Assessing the Benefits of Trade Facilitation: A Global Perspective

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1. INTRODUCTION

UNDERSTANDING the relationships between trade facilitation and trade flows is of growing interest, in part with the start of talks on trade facilitation in the Doha Development Agenda of the World Trade Organisation. As tariff rates of protection have fallen, assessing how other factors affect trade has increasing policy relevance. The relationship between trade flows and trade facilitation is complex, because a country's trade flows will change not only through its own reforms but also the reforms of its trading partners. Differences in the relative magnitude of trade facilitation efforts on trade, as calculated by category of trade facilitation effort or group of trading partners, could help focus and clarify development agendas. This paper defines and measures trade facilitation, and then estimates the relationships between trade facilitation and trade flows, considering the relationships from a variety of perspectives.

Empirical research on the issue of trade facilitation must address three challenges: defining and measuring trade facilitation; choosing a modelling methodology to estimate the importance of trade facilitation for trade flows; and designing a scenario to estimate the effect of improved trade facilitation on trade flows.

- It is important to *define and measure trade facilitation* with enough specificity to inform policymaking. We consider four categories of trade facilitation effort: port infrastructure, customs environment, regulatory environment and e-business infrastructures (which is a proxy for the service sectors of telecommunications and financial intermediation, which are key for all types of trade). As a first step, benchmarking a country's condition in these four

The findings, interpretations and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the World Bank, its Executive Directors, or the countries they represent nor those of the Institute for International Economics.

categories with respect to the global best practice can yield insights for policymakers.

- The *modelling methodology* has to account for the fact that both export and import trade flows will be affected by trade facilitation efforts, and that the effect of trade facilitation will differ depending on the trading patterns of the countries being examined. We include trade facilitation measures for countries as importers and as exporters in a gravity model using data on manufactures trade among 75 countries in 2000–2001. We investigate the stability of the estimated relationships across directions of trade (South-to-North, South-to-South), which may be pertinent to trade negotiations and policymakers.
- The *simulation scenario design* accounts for differences in the initial conditions for a country relative to global best practice. We design a scenario where each country improves toward best practice by a country-specific amount. Each country's trade facilitation effort is characterised by four country-specific measures of trade facilitation. Because each country has a unique trading pattern, the trade-increasing effect of improvement of one vs. another trade facilitation measure is also country specific. Results at an aggregated level – the relative gains across geographical regions, trade facilitation categories and who is undertaking reforms (domestic or trading partners) – are shown in this paper.

2. OVERVIEW OF PREVIOUS WORK

a. Definition of Trade Facilitation

There is no standard definition of trade facilitation in public policy discourse. In a narrow sense, trade facilitation simply addresses the logistics of moving goods through ports or more efficiently moving customs documentation associated with cross-border trade. In recent years, the definition has been broadened to include the environment in which trade transactions take place, including the transparency and professionalism of customs and regulatory environments, as well as harmonisation of standards and conformance to international or regional regulations. These move the focus of trade facilitation efforts 'inside the border' to domestic policies and institutional and governance structures. In addition, with the rapid integration of networked information technology, including telecommunications for data flows and financial infrastructure to support the fragmentation of the international value-chain, modern definitions of trade facilitation include these services infrastructure as well.

In light of this broadening definition of trade facilitation, our definition of trade facilitation incorporates relatively concrete 'border' elements, such as port

efficiency and customs administration, and 'inside the border' elements, such as domestic regulatory environment and the services infrastructure to enable the effective use of information technology for e-business.

b. Measuring the Impact of Trade Facilitation

The empirical literature on trade facilitation is limited; it is outlined in more detail in Wilson, Mann and Otsuki (2003) (henceforth WMO). Early work discussed concepts of trade facilitation, but not measurement or estimation of the effect on trade (Maskus, Wilson and Otsuki, 2001; and Asia Pacific Foundation of Canada, 1999). Subsequent work used a single measure of trade facilitation in a computable-general-equilibrium (CGE) framework to estimate effects of a trade facilitation 'shock' on trade, with large gains from improved trade facilitation suggested, including that the elasticity of trade flows with respect to trade facilitation could be greater than one and that improved efficiency of services infrastructure are estimated to yield large gains.[1]

Other authors consider specific measures of trade facilitation (including 'inside the border' measures) or estimate the relationships for a limited country set. 'Inside the border' measures, for example, include the effects of greater standards harmonisation on Japan-Singapore trade, addressed in Hertel, Walmsley and Itakura (2001) and more generally in Moenius (2000); the impact of anti-competitive practices in port and transport services in Fink, Mattoo and Neagu (2002a); the impact of tighter European food standards on African trade in certain cereals, nuts and dried foods in Otsuki, Wilson and Sewadeh (2001a and 2001b). With respect to defining trade facilitation as inclusive of services infrastructure and information technology, Freund and Weinhold (2000) consider the impact of web hosts and Fink, Mattoo and Neagu (2002b) address the price of telecommunications. Finally, Hummels (2001) links trade facilitation measures to tariffs, finding that each day saved in shipping time (due in part to faster customs clearance – a trade facilitation category) is worth a 0.5 percentage point reduction of *ad valorem* tariffs.

WMO advance these approaches to understanding the relationship between trade facilitation and trade flows in two ways: First, they construct four measures of trade facilitation (port efficiency, customs environment, regulatory environment, e-business usage) using country-specific survey and hard data. Then, they estimate the independent effects of the four measures on the trade flows among a broad group of countries in the Asia-Pacific region using an augmented 'gravity' model of trade. Finally, they use the estimated model to simulate the effect

[1] See *Paperless Trading: Benefits to APEC* (2001, p. 18); *Assessing APEC Trade Liberalization and Facilitation: 1999 Update*, Economic Committee (September 1999, p. 11); and UNCTAD, *E-Commerce and Development Report 2001* (Tables 8–11, pp. 33–36).

of country-specific improvements in each trade facilitation measure for that country's trade and for APEC-wide trade. They find that, on average, trade flows for the region are most closely associated with port efficiency. However, since each country has a unique set of trade facilitation measures and patterns of trade, detailed analysis of the simulation results shows that trade flows for a specific country might be most greatly increased through the improvement of a trade facilitation measure other than port efficiency.

OECD (2003) brings the innovations from the WMO approach into the CGE framework. They decompose trade transactions costs into direct costs (expenses associated with supplying information and documents to authorities) and indirect costs (procedural delays) and develop proxies for each economy in each of the two areas using some of the survey data utilised by WMO.

3. DATA USED IN THIS STUDY

a. Rationale for These Indicators of Trade Facilitation

Quantitative analysis of trade facilitation requires developing measures of trade facilitation. WMO present four distinct areas of focus that meet policymakers' needs for specificity on how to approach trade facilitation reforms. They are: (1) port efficiency, (2) customs environment, (3) own regulatory environment and (4) service sector infrastructure (for effective use of information technology).

Port efficiency is designed to measure the quality of infrastructure of maritime and air ports. Customs environment is designed to measure direct customs costs as well as administrative transparency of customs and border crossings. Regulatory environment is designed to measure the economy's approach to regulations. Service sector infrastructure[2] is designed to measure the extent to which an economy has the necessary domestic infrastructure (such as telecommunications, financial intermediaries and logistics firms) and is using networked information to improve efficiency and to transform activities to enhance economic activity.[3]

Not only do these categories match areas for policymaker attention, these trade facilitation measures also match several GATT articles and appear in the list of Singapore issues in the Doha Development Agenda, and therefore have salience for WTO negotiations. The *port efficiency* measure has been constructed in accordance to GATT Article V (freedom of transit). This article says that

[2] WMO used a different terminology – e-business usage – for this category.
[3] For further discussion of the relationship between domestic infrastructure and e-commerce, see Mann, Eckert and Knight (2000).

freedom of movement is to be assured for goods, which should be allowed to move via the most convenient route, should be exempt from customs or transit duties and should be free from unnecessary delays or restrictions. *Customs environment* here consists of components that have their basis in GATT Article VIII. GATT Article VIII states that in order to minimise impediments to trade due to customs procedures, fees charged by customs officials must be limited to the approximate cost of customs services. Also, there should not be substantial penalties for minor breaches of customs regulations such as clerical errors. *Regulatory environment* issues are contained in GATT Article X that discusses Publication and Administration of Trade Regulations. This article comes from the basic transparency obligation that requires prompt publication of laws and regulations affecting imports and exports so that foreign governments and traders may clearly understand them. *Services infrastructures* are a key area for trade negotiation in the Doha Development Agenda.

b. Constructing the Measures Used in This Study

This paper builds on the WMO methodology and categories of trade facilitation. However, because this paper broadens the set of countries for analysis to 75, the cross-country survey data on business and policy climate that are used to construct the four measures for each country are somewhat different from the data used in WMO. In this study we rely on three sources – World Economic Forum, *Global Competitiveness Report 2001–2002* (henceforth GCR), IMD Lausanne, *World Competitiveness Yearbook 2002* (henceforth WCY), and Kaufmann, Kraay and Zoido-Lobaton (2002) (henceforth KKZ).[4]

[4] Survey information, such as those from these sources needs to be used with care, but is the only data available today for specific assessment, by a wide set of respondents, on the categories of trade facilitation that we would like to address. These sources are transparent with respect to the survey questions, the sample surveyed, and present statistical analyses of their samples. In the World Economic Forum, *Global Competitiveness Report 2001–2002*, all survey data are from the World Economic Forum's Executive Opinion Survey of senior business leaders in 4,022 firms in different countries. Chapter 2.7 of that volume describes the survey sample set as well as presents robustness analysis of the survey data. IMD Lausanne, in *World Competitiveness Yearbook 2002*, uses a 115 question survey sent to executives in top and middle management of firms in 49 countries. The sample size of each country is proportional to its GDP, and firms 'normally have an international dimension'. The firms are selected to be a cross-section of manufacturing, service and primary industries. There were 3,532 responses to the survey in 2000. The chapter 'Methodology and Principles of Analysis' addresses statistical properties of the survey sample results. Finally, the database compiled for Kaufmann, Kraay and Zoido-Lobaton (2002) contains more than 300 governance indicators for 175 countries compiled from a variety of sources in 2000–2001. Six aggregate indicators are constructed corresponding to six basic governance concepts: Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption.

Because the survey scales of the sources differ, we must put all survey data from the three sources on a comparable basis. In contrast to WMO, we index each observation of a raw series (which is an observation representing a country) to the maximum of all the countries' value for the raw series (e.g. global best practice).[5] We use the maximum as a benchmark since this easily indicates how far a country's performance is from the best-practice country whose indexed value is 1.0.

Two survey data inputs are used to form each of the trade facilitation measures. We use two survey inputs into each trade facilitation indicator to avoid depending too heavily on any one survey question or source.

The next step in creating the trade facilitation indicators involves collecting these indexed inputs into the four specific trade facilitation indicators. A simple average of the two indexed inputs is used for transparency of method, and also because there is no specific argument (theoretical or statistical) to choose a different aggregation method. The indicators and inputs we use are as follows and Table 1 provides summary statistics for the indicators and inputs:

- Port efficiency for each country *J* is the average of two indexed inputs from GCR:
  - Port facilities and inland waterways
  - Air transport
- Customs environment for each country *J* is the average of two indexed inputs from GCR:
  - Hidden import barriers
  - Irregular extra payments and bribes
- Regulatory environment for each country *J* is constructed as the average of indexed inputs from WCY and KKZ:[6]
  - Transparency of government policy is satisfactory (WCY)
  - Control of corruption (KKZ)
- Service sector infrastructure for each country *J* is from GCR:
  - Speed and cost of Internet access
  - Effect of Internet on business.

Within each of the trade facilitation categories, the correlation of the inputs that go into the final index are high, but less than one suggesting robustness of the methodology of using more than one survey series to construct the measure. As well, this raises confidence that the measure is correctly assessing each country on that particular indicator of trade facilitation. Correlation coefficients

[5] WMO used the mean of all countries as a benchmark for each of the indices.

[6] Since only 49 countries are available in WCY, only the indexed input from KKZ is used for the 'regulatory environment' indicator for the remaining 26 countries.

TABLE 1
Summary Statistics for Values of Trade Facilitation Indicators

Category	*Indexed Inputs*	*Source*	*Mean*	*Std. Dev.*	*Min.*	*Min. Importer*	*Max.*	*Max. Importer*
Port Efficiency	Ports Facilities	GCR	0.636	0.189	0.261	Bolivia	1.000	Singapore
	Air Transport	GCR	0.710	0.166	0.229	Slovak Republic	1.000	Singapore
Aggregate Index			0.673	0.169	0.345	Bolivia	1.000	Singapore
Customs	Hidden Import Barriers	GCR	0.702	0.167	0.368	Paraguay	1.000	Finland
Environment	Bribery	GCR	0.689	0.175	0.343	Bangladesh	1.000	Iceland
Aggregate Index			0.695	0.163	0.384	Paraguay	0.979	Finland
Regulatory	Transparency of Government Policies	WCY	0.619	0.205	0.089	Argentina	1.000	Finland
Environment	Control of Corruption	KKZ	0.746	0.140	0.530	South Africa	1.000	Finland
Aggregate Index			0.689	0.139	0.353	Venezuela	1.000	Finland
Service Sector	Speed and Costs of Internet Access	GCR	0.629	0.162	0.348	Vietnam	1.000	Finland
Infrastructure	Effect of Internet on Business	GCR	0.719	0.102	0.481	Greece	1.000	Finland
Aggregate Index			0.674	0.121	0.482	Mauritius	1.000	Finland

Source: Authors' calculations based on *Global Competitiveness Report 2001–2002*, Kaufmann, Kraay and Zoido-Lobaton (2002) and *World Competitiveness Yearbook 2002*.

of the two inputs to each of the trade facilitation measures are 0.802, 0.820, 0.696 and 0.658 for the port efficiency, customs environment, regulatory environment and service sector infrastructure, respectively.

c. Trade Flows and Other Key Variables

We use bilateral trade flow data available at the Commodity and Trade Database (COMTRADE) of the United Nations Statistics Division for 2000 and 2001.

Manufactured goods are defined as commodities in categories 5 to 8 at the one-digit level of the Standard International Trade Classification (SITC Revision 1) except those in category 68 (non-ferrous metals), which are at the two-digit level. Our trade flow data aggregate the disaggregated trade data over the manufactured goods for a given importer-exporter pair.[7]

Tariff data were derived from the Trade Analysis and Information System (TRAINS) of the United Nations Conference on Trade and Development (UNCTAD). We use the weighted average of applied tariff rates for the manufactured goods for 2000 and 2001 under the above definition where bilateral trade values corresponding to each tariff line are used as the weight. Applied tariff rates are particularly important for some nations since, unlike the EU whose tariff policies are harmonised, applied tariff rates generally vary across most other countries and possibly across their exporting partners.

The data on gross national product (GNP) and GNP per capita were derived for years 2000 and 2001 from the World Development Indicators published by the World Bank and are in 1995 US dollars.

4. THE ECONOMETRIC MODEL AND RESULTS

a. An Aside on the Gravity Model

The gravity model of international trade flows, which we use, is a common approach to modelling bilateral trade flows. It is enjoying a resurgence given its affiliation with current interest in the relationships between geography and trade. The standard empirical formulation for the gravity model includes various measures of supplier and market size (GDP, population, GDP per capita to account for intra-industry trade effects that may be associated with countries of similar incomes but varied tastes). To this basic formulation, and as the focus of hypothesis testing, measures of trade augmentation and trade barriers are often

[7] A full set of bilateral data pairs would yield 9,560 observations, but some of the import data are missing, yielding 7,904 observations – an 83 per cent observation ratio.

added, including regional trade arrangements, language/ethnic similarities, distance, adjacency, land-locked, island. For our hypothesis testing, we will add tariffs as well as the trade facilitation indicators and some additional factors, as described further below.

Despite the empirical success of gravity models to mimic trade patterns, there are serious questions as to its theoretical validity. Some studies add structural elements to the gravity model to better reflect world trade, focusing in particular on the heterogeneity of traded goods in quality and price by origin, and price differentials associated with border and transportation costs (Anderson, 1979; Anderson and van Wincoop, 2003; and Balistreri and Hillberry, 2001).

Moreover, the empirical specification of the gravity model has also been questioned, in part because of this same heterogeneity in trade. Work by Maytas (1997), Moenius (2000), Egger and Pfaffermayr (2003) and Cheng and Wall (2004) point to potential bias in the estimated coefficients (most dramatically of the trade augmentation and trade barriers variables) because of misspecification of the intercept term. Their work argues that a correct specification of the gravity model is parsimonious in specific economic variables (including only GNP, population, and a few other country-time-varying terms) and is rich in fixed effects (for countries as importers, as exporters and as joint trading pairs) and time effects.

b. Our Gravity Model Specification

The basic structure of a gravity equation is the following:

$$Y_{JI}^{t} = \beta_0 + \sum_{k=1}^{K} \beta_k z_{k,JI}^{t} + \varepsilon_{JI}^{t},$$

where Y_{JI}^{t} is value of trade flows, $z_{k,JI}^{t}$ ($k = 1, 2, \ldots, K$) corresponds to the gravity variables (such as GDP, GDP per capita).

Egger and Pfaffermayr show that the error term $\varepsilon_{JI}^{t} = \alpha_J + \alpha_I + \alpha_{JI} + \gamma^t + e_{JI}^{t}$ is a composite of exporting (importing) country fixed effects, $(\alpha_J)(\alpha_I)$ such as variations in trade flows due to the unobserved difference in quality of goods and domestic policies in exporting (importing) countries; pairwise unique unobservable trade relationships, (α_{JI}); time-specific fixed effects, (γ^t); and the random error term, (e_{JI}^{t}), which is assumed to be normally distributed with mean zero.

Egger and Pfaffermayr and Cheng and Wall show the importance of taking account of country fixed effects when hypothesis testing focuses on potential trade enhancing or reducing effects of, for example, regional trade arrangements, language/ethnic similarities, distance, adjacency, land-locked and island.

Our gravity model specification addresses country heterogeneity through the trade facilitation variables, rather than incorporate hypothesis-free country

fixed effects. We test for the statistical significance of these trade facilitation variables using partner fixed effects. In addition, we include other trade enhancing and reducing variables often included in gravity equations. Our initial specification is:

$$\begin{aligned}\ln(V_{JI}^t) = {} & a_0 + b_1 \ln(100 + \text{TARIFF}_{JI}^t) + b_2 \ln \text{PE}_J + b_3 \ln \text{RE}_J + b_4 \ln \text{SI}_J + b_5 \ln \text{PE}_I \\ & + b_6 \ln \text{CE}_I + b_7 \ln \text{RE}_I + b_8 \ln \text{SI}_I + b_9 \ln(\text{GNP}_I^t) + b_{10} \ln(\text{GNP}_J^t) \\ & + b_{11} \ln(\text{GNPPC}_I^t) + b_{12} \ln(\text{GNPPC}_J^t) + b_{13} \ln(\text{DIST}_{IJ}) + b_{14} D_{ADJ} \\ & + b_{15} D_{ASEAN} + b_{16} D_{NAFTA} + b_{17} D_{LAIA} + b_{18} D_{AUNZ} + b_{19} D_{MERCOSUR} + b_{20} D_{EU} \\ & + b_{21} D_{ENG} + b_{22} D_{FRC} + b_{23} D_{SPN} + b_{24} D_{ARB} + b_{25} D_{CHN} + b_{26} D_{GMN} \\ & + b_{27} D_{POR} + b_{28} D_{RUS} + b_{29} D_{2000} + \varepsilon_{JI}^t, \end{aligned} \tag{1}$$

where I and J stand for the importer and exporter respectively, and t denotes trading years ($t = 2000, 2001$). Parameter b's are coefficients. V_{JI} is the value of manufactures exports from country J to I so V_{JI} is exporter to importer. The term TARIFF_{JI}^t denotes applied tariff rate in the per cent *ad valorem* term that is specific to the trading partners I and J and year t. A dummy for year 2000 D_{2000} is included in the model to control for time-specific shocks. Incorporating both the TARIFF_{JI} and the time dummy D_{2000} effectively addresses the pairwise unobservable relationship and the time component of the residual.

The terms PE_J, RE_J and SI_J denote exporting country J's indicators of port efficiency, regulatory environment and service sector infrastructure. Similarly, PE_I, RE_I and SI_I stand for the same trade facilitation measures in the importing country. For the importing country we include one additional measure, i.e. 'customs environment' or CE_I. We use 'customs environment' only for the importers since in bilateral trade customs is more relevant as a factor affecting imports than exports. These country-specific variables effectively address the country-specific fixed effects of the residual.

The term GNP denotes gross national product and GNPPC denotes per capita GNP, where both are expressed in 1995 US dollar terms.

Additional variables are often included in standard gravity specifications (although recall the caveat findings of Egger and Pfaffermayr and Cheng and Wall): Geographical distance between capital cities I and J is denoted as DIST_{IJ}. Dummy variables are included to capture the effect of preferential trade arrangements, language similarity and adjacency. The trade arrangements dummies include NAFTA (D_{NAFTA}), ASEAN (D_{ASEAN}), LAIA (D_{LAIA}), AUNZ (D_{AUNZ}), MERCOSUR ($D_{MERCOSUR}$) and EU (D_{EU}). The language dummies include English (D_{ENG}), French (D_{FRC}), Spanish (D_{SPN}), Arabic (D_{ARB}), Chinese (D_{CHN}), German (D_{GMN}), Portuguese (D_{POR}) and Russian (D_{RUS}). The adjacency dummy D_{ADJ} takes the value of one if country I is adjacent to country J and zero otherwise. We test the statistical significance of these variables in various formulations.

c. Regression Results

Our approach to construct country-specific, trade-direction-specific and distinct set of trade facilitation indicators and deploy them in a gravity model of trade is generally successful. The model was run using an ordinary least squares (OLS). Table 2 and Table 3 display regression results. In Table 2 we compare alternative additional variables. Column (1) includes the estimated coefficients and standard errors for the model under the specification in equation (1). Column (2) shows a more parsimonious specification of FTA and language dummies (i.e. membership of any FTA, or any common language). Foreign direct investment may be another factor affecting bilateral trade flows, results shown in column (3).[8]

In Table 3, we test for possible spurious relationships between the trade facilitation variables and trade, as compared with a hypothesis-free fixed-effects specification. Column (1) shows the original specification with importer and exporter trade facilitation variables. Column (2) replaces the importers' trade facilitation variables with importer fixed effects. Column (3) then replaces exporters' trade facilitation variables with exporter fixed effects.

Throughout, the coefficients for tariffs and the four trade facilitation measures are statistically significant and quite robust to the alternative specifications and replacement with fixed effects for the trading partner. The value of the tariff coefficient is somewhat higher in the trade facilitation and fixed-effects models (Table 3, columns (2) and (3) compared with (1)). The coefficients on the customs trade facilitation variable and the e-business trade facilitation variable are a bit lower in the exporter fixed-effect specification (column (3)). But the estimated trade facilitation coefficients for the exporters' trade facilitation variables (with importers' fixed effects) are virtually unchanged. This is particularly useful because of the role that these estimated exporter trade facilitation coefficients play in the simulations and analysis.

From a policy perspective, the fact that the trade facilitation variables each have a different estimated relationship to trade flows implies that improvement in one category of trade facilitation will yield a different effect on trade than improvement in another category of trade facilitation.

Before considering the impact of trade facilitation, consider the effect of tariffs and distance. Higher tariffs have a significant and the expected negative effect (with –1.2 coefficient) on trade. The coefficient on tariffs is similar to that of distance. In *ad valorem* terms, the elasticity of tariff is –1.2 at the global average level of tariff rates – i.e. 1 per cent reduction in *ad valorem* tariff from the global average (from 8.5 per cent to 7.5 per cent) would be associated with an increase in trade of 1.2 per cent and a 1 per cent reduction in distance (80 kilometres from

[8] Data from the *World Investment Report* (UNCTAD, 2004).

TABLE 2
Regression Results – Alternative Additional Variables

	Model 1		*Model 2*		*Model 3*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
Constant	−10.641***	1.558	−10.771***	1.549	−10.115***	1.574
Tariff Rates	−1.155***	0.318	−1.163***	0.318	−1.109***	0.322
Port Efficiency of Importer	0.307*	0.163	0.338*	0.160	0.277*	0.163
Port Efficiency of Exporter	0.924***	0.148	0.938***	0.146	1.075***	0.152
Customs Environment of Importer	0.472**	0.199	0.486*	0.199	0.484**	0.201
Regulatory Environment of Importer	0.281*	0.144	0.264	0.144	0.276*	0.145
Regulatory Environment of Exporter	0.620***	0.132	0.580***	0.131	0.577***	0.133
Service Sector Infrastructure of Importer	0.729***	0.224	0.657**	0.224	0.744**	0.226
Service Sector Infrastructure of Exporter	1.943***	0.216	1.943***	0.217	1.768***	0.219
GNP of Importer	0.915***	0.014	0.915***	0.014	0.910***	0.014
Per Capita GNP of Importer	−0.182***	0.037	−0.210***	0.037	−0.166***	0.038
GNP of Exporter	1.246***	0.014	1.241***	0.014	1.140***	0.026
Per Capita GNP of Exporter	−0.226***	0.029	−0.251***	0.029	−0.215***	0.030
Geographical Distance	−1.258***	0.025	−1.225***	0.025	−1.282***	0.026
Adjacency Dummy	0.336***	0.114	0.426***	0.108	0.326**	0.114
Membership Dummy for any FTA			−0.021	0.078		
Foreign Direct Investment – Inflows					0.169***	0.026
Foreign Direct Investment – Outflows					−0.034***	0.007
ASEAN Membership Dummy	0.509***	0.190			0.461**	0.189
NAFTA Membership Dummy	−0.645	0.501			−0.691	0.499
LAIA Membership Dummy	0.593***	0.154			0.627***	0.154
AUNZ Membership Dummy	1.118	0.858			1.051	0.854
MERCOSUR Membership Dummy	0.229	0.302			0.224	0.301
EU Membership Dummy	−0.515***	0.106			−0.606***	0.108

Dummy for any Common Language			0.823***	0.061		
English Language Dummy	0.808***	0.089			0.807***	0.090
French Language Dummy	−1.413***	0.500			−1.763**	0.607
Spanish Language Dummy	0.598***	0.098			0.537***	0.980
Arabic Language Dummy	−1.223	0.992			−1.439	1.207
Chinese Language Dummy	1.747***	0.406			1.610***	0.405
German Language Dummy	−0.826	0.505			−0.840*	0.503
Portuguese Language Dummy	0.569	0.986			0.589	0.981
Russian Language Dummy	2.026***	0.362			2.007***	0.361
Year 2000 Dummy	−0.031	0.039	−0.038	0.039	−0.039	0.039
Adjusted *R*-squared	0.758		0.755		0.759	
Number of Observations	7,904		7,904		7,713	

Note:
The significance levels at 10 per cent, 5 per cent and 1 per cent are denoted by *, ** and ***, respectively.

Source: Authors' calculations.

TABLE 3
Regression Results – Trade Facilitation Variables Compared to Fixed Effects

	Model 1 (Original)		*Importer Fixed Effects (2)*		*Exporter Fixed Effects (3)*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
Constant	–10.641***	1.558	–72.756	74.139	–40.757	57.342
Tariff Rates	–1.155***	0.318	–2.669***	0.440	–1.926***	0.258
Port Efficiency of Importer	0.307*	0.163			0.769***	0.131
Port Efficiency of Exporter	0.924***	0.148	0.897***	0.143		
Customs Environment of Importer	0.472**	0.199			0.627***	0.159
Regulatory Environment of Importer	0.281*	0.144			0.281**	0.115
Regulatory Environment of Exporter	0.620***	0.132	0.640***	0.128		
Service Sector Infrastructure of Importer	0.729***	0.224			0.490**	0.179
Service Sector Infrastructure of Exporter	1.943***	0.216	1.960***	0.209		
Geographical Distance	–1.258***	0.025	–1.408**	0.028	–1.208***	0.022
Adjacency Dummy	0.336***	0.114	0.232***	0.111	0.260**	0.092
Year 2000 Dummy	–0.031	0.039	–0.037	0.054	–0.013	0.042
Adjusted *R*-squared	0.758					
R-squared – Within			0.716		0.713	
R-squared – Between			0.558		0.240	
R-squared – Overall			0.333		0.326	
Number of Observations	7,904		7,904		7,904	

Notes:
The significance levels at 10 per cent, 5 per cent and 1 per cent are denoted by *, ** and ***, respectively.
Regressions include all the variables in Model (1) – estimated coefficient not shown.

Source: Authors' calculations.

the global average) would yield a 1.3 per cent increase in trade flow. These figures are useful benchmarks against which to compare the coefficients on the trade facilitation indicators.

Port efficiency of both the importer and the exporter is positively associated with trade; that is, an improvement in the indicator toward global best practice is associated with an increase in trade flows. Comparing the effect of port efficiency on imports vs. exports, the coefficient is higher for exporters than importer (0.92 vs. 0.31), which implies that global trade flows get a bigger boost when the exporters' port efficiency improves. For countries and regions that are well below global best practice, such as Bolivia and the Slovak Republic (from Table 1) there is great potential for exports coming from an improvement in port efficiency. The range of this measure for exporters is the largest among the trade facilitation indicators (again see Table 1). So, the opportunities for increased global trade from improvements in this measure of trade facilitation could be quite large.

Customs environment also has a significantly positive association with trade of the importing country with a coefficient of 0.47, smaller than that for tariffs. Although the two metrics are different (*ad valorem* for tariffs and survey indicator for customs), the sign and size of coefficient support the attention to customs as a Singapore issue in the Doha Development Agenda. Trade facilitation through customs improvements is a possible avenue to reduce the cost of imports even as tariffs remain where they are.

Improving the regulatory environment of the importer and exporter has a positive and significant association with trade with coefficients of 0.28 and 0.62, respectively. Regulatory transparency and control of corruption (the two inputs) reduce unnecessary information costs of trading and reduce barriers to private business.[9]

Improving indicators of service sector infrastructure are positive and significantly associated with trade among the studied countries. Similar to port efficiency and regulatory environment, service sector infrastructures have a more significant positive association for export trade than for imports. The coefficient of the exporters' service sector infrastructure is the highest among all trade facilitation measures (1.94). This high coefficient reflects the important role that services play in all types of trade.[10]

For all the trade facilitation indicators that are paired (that is, are estimated for both exporters and importers), the coefficient for exporters exceeds that for

[9] The sign of the coefficient for regulatory environment of importer is reversed from that in WMO, which had a different approach to constructing the regulatory measure.

[10] Other research investigates the relative magnitude of service sector liberalisation compared to manufactures and agricultural liberalisation in the context of the Uruguay Round and the Doha Agenda. Several researchers conclude that liberalisation of services trade would yield at least as large an increase in GDP than does liberalisation of manufactures trade, and much larger than liberalisation of agriculture trade. See the discussion and sources in Mann, Rosen and APEC (2001, 2002, pp. 33–35).

TABLE 4
Regression Results (South-to-South and South-to-North Trade)

	Full Sample	*South-to-North Trade*	*South-to-South Trade*
Tariff Rates	–1.555***	–1.512	–1.5***
Port Efficiency of Importing Country	0.307*	0.344	–0.283
Port Efficiency of Exporting Country	0.924***	0.845***	0.949***
Customs Environment of Importing Country	0.472**	1.041	0.202
Regulatory Environment of Importing Country	0.281*	–1.120*	0.816***
Regulatory Environment of Exporting Country	0.620***	2.437***	0.827***
Service Sector Infrastructure of Importing Country	0.729***	2.134***	0.866
Service Sector Infrastructure of Exporting Country	1.943***	2.124***	3.133***
Adjusted *R*-squared	0.758	0.702	0.649
Number of Observations	7,904	2,188	3,094

Note:
The significance levels at 10 per cent, 5 per cent and 1 per cent are denoted by *, ** and ***, respectively.

Source: Authors' calculations.

importers. There are several reasons why this might be the case. First, in the sample of countries, there are 30 developed countries (North) and 45 developing countries (South). Thus, the sample is weighted toward developing countries where the coefficient relating trade facilitation indicators to trade could be higher than for the developed countries whose trade facilitation indicators are already high. (We confirm this hypothesis in the next section.) Second, there are more observations in the sample of South-South trade even if the value of trade North-North and South-North trade is larger. So, the estimated coefficients in the aggregate would tend toward the higher coefficient relating trade and trade facilitation from the South to the North.

To further investigate this issue, as well as to shed light on the potential for capacity building in the area of trade facilitation in the South, we examined the gravity model using several sub-sets of the 75-country bilateral trade. Specifically, we re-estimated the model on South-to-North trade and on South-to-South trade. Table 4 presents the results for the trade facilitation indicators for these two sub-panels. (The coefficients from the full panel are also shown.)

Comparing across the three groups, several points emerge. In the South-to-North panel, many of the variables added to the gravity model for the North (as importer) are not significant – tariffs, port efficiency, the customs environment, and (nearly) the regulatory environment. The lack of significance on tariffs suggests that tariffs are not the major impediment to South-to-North trade.[11] The fact

[11] This does not reject the focus on market access for South manufactures, given that there are other sources, such as quotas and regulations that limit South exports to the North. See simulations that follow.

that the trade facilitation indicators are nearer to global best in the North means that the other variables in the gravity model (such as GDP) dominate in estimation. On the other hand, the service sector infrastructure indicator has a higher coefficient than in the full sample for both importer and exporter; corroborating work cited earlier on the benefits of more web-hosts and lower telecommunications costs for trade. The high coefficient on regulatory environment in the exporting country (South) would support a focus on capacity building in this area in the South.

Second, compare the South-to-South panel with the other two samples. Tariffs are once again significant, suggesting that South-to-South trade is more affected by tariffs than is South-to-North trade.[12] Regulatory environment appears to be very important for both directions of trade. Looking at all the indicators, the coefficient estimated on the exporter is larger than the full sample and larger than for the importer in the restricted sample, suggesting that trade facilitation efforts could complement more direct approaches to export promotion in the South.

d. Implications of Geographical Characteristics

Geographical characteristics such as being landlocked or an island can affect trade. Frankel and Rose (2000) included dummy variables for those geographical characteristics to allow for the intercept term to vary accordingly. We additionally allow for the coefficient for trade facilitation indicators to vary according to those characteristics. Our particular interest is whether ports play a more important role in the import and export of landlocked countries, or whether ports play a less important role for island countries. Ports may play a less important role in trade between countries that share land borders. We perform this analysis by introducing cross-product terms between the port efficiency indicators and these geographical characteristics based on the main regression model.

Landlocked, island and adjacency variables are used here to differentiate the effect of port efficiency. Table 5 indicates the results for varied specifications. In the first three columns one characteristic is considered at a time. In the fourth column landlocked and island are jointly considered as these characteristics are mutually exclusive. The last column allows for the coefficients for port efficiency to vary with respect to all three characteristics.

Consider first geographical adjacency. As expected, for countries that share land borders, ports are less important than for countries that do not. Interpreting the estimates for landlocked and island is more difficult. For landlocked countries, ports are as important for both import and export as in non-landlocked

[12] Both bound and applied tariff rates are about six times higher in the South than in the North (International Monetary Fund and World Bank, 2001).

TABLE 5
The Effect of Port Efficiency by Geographical Characteristics

Port Efficiency of Importer	0.333**	0.311*	0.368**	0.303*	0.357**
	(0.165)	(0.163)	(0.164)	(0.165)	(0.166)
Landlockedness*Port Efficiency of Importer	−0.157			−0.128	−0.126
	(0.783)			(0.783)	(0.781)
Island*Port Efficiency of Importer		1.198**		1.223**	1.307**
		(0.604)		(0.606)	(0.605)
Adjacency*Port Efficiency of Importer			−1.360***		−1.333***
			(0.409)		(0.410)
Port Efficiency of Exporter	0.940***	0.866***	1.007***	0.982***	1.057***
	(0.149)	(0.149)	(0.149)	(0.150)	(0.150)
Landlockedness*Port Efficiency of Exporter	0.268			0.229	0.424
	(0.836)			(0.835)	(0.835)
Island*Port Efficiency of Exporter		−2.000***		−2.107***	−2.038***
		(0.612)		(0.614)	(0.612)
Adjacency*Port Efficiency of Exporter			−1.582***		−1.592***
			(0.388)		(0.389)
Customs Environment of Importer	0.461**	0.461**	0.431**	0.444**	0.402**
	(0.200)	(0.199)	(0.199)	(0.200)	(0.199)
Regulatory Environment of Importer	0.283**	0.294**	0.279*	0.288**	0.287**
	(0.144)	(0.143)	(0.143)	(0.144)	(0.143)
Regulatory Environment of Exporter	0.619***	0.608***	0.607***	0.624***	0.610***
	(0.132)	(0.132)	(0.132)	(0.132)	(0.132)
Service Sector Infrastructure of Importer	0.713***	0.745***	0.753***	0.764***	0.791***
	(0.225)	(0.224)	(0.224)	(0.225)	(0.225)
Service Sector Infrastructure of Exporter	1.936***	2.002***	1.944***	1.867***	1.874***
	(0.217)	(0.218)	(0.216)	(0.218)	(0.217)
Tariff Rates	−1.161***	−1.239***	−1.127***	−1.205***	−1.177***
	(0.319)	(0.318)	(0.318)	(0.318)	(0.318)
Landlockedness Dummy	0.328			0.324	0.386
	(0.794)			(0.793)	(0.791)
Island Dummy		−0.260		−0.263	−0.222
		(0.483)		(0.370)	(0.370)
Adjacency Dummy	0.329***	0.331***	−0.955***	0.329***	−0.953***
	(0.114)	(0.113)	(0.235)	(0.114)	(0.235)
Adjusted *R*-squared	0.759	0.761	0.760	0.760	0.761

Note:
The significance levels at 10 per cent, 5 per cent and 1 per cent are denoted by *, ** and ***, respectively.

Source: Authors' calculations.

countries since the product terms are insignificant. Landlocked countries are disadvantaged in maritime transport but may have developed ground and air transport infrastructure and our port efficiency indicator is a combination of both types of ports. For island countries, it appears that ports are more important for their import and less important for their export compared to non-island countries. This result is difficult to interpret, but is consistent with some research that finds that small island economies are disadvantaged in export trade because they cannot offer a scale of production sufficiently large to compete in international markets or be part of an international value chain in production (Winters, 2004).

e. Robustness of the OLS Estimators

OLS estimation imposes the assumption that the error term is identically distributed. This assumption often is inappropriate for grouped data where the error term is heteroscedastic. Robustness of the OLS estimated standard error of the coefficients is examined by running weighted least squares (WLS) that corrects the error term for heteroscedasticity by using the estimated variance for importer (column (2) in Table 6) or exporter (column (3)). These results are compared with the main result displayed in column (1). The comparison reveals sensitivity of some of the estimated coefficients to specifications. Statistical significance varies across specifications, as do size of coefficients. However, most of the signs of coefficients remain unchanged with an exception of regulatory environment variables. Combining the results in Table 3 associated with alternative fixed-effects assumptions, we can conclude that the signs of the estimated coefficients are reasonably robust. But, the size of coefficients varies across specifications, and hence the size of coefficients must be viewed with caution.

5. POTENTIAL BENEFITS FROM TRADE FACILITATION: SIMULATION RESULTS

a. Simulation Design and Aggregate Results

The gravity model allows us to consider how much trade among the 75 countries might be increased under various scenarios of improved trade facilitation and/or tariff reduction. We will examine scenarios that focus on improved port efficiency, improved customs environment, improved service sector infrastructure and regulatory environment. Our objective in the simulations is to help inform policymakers regarding specific trade facilitation initiatives that might have the greatest potential to increase trade and economic growth. A full consideration of policy approach would require complete cost as well as this benefit analysis.

We base our policy simulation on the estimated coefficients in Model 1 of Table 2 as that model includes the full set of trade facilitation variables and greatest number of observations. But, one must keep in mind that variation of the simulated numbers is inevitable to some degree since the estimated coefficients vary across specifications.

Before considering simulations of trade facilitation improve, given the juxtaposition in the Doha Agenda of tariff negotiations and trade facilitation issues, it is interesting to apply the regression results to the question of tariff reductions vs. trade facilitation improvements. The data used in the estimation indicate an average 8.5 per cent tariff rate. Figure 1 suggests that complete tariff elimination would be associated with an increase in trade flow equivalent to a 15.6 per cent

TABLE 6
Robustness Check for the OLS Estimator

Variable	*OLS*	*WLS*	*WLS*
Tariff Rates	–1.155***	–1.467***	–0.483**
	(0.318)	(0.343)	(0.246)
Port Efficiency of Importer	0.307*	0.246	0.473***
	(0.163)	(0.157)	(0.119)
Port Efficiency of Exporter	0.924***	0.913***	0.537***
	(0.148)	(0.142)	(0.137)
Customs Environment of Importer	0.472**	0.472**	1.112***
	(0.199)	(0.193)	(0.147)
Regulatory Environment of Importer	0.281*	0.288**	–0.069
	(0.144)	(0.138)	(0.107)
Regulatory Environment of Exporter	0.620***	0.594***	0.180
	(0.132)	(0.127)	(0.118)
Service Sector Infrastructure of Importer	0.729***	0.647***	0.494***
	(0.224)	(0.227)	(0.166)
Service Sector Infrastructure of Exporter	1.943***	1.831***	2.336***
	(0.216)	(0.208)	(0.189)
GNP of Importer	0.915***	0.931***	0.892***
	(0.014)	(0.014)	(0.010)
Per Capita GNP of Importer	–0.182***	–0.183***	–0.227***
	(0.037)	(0.037)	(0.028)
GNP of Exporter	1.246***	1.239***	1.169***
	(0.014)	(0.014)	(0.012)
Per Capita GNP of Exporter	–0.226***	–0.231***	–0.153***
	(0.029)	(0.028)	(0.022)
Geographical Distance	–1.258***	–1.238***	–1.143***
	(0.025)	(0.025)	(0.018)
Robust Standard Error	No		
Cluster			
Weighted Least Squares		Yes	Yes
Cluster		Importer	Exporter
Adjusted *R*-squared	0.759		
Chi-squared against all being zero		26,755	38,700

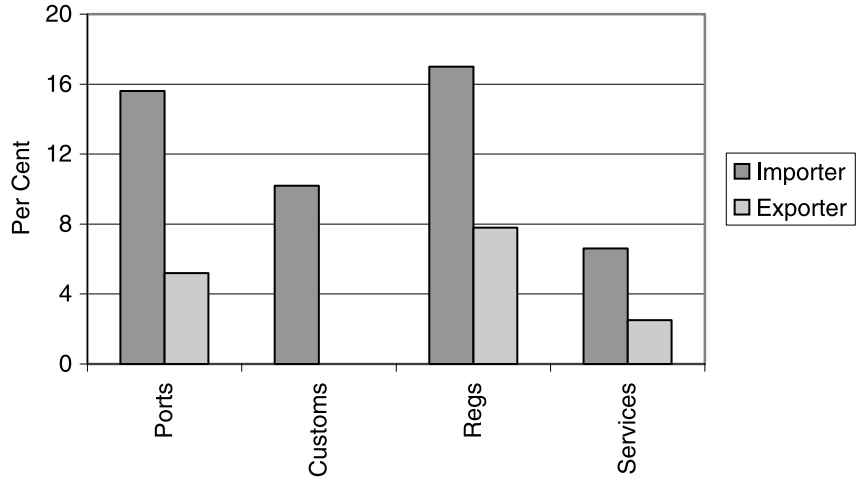
Note:
The significance levels at 10 per cent, 5 per cent and 1 per cent are denoted by *, ** and ***, respectively.

Source: Authors' calculations.

(or 5.2 per cent) improvement in port efficiency by importer (or exporter), a 10.2 per cent improvement in customs environment by importer or an increase in indicator of service sector infrastructure by 6.6 per cent (importer) or 2.5 per cent (exporter). In terms of regulatory environment the same trade gains from a complete tariff cut is equivalent to 17.0 per cent (7.8 per cent) improvement of regulatory environment by importer (exporter).

For the simulation of alternative trade facilitation improvements, we follow the simulation strategy presented in WMO, which uses a formula to design a unique programme of reform for each country in the sample. The formula brings

FIGURE 1
Changes in Trade Facilitation Measures to Have an Equivalent Increase in Trade Flow to a Total Elimination of Tariffs in Manufacture



Source: Authors' calculations.

the *below-average* countries in the group *halfway* to the average for the entire set of countries. We focus on the *below-average* country on the grounds that donor attention and capacity-building efforts should be extended to this group. It is not that the country with the best practice should not try to do better; it is just that limited multilateral resources are not best utilised that way. Our simulation approach acknowledges the differential potential for improvement revealed by Table 1. Since each economy has a specific value for each trade facilitation indicator, each country that is below average on that indicator will improve by a different amount so as to get halfway to average.[13] This approach contrasts with the heretofore standard approach to simulation design where all countries improve trade facilitation measures by a given percentage, such as when trade costs or sector productivity are 'shocked' by, say, one per cent in a CGE model.

This simulation design also contrasts with standard trade negotiation methods. The simulation design implies that countries that are the furthest away from global best have to make the greatest changes to trade facilitation and policy, whereas those already near the global best have to reform little. This is opposite to the formulation in trade negotiations and tariff reductions where the least

[13] We do not take into account the endogeneity between the change in the performance of a country on a trade facilitation measure and the global average for that trade facilitation measure. By restricting the improvement to halfway to average, we limit to some degree these second-round effects.

developed countries need to make the fewest concessions. Quantifying the benefit of trade facilitation improvement may guide future WTO negotiation.

The countries for which we will simulate an improvement in trade facilitation will differ by the trade facilitation indicator. However, because trade facilitation links exporters and importers, all economies enjoy an increase in trade among each other even when only some have an improvement in their trade facilitation indicator. Having the coefficients for both importer's and exporter's trade facilitation measures enables us to simulate the change in trade flow from different perspectives: the country itself and the region or globe as a whole.

From the standpoint of a specific country, improvement say in port efficiency, should increase both its own imports and exports. The same can be expected for regulatory environment, and service sector infrastructure, as well as customs on the import side. But, a country will export more not only because of its own reforms, but also because of reforms undertaken by its trading partners as importers. Thus export gains are the sum of the simulated effect on exports of unilateral domestic reform and of import reforms undertaken by the country's trading partners. On the import side, a country's imports increase first on account of its unilateral domestic reforms, and secondarily on account of the reforms undertaken by its trading partners as exporters. Examining the relative gains to trade from unilateral reforms as compared to partner's reforms, and on exports vs. imports, and across trade facilitation indicators offers three dimensions of potential insight to policymakers, donors and the private sector.

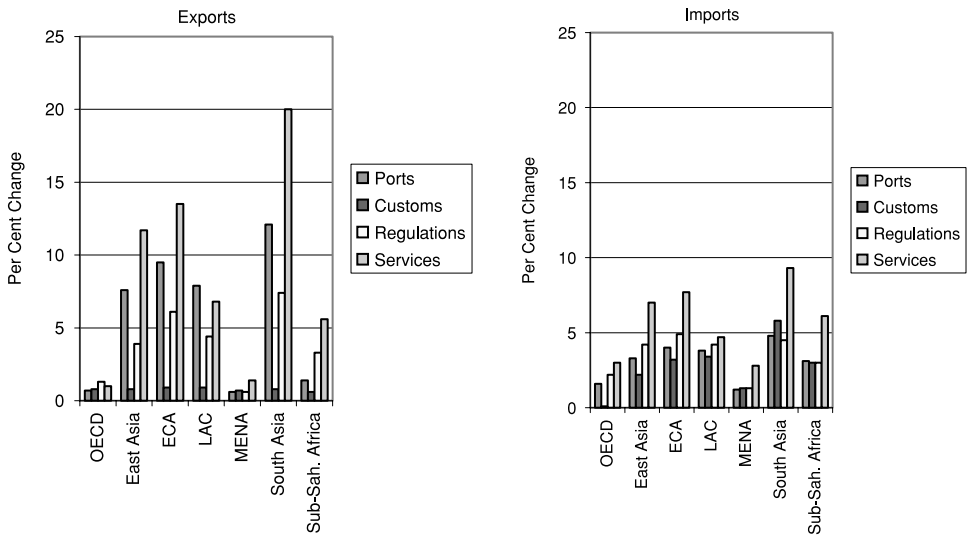
Table 7 summarises the results for the simulations and presents the results for the 75 countries as a whole. In total, the collection of simulations on the four trade facilitation indicators yields an increase in trade among the 75 countries worth about $377 billion, representing an increase of about 10 per cent in total trade among these countries. About $107 billion of the total gain comes from

TABLE 7
Overview of Simulation: Bring Below-average Members Halfway up to the Global Average
(Change in Trade Flow in $ Billion)

	Importer's Change in Trade Facilitation	*Exporter's Change in Trade Facilitation*	*Total*
'Border' Measures			
Port Efficiency	23.40 (0.6 per cent)	84.53 (2.2 per cent)	106.93 (2.8 per cent)
Customs Environment	32.87 (0.8 per cent)		32.87 (0.8 per cent)
'Inside-the Border' Measures			
Service Sector Infrastructure	36.64 (0.9 per cent)	117.38 (3.0 per cent)	154.02 (4.0 per cent)
Regulatory Environment	24.39 (0.6 per cent)	58.86 (1.5 per cent)	83.25 (2.1 per cent)
Grand Total	117.30 (3.0 per cent)	259.77 (6.7 per cent)	377.06 (9.7 per cent)

Source: Authors' calculations.

FIGURE 2
Change in Exports and Imports by Region



Source: Authors' calculations.

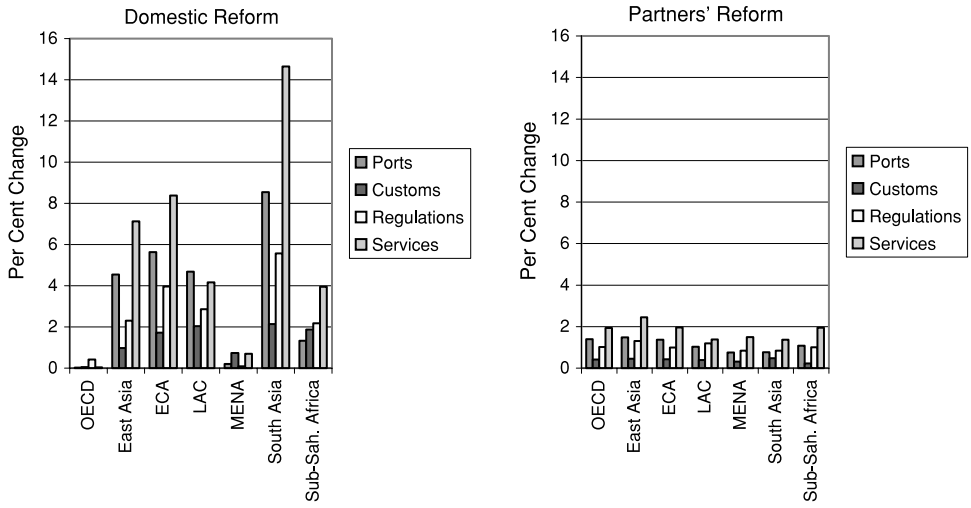
the improvement in port efficiency and about $33 billion emanates from the improvement in customs environment. The gain from the improvement in regulatory environment is $83 billion. The largest gain comes from the improvement in service sector infrastructure ($154 billion), which is consistent with the broad concept of services infrastructure that this variable is designed to capture.

The change in trade flow can be calculated by country, by region, by trade facilitation indicators, and by own vs. trading partners' reforms. All this detail can be combined in several ways to give different perspectives on which regions gain the most and why. One cut, exports and imports by region and by trade facilitation indicator, is shown in Figure 2. Figure 3 show increases in exports and imports from domestic and partner reforms by region and by trade facilitation indicator.

b. Exports and Imports by Region

The first perspective on the detail is which region gains the most from what kinds of trade facilitation improvement and as an exporter or importer, and whether through own or trading-partner reforms. In all of these scenarios, the gains from own reforms are much larger, whether as importer or exporter, and the gains as an exporter from own reforms are dramatic. With respect to regions, the largest gainers (in percentage terms) are generally South Asia and Eastern Europe and Central Asia, with Latin America and the Caribbean not far behind in terms of

FIGURE 3
Change in Manufacturing Exports 'Halfway to the Global Average' Scenario: Gains from Domestic and Partners' Reform



Source: Authors' calculations.

potential increases. In contrast, and on account of their relatively lower integration in global trade, Middle East and North Africa and Sub-Saharan Africa do not see much of an improvement in their trade flows, either as exporters or importers. The results for the Middle East and North Africa and for Sub-Saharan Africa must be viewed with caution, as the number of countries with data from these two regions is quite limited.[14]

Considering *port efficiency*, South Asia gains the most as an exporter (12.1 per cent increase in trade) followed by East Europe and Central Asia (ECA) (9.5 per cent). The bulk of South Asia gains come from increased exports due to its own improvements (11.5 per cent) as opposed to only 0.4 per cent export gain due to its importing partners' improvement in port efficiency. South Asia's percentage gain is the highest because the region's average port efficiency is the lowest of all the regions. The 'halfway to the global average' scenario will consequently lead to a significant improvement in port efficiency in South Asia, which will have a large export promotion effect in the region. An examination of the detail from the simulation finds that in the South Asia region, Bangladesh accrues the highest percentage gain (32.5 per cent) whereas India has the maximum gain in dollar amount ($2.3 billion). A similar pattern occurs in the ECA region, with the export

[14] The countries from MENA are Egypt, Jordan and Israel. For Sub-Saharan Africa, data are available only for Mauritius, Nigeria and South Africa.

gains from its own improvements at 8.7 per cent versus only 0.8 per cent increase in exports due to improvement in ports by its importing partners. In the ECA region the highest export gain is attained by Hungary in the amount of $3.0 billion (13.4 per cent change) and Slovak Republic gains the most in terms of percentage (28.8 per cent or $2.4 billion gain).

Examining the importer's side, regional variation in trade gains in percentage is much smaller for imports than exports. Four out of the seven regions will have an increase of more than 4 per cent. The ECA obtains the highest import gain (4.9 per cent) followed by South Asia (4.5 per cent). ECA has an increase in imports of 3.1 per cent from improving its own ports, and an additional 1.8 per cent increase in imports from its exporting partners' improvement in their port efficiency. For South Asia these percentages are slightly lower: the gains from the partners' improvement (1.4 per cent) is less than from own improvement (3.1 per cent). As an example of the country detail from these simulations (available from the authors on request), in ECA the largest increase in imports from own and partners' reforms turns out to be Hungary and the Slovak Republic: Hungary in terms of dollar amount ($1.5 billion) and the Slovak Republic in terms of percentage (12.3 per cent). In South Asia, India obtains the largest import gain in dollar amount ($0.79 billion) and Sri Lanka attains the maximum percentage gain (5.7 per cent). Thus, improvement in port efficiency is found to provide a country a dual benefit by promoting both imports and exports.

Considering the *customs environment*, all the regions increase exports from the improvements in customs of the trading partners. This indicator is a good place to show the value of examining the simulation results from the standpoint of exporters or importers and at both regional and country detail. In principle, as exporters, countries gain when their partners engage in customs reforms. The simulations suggest, however, that the increase in trade coming from the improvement in a country's own customs environment exceeds the increase in trade when exporters undertake the improvement in customs. At least this is true when looking at the regions. Careful analysis of the country detail (where the individual nature of a country's trading pattern is crucial for the simulations) could find a more nuanced result.[15]

For example, as exporters, somewhat larger gains are enjoyed by Latin America and the Caribbean (LAC) and Eastern Europe and Central Asia (ECA), where both regions increase exports by 0.9 per cent. In terms of country detail, in the ECA region Russia gains the most with an amount of $0.37 billion (2.2 per cent) whereas Ukraine would have the highest percentage gain (4.5 per cent). In the

[15] For the simulations, the coefficient on importer customs was used for the expansion factor for the exporter as well.

LAC region, Brazil has the highest amount of export gain with $0.53 billion whereas Panama would enjoy the highest export gain in term of percentage increase (5.1 per cent).

As importers, the increase in trade from domestic reform is more than double that for partners' reforms. South Asia accrues the highest percentage gain (5.8 per cent). India gains in the amount of $0.98 billion (5.4 per cent) and Sri Lanka gains by 16.9 per cent with the amount of $0.25 billion. In South Asia only India and Sri Lanka turn out to be gainers while no data are available for Bangladesh.

Considering service sector infrastructure, the regional pattern is similar to that of ports, as is the source of the distribution of the gains. From the standpoint as exporter, South Asia gains the most (20.0 per cent), with the largest export gain by percentage accrued by Bangladesh (30.6 per cent) and India gets the maximum gain in dollar amount ($5.4 billion) of exports. East Europe and Central Asia obtains 13.5 per cent export gain from improvement in service sector infrastructure halfway up to the average. In the ECA region the largest export gain goes to Russia ($6.3 billion or 37 per cent) from the improvement of service sector infrastructure. As in the case of ports, the lion's share of the gain comes from country's own improvements, rather than improvements by their trading partners. South Asia gains 0.7 per cent from the improvement of service sector infrastructure by its trading partners whereas from its own improvement of service sector infrastructure the export gain for South Asia is 19.2 per cent.

If we look at the importers' experience, we find the same picture. South Asia gaining the most as importers (9.3 per cent) followed by East Europe and Central Asia (ECA) (7.7 per cent). Again in both regions gains are realised from improvement in service sector infrastructure in trading partners but relatively more imports arrive as a consequence of own improvements. In South Asia, India gains the most as importer ($1.7 billion or 9.6 per cent). In the ECA region, Russia has the highest import gain ($3.2 billion or 16.9 per cent).

Finally, considering the *regulatory environment* there is some change in the regional pattern, but not in the source of the gains. Examining first the perspective as exporters, an improved regulatory environment leads to a 7.4 per cent and 6.1 per cent export gain for South Asia and LAC, respectively, India contributes the most to the South Asia's gains ($2.4 billion) and Mexico contributes most to LAC's gains ($2.9 billion). Just as for the other trade facilitation measures, however, the source of the exports gain is predominantly on account of improvements in the exporter's own regulatory environment, rather than a change in the environment of its trading partners.

In the experience of importers, South Asia is the largest gainer in percentage terms (4.8 per cent), followed by the ECA region (4.0 per cent). In South Asia, India is the largest gainer in the amount and percentage ($0.93 billion; 5.2 per cent). In the ECA region, Turkey is the largest gainer in the amount

– $1.7 billion (6 per cent) – while Russia gains the largest percentage (6.5 per cent). As before, the source of the gains comes from own reforms, although the differences are less dramatic. For example, in the case of South Asia, 3.3 per cent of the gain comes from own reforms and 1.5 per cent from reforms by trading partners.

The simulation result of the regulatory environment scenario is particularly sensitive due to the large positive coefficient of trade flow with respect to exporter's regulatory environment. The simulation result therefore should be viewed with care.

Overall, from improvement in all trade facilitation measures the highest export gain is attained by South Asia (40.3 per cent) followed by the ECA region (30.0 per cent). High gains for South Asia emanate from high export gains due to improvement in port efficiency, and service sector infrastructure. Likewise, the ECA region gains in its exports mainly from reforms in port efficiency and service sector infrastructure. In both cases, the gains come principally on account of their own improvements, rather than the improvements by trading partners. In the South Asia region, India has the highest dollar amount gain ($10.4 billion) and Bangladesh obtains the maximum percentage gain (68.3 per cent). In the LAC region, Mexico accrues an export gain in the amount of $17.3 billion, i.e. the highest in the region, and Paraguay realises a gain of 74.8 per cent. Mexico and Paraguay's high gains again come from the improvement in ports and service sector infrastructure.

Looking globally, the highest export gain among all the countries due to the combined improvement of all trade facilitation measures is attained by China and it is in the amount of $120.7 billion. However, the East Asia region (which includes China) does not stand out in terms of export gains since the other countries in that region do not enjoy large export gains because many of the East Asian countries rank rather highly in terms of the trade facilitation indicators already and therefore are not 'reforming' very much in these simulations.

In the global picture as importers, South Asia is the biggest gainer (24.4 per cent) followed by the ECA region (19.8 per cent). In the South Asia region, India gains the most, accruing $4.4 billion or 24.5 per cent. India gains in large amount as importer due to the improvement in all the trade facilitation measures. In the ECA region, the big winner is Russia gaining a high amount from improvement in service sector infrastructure.

Finally, it is worthwhile to mention the results for the OECD countries, since they further emphasise the importance of the reforms by the developing countries. The simulations show that the OECD countries increase their imports when the developing countries improve their trade facilitation measures. Whereas the percentage increase in OECD trade as an importer (at 6.9 per cent) is not particularly dramatic among regional groups, because the value of OECD trade is much larger than any other regional group's trade (at $2,761 billion it represents

about three-quarters of the trade in the sample) the dollar value of gains is huge. It is worthwhile for developing countries to invest in their own trade facilitation because the increase in developing-country exports will occur through the increased *ability to export* to the OECD market.[16] The export gains will particularly accrue to the countries that undertake dramatic reforms and those which are net exporters of manufacturing goods.

Does this observation regarding the large size of the OECD market mean that South-to-South trade facilitation efforts or regional integration efforts should be abandoned? No. The South-to-South sample discussed earlier shows the importance of improvements in trade facilitation efforts in the South, and suggests that the trade flow effect of trade facilitation efforts South-to-South could be quite large.

c. Domestic and Partner Improvements

The relative importance of own reforms is further confirmed by the information shown in Figure 3. The figure illustrates the simulated change in the sum of imports and exports by region from domestic reforms (left panel) and partners' reform (right panel) in trade facilitation. Comparing across trade facilitation areas, the relative importance of domestic trade facilitation measures differs significantly. The largest increase in trade come from service sector infrastructure and port efficiency, which are consistent with the other findings. This implies that priority areas for own trade facilitation efforts within an individual region are the same as those in a global negotiation, such as in Doha. The focus on domestic reforms is somewhat different from the 'request-offer' procedure common in trade negotiations. Finally, this figure corroborates that the gains to developing countries will be much greater than those to the (high-income) OECD countries, because the developed countries in the OECD region are collectively much closer to best practice across all the indicators examined.

Importantly, from the standpoint of balance of payments concerns, for most developing countries domestic reforms will translate into more exports than imports – with a significant part of the gains resulting from the increased exports to OECD markets.[17]

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[16] These simulations take into account various regulatory barriers facing developing country exports to the OECD markets, but do not account for other barriers, such as anti-competitive local laws that might act as trade barriers.

[17] As the exception, Africa and Middle East regions may have relatively small export gains compared to import gains – suggesting that they do not benefit from the increased access to OECD markets as much. The results suggest that trade facilitation reform should be implemented with particular care in these regions to the extent that countries' major objective of the reform is export promotion and there are balance-of-payments concerns.

6. CONCLUSIONS AND APPROACH TO CAPACITY-BUILDING DESIGN

The analysis in this paper develops measures of trade facilitation and investigates their relationship to trade for a sample of 75 countries. Four measures of trade facilitation are developed: port efficiency, customs environment, regulatory environment and service sector infrastructure (proxied by the Internet and e-commerce use by business). These measures are included in a gravity model of trade to assess their importance for trade flows; country-specific effects are considered both for countries as exporters and as importers for the four measures of trade facilitation. Simulations are designed to take account of the differential character of trade facilitation in each country as measured by each of the four categories. Using this set of indicators, modelling approach and simulation design offers policymakers more information about what type of trade facilitation efforts might provide the largest gains in terms of increasing trade flow.

Increased trade in manufacturing goods from trade facilitation improvements in all four areas yields increases in both exports and imports. Most regions increase exports more than imports in large part by increasing exports to the OECD market. The most important ingredient in achieving these gains, particularly to the OECD market, is a country's own trade facilitation reform efforts. In terms of regional analysis, South Asia has the greatest potential for both export and import growth, with export gains greater than import gains. In contrast, countries in Africa and the Middle East have relatively small export gains compared to import gains because they are less integrated into the global trading systems in manufactures, and have less overall access to the OECD market. (The number of countries from these regions in the sample is small, so the results for these regions must be viewed with caution.)

Based on the specific simulation design, improvement in all four forms of trade facilitation of the 'below-average' countries 'halfway' to global average yields an increase in global trade of $377 billion. A decomposition of our results sheds some light on the GATT articles now under discussion as part of the WTO Doha Development Agenda. Compliance with GATT Article V (freedom of transit) as proxied by the port (air and maritime) efficiency indicator, and with Article VIII (fees and formalities connected with importation and exportation), as proxied by the customs environment indicator, could yield a $107 billion and $33 billion increase in manufacturing trade, respectively. Compliance with GATT Article X (publication and administration of trade regulations), as proxied by the regulatory environment indicator could yield an $83 billion increase in trade flows. Finally, improvements in service sector infrastructure could yield a $154 billion increase in trade.

The results of this analysis suggest that the scope and benefit of unilateral trade facilitation reforms can be substantial and that the gains are largely through export expansion. It is important to note that obtaining these gains requires policy

reform that need not be costly in regard to administrative procedures and strengthening legal instruments that can facilitate trade. Combining the country detail from these simulations, the specifics of a country's trade facilitation challenges, and case study of specific reform efforts and costs can help policymakers design a cost-benefit framework and effective strategy for capacity building to increase trade and economic well-being.

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