (1988)	Liberia*	Madagascar (1963)
Malawi (1964)	Mali (1993)	Mauritius (1970)	Mozambique (1992)
Namibia (1992)	Nigeria (1960)	Rwanda (1966)	Senegal (1963)
Sierra Leone (1961)	South Africa (1948)	Swaziland (1993)	Tanzania (1961)
Togo (1964)	Uganda (1962)	Zambia (1982)	Zimbabwe (1948)
		East Asia and Pacific	
Brunei Dar. (1993)	Cambodia (2004)	China (2001)	Chinese Taipei (2002)
Fiji (1993)	Hong Kong, China (1986)	Indonesia (1950)	Korea, Rep. (1967)

Malaysia (1957)	Mongolia (1997)	Papua N. G. (1994)	Philippines (1979)
Singapore (1973)	Thailand (1982)	Viet Nam (2007)	
	Europe and Central Asia		
Albania (2000)	Armenia (2003)	Azerbaijan*	Belarus*
Bosnia and Herzegovina*	Bulgaria (1996)	Croatia (2000)	Czech Rep. (1993)
Georgia (2000)	Hungary (1973)	Kazakhstan*	Kyrgyz Rep. (1998)
Latvia (1999)	Lithuania (2001)	Moldova (2001)	Montenegro (2012)
Poland (1967)	Romania (1971)	Russian Fed. (2012)	Serbia*
Slovak Republic (1993)	The FYROM (2003)	Turkey (1951)	Ukraine (2008)
	Latin America and the Caribbean		
Antigua and Barb. (1987)	Argentina (1967)	Barbados (1967)	Belize (1983)
Bolivia (1990)	Brazil (1948)	Colombia (1981)	Costa Rica (1990)
Cuba (1948)	Dominican Rep. (1950)	Ecuador (1996)	El Salvador (1991)
Guatemala (1991)	Honduras (1994)	Jamaica (1963)	Mexico (1986)
Nicaragua (1950)	Panama (1997)	Paraguay (1994)	Peru (1951)
Suriname (1978)	Trinidad and Tob. (1962)	Uruguay (1953)	Venezuela (1990)
	Middle East and North Africa		
Algeria*	Bahrain (1993)	Jordan (2000)	Kuwait (1963)
Lebanon*	Morocco (1987)	Oman (2000)	Qatar (1994)
Saudi Arabia (2005)	Tunisia (1990)	UAE (1994)	
	South Asia		
Bangladesh (1972)	Bhutan*	India (1948)	Nepal (2004)
Pakistan (1948)	Sri Lanka (1948)		
	Offshore		
Bahamas*			
	Industrial		
Australia (1948)	Belgium (1948)	Canada (1948)	Cyprus (1963)
Denmark (1950)	France (1948)	Germany (1951)	Greece (1950)
Italy (1950)	Japan (1955)	Malta (1964)	Netherlands (1948)
New Zealand (1948)	Norway (1948)	Portugal (1962)	Spain (1963)
Sweden (1950)	Switzerland (1966)	United Kingdom (1948)	United States (1948)

* WTO observer government.
Year of WTO (GATT, where applicable) membership in parentheses.
For official nation names, refer to http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm.

Table 14. *Variables list*

Variable	Description	Data source
	Dependent variables of ij regressions	
npd_{ij}	Number of products by destination	UN Comtrade
em_{ij}	Hummels and Klenow (2005) bilateral extensive margin	UN Comtrade
	Dependent variables of ik regressions	
ndp_{ik}	Number of destinations by product	UN Comtrade
em_{ij}	Product extensive margin	UN Comtrade
	Exporter controls (*matrices* $\mathbf{x_1}$, *and* $\mathbf{x_2}$)	
TFI	Average Trade Facilitation Index	OECD TFI dataset
Log(pcGDP)	Log of GDP per capita (current US$)	World Development Indicators (WDIs)
Log(market access)	Log of Market Access Trade Restrictiveness Index	Kee *et al.* (2009)
Number of PTAs	Number of Preferential Trade Agreements signed	WTO PTAs dataset
Log(area)	Log of area (sq. kms)	CEPII gravity dataset (Head *et al.*, 2010)
Landlocked	Dummy equal one if *i* is landlocked	CEPII gravity dataset (Head *et al.*, 2010)
Log(weighted *j*'s TFI)[a]	Inverse distance-weighted average of partners' TFI	OECD TFI and CEPII gravity datasets
Log(remoteness)[b]	Log of remoteness (Head & Mayer, 2013 definition)	CEPII gravity dataset (Head *et al.*, 2010)
	Pair controls (*matrix* $\mathbf{w}$)	
Log(bilateral GDP)	Log of $GDP_i^* GDP_j$ (current US$)	World Development Indicators (WDIs)
PTA	Dummy equal one if *i* and *j* have a Preferential Trade Agreement	WTO PTAs dataset
Log(distance)	Weighted distance between *o* and *d* (pop-wt, km)	CEPII gravity dataset (Head *et al.*, 2010)
Common border	Dummy equal one if *o* and *d* share a common border	– " –
Common language	Dummy equal one if *o* and *d* share an official or primary language	– " –
Colony	Dummy equal one if *o* and *d* were in a colonial relation post 1945	– " –
	Multilateral resistance (MR) controls (*matrix* $\mathbf{r}$)	
MR PTA	Baier and Bergstrand (2009) MR term based on PTA dummy	WTO PTAs dataset
MR Log(distance)	Baier and Bergstrand (2009) MR term based on Log(distance)	CEPII gravity dataset (Head *et al.*, 2010)

MR Common border	Baier and Bergstrand (2009)	MR term based on Common border dummy – " –
MR Common language	Baier and Bergstrand (2009)	MR term based on Common language dummy – " –
MR Colony	Baier and Bergstrand (2009)	MR term based on Colony dummy – " –

[a] Only in *ij* regressions.
[b] Only in *ik* regressions.

Table 15. *Correlations (ij sample)*

	npd	Log (TFI)	Log (pcGDP)	Log(market access)	Number of PTAs	Log (area)	Landlocked	Log (weighted *j*'s TFI)	Log (bilateral GDP)	PTA	Log (distance)	Common border	Common language	Colony
npd	1													
Log(TFI)	0.22*	1												
Log(pcGDP)	0.35*	0.39*	1											
Log(market access)	−0.00	0.10*	−0.26*	1										
Number of PTAs	0.23*	0.26*	0.33*	0.11*	1									
Log(area)	0.19*	0.03*	−0.17*	−0.10*	−0.03*	1								
Landlocked	−0.15*	−0.05*	−0.32*	0.04*	−0.21*	0.00	1							
Log(weighted *j*'s TFI)	0.19*	0.23*	0.38*	−0.10*	0.23*	−0.06*	0.05*	1						
Log(bilateral GDP)	0.57*	0.29*	0.40*	−0.10*	0.24*	0.32*	−0.21*	0.14*	1					
PTA	0.25*	0.09*	0.09*	0.04*	0.32*	−0.00	−0.08*	0.06*	0.17*	1				
Log(distance)	−0.29*	−0.02*	−0.053	0.07*	−0.14*	0.06*	−0.05*	−0.11*	−0.07*	−0.40*	1			
Common border	0.23*	0.01	−0.01	−0.01	0.01	0.05*	0.02*	0.01	0.05*	0.21*	−0.37*	1		
Common language	0.05*	−0.06*	−0.08*	0.10*	−0.04*	−0.04*	−0.01	−0.18*	−0.13*	0.11*	−0.11*	0.12*	1	
Colony	0.12*	0.02*	0.05*	0.00	0.05*	0.02*	−0.02*	0.03*	0.08*	0.03*	−0.03*	0.05*	0.14*	1

Correlations computed from the sample of column (7) of Table 4.
*$p < 0.05$.

Table 16. *Correlations (ik sample)*

	ndp	Log(TFI)	Log(pcGDP)	Log(market access)	Number of PTAs	Log(area)	Landlocked	Log(remoteness)
npd	1							
Log(TFI)	0.22*	1						
Log(pcGDP)	0.35*	0.38*	1					
Log(market access)	0.00	0.10*	−0.26*	1				
Number of PTAs	0.22*	0.26*	0.33*	0.11*	1			
Log(area)	0.19*	0.03*	−0.17*	−0.10*	−0.03*	1		
Landlocked	−0.15*	−0.05*	−0.32*	0.04*	−0.21*	0.00	1	
Log(remoteness)	−0.35*	−0.34*	−0.60*	0.16*	−0.47*	0.22*	0.08*	1

Correlations computed from the sample of column (7) of Table 5.
*$p < 0.05$.

Table 17. *Summary statistics, Hummels–Klenow extensive margins*

	em_{ij}			em_{ik}		
World Bank region	Mean	Sd	*N*	Mean	Sd	*N*
Sub-Saharan Africa	0.06	0.12	3,509	0.07	0.15	50,954
East Asia and Pacific	0.27	0.26	1,867	0.37	0.33	46,099
Europe and Central Asia	0.16	0.21	2,985	0.19	0.24	75,335
Latin America and Caribbean	0.10	0.17	2,991	0.13	0.20	62,038
Middle East and North Africa	0.12	0.16	1,471	0.12	0.18	28,156
South Asia	0.15	0.21	805	0.28	0.32	15,147
Offshore	0.04	0.07	106	0.05	0.09	1,242
Industrial	0.40	0.29	3,147	0.47	0.33	91,064
Whole sample	0.18	0.24	16,881	0.25	0.30	370,035

Descriptive statistics for em_{ij} computed from the sample of column (1) of Table 6.
Descriptive statistics for em_{ik} computed from the sample of column (3) of Table 6.
All descriptive statistics based on HS6 trade data.