The B.E. Journal of Economic Analysis & Policy

Topics

Volume 8, *Issue* 1 2008 *Article* 42

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Recommended Citation

Inma Martinez-Zarzoso and Laura Márquez-Ramos (2008) "The Effect of Trade Facilitation on Sectoral Trade," *The B.E. Journal of Economic Analysis & Policy*: Vol. 8: Iss. 1 (Topics), Article 42.

Available at: http://www.bepress.com/bejeap/vol8/iss1/art42

The Effect of Trade Facilitation on Sectoral Trade*

Inma Martinez-Zarzoso and Laura Márquez-Ramos

Abstract

This paper aims to analyse the effect of trade facilitation on sectoral trade flows. We use data from the World Bank's Doing Business Database on the fees associated with completing the procedures to export or import goods in a country, on the number of documents needed and on the required time to complete all the administrative procedures to import and export. An augmented gravity equation is estimated for 13 exporters and 167 importers using a number of estimation techniques, namely OLS, PPML and the Harvey model. A common result is that trade flows increase by lowering transport costs and the number of days required to trade. The outcome supports multilateral initiatives, as that in the WTO, which encourages countries to assess their trade facilitation needs and priorities and to improve them. The measures adopted will not only benefit the country that improves trade facilitation, but also it's trading partners.

KEYWORDS: gravity model, trade facilitation, time, trade cost

*Financial support from Fundación Caja Castellón-Bancaja, Generalitat Valenciana, and the Spanish Ministry of Education is gratefully acknowledged (P1-1B2005-33, ACOMP07/102 and SEJ 2007-67548).

1. INTRODUCTION

The aim of this paper is to shed some light on the relationship between trade facilitation and trade flows, and to evaluate the potential benefits of trade facilitation in terms of boosting exports. This issue is of growing interest in the trade policy debate since trade facilitation has been included in the Doha Development Agenda. The mandate for the World Trade Organization (WTO) negotiations on trade facilitation was adopted in July 2004. Special and differential treatment, and technical assistance and capacity building, are integral parts of the negotiations, and are linked to the final outcome. The Mandate encourages WTO members to assess their trade facilitation needs and priorities, mainly those of developing and the least-developed countries. This paper shows that any trade facilitation efforts made by developing countries to accomplish the WTO mandate will have a positive effect on trade volumes, and will help to improve economic development and living standards. While other trade costs (tariffs and non-tariff barriers) have fallen as a result of WTO trade negotiations and regional integration agreements, transaction costs related to cross-border trade procedures have become relatively more important.

The measurement and quantification of the potential benefits of trade facilitation have only been investigated recently. Although increasing attention has been paid to this issue, no consensus has been reached in the trade policy discourse on the definition of trade facilitation. In most cases, two ways of defining this concept have been used. On the one hand, trade facilitation in a narrow sense includes the so-called "at the border procedures", such as customs documentation or the time involved in crossing a border. On the other hand, trade facilitation in a broad sense also includes some "inside the border" elements, such as institutional quality, regulatory environment and service infrastructure.

Since the effect of institutional quality and regulatory environment on trade has already been investigated elsewhere,[1] in this work we focus on the narrow definition and consider only "border" related elements. In this line, trade facilitation is understood as the reduction, or at least the simplification, of "at the border procedures", comprising the number of documents and the time involved in crossing the border, as well as the transaction cost incurred. In addition, we consider the Technological Achievement Index (UNDP, 2001) as a proxy for services infrastructure, whose composition includes several indicators of service infrastructure.

As far as we know, the effects of trade facilitation on trade volumes at a disaggregated level have not yet been investigated. The innovation of the paper consists of using recent methodological developments to address the issue of trade

[1] Levchenko (2007).

facilitation at the sectoral level. We use Rauch classification (1999) to divide our sample into differentiated, reference-priced and homogenous goods[2] and we allow the effect on trade of the number of days and the number of required documents to differ among groups. The results indicate that trade flows increase by lowering the number of days and documents required to trade to a higher extent in trade of differentiated goods, and that improvements in service infrastructure foster international trade flows in all sectors.

The paper is arranged as follows. The most recent literature on trade facilitation is reviewed in Section 2. Section 3 describes the selection of countries, data sources and variables. Section 4 presents the estimation strategy, the main results and a number of robustness checks. Section 5 analyses and compares the results with other studies, and presents some simulations and policy implications. A final section summarises the main findings.

2. LITERATURE REVIEW

In recent years, growing interest in the study of the beneficial effects of trade facilitation has been shown. However, the approaches used are far from uniform in terms of the definition of trade facilitation and the empirical approach used.

In relation to the definition of trade facilitation, Wilson, Mann and Otsuki (2003, 2005) considered a broad definition of trade facilitation, and quantified the impact of four different measures (port efficiency, customs environment, regulatory environment and e-business usage). As an alternative, Engman (2005) used the WTO definition of trade facilitation (the simplification and harmonisation of international trade procedures) by paying attention only to what happens around the border. Other authors[3] focused, instead, on the effects of single measures of trade facilitation (information technology, port efficiency, institutions' quality).

Two main modelling approaches have been used. On the one hand, several investigations use the gravity model of trade augmented with "trade facilitation" variables. In this line, Wilson, Mann and Otsuki (2003, 2005) estimated a gravity model of trade augmented with the above-mentioned trade-facilitation variables for a group of countries in the Asia-Pacific region and for a sample of 75 countries. In addition, Soloaga, Wilson and Mejía (2006) used a similar methodology and data, but focused on Mexican competitiveness. In a more general setting, Djankov, Freund and Pham (2006) used the World Bank's Doing Business Database, as we do in this paper, but focused only on the effects of time delays in the exporting country whereas Nordas, Pinali and Grosso (2006) centred

[2] We denote homogeneous goods those traded on organised exchanges.
[3] See Wilson, Mann and Otsuki (2003, 2005) for a more detailed review of earlier work on single measures of trade facilitation.

on how time delays affect the probability to export and the export volumes for imports from Japan, Australia and the United Kingdom. Finally, Persson (2007) studied the effect of time delays and transaction costs on trade flows using a sample selection approach and focussing on the specific effects for each of the six groups of ACP countries negotiating Economic Partnership agreements with the EU.

On the other hand, several institutions and authors (UNCTAD, 2001; OECD, 2003; Dennis, 2006; Decreux and Fontagne, 2006) used a computable general equilibrium model to estimate the effect of a composite index of trade facilitation on trade flows.

Although several data sets and estimation methods have been utilised within the context of these two approaches, the results reveal significant and positive effects on trade flows in most cases.

This paper mainly differs from existing literature in that it uses disaggregated trade data (4-digit level), which not only allow us the possibility to analyse the differential effect of trade facilitation on sectoral trade flows, but also the inclusion of three different measures of trade facilitation for exporter and importer countries separately.

3. SELECTION OF COUNTRIES, DATA, SOURCES AND VARIABLES

3.1 Country selection

Since the amount of data available at the sectoral level is huge, and we wish to investigate the effect of trade facilitation on sectoral trade at a broad level, it is important to select a representative sample of countries. With this aim, we use a revealed comparative advantage (RCA) index in order to classify countries according to their specialisation and pattern of trade. The RCA is calculated according to Balassa's (1965) measure of relative export performance by country and industry to determine which goods countries are specialised. The index is defined as a country's share of world exports of a given good divided by its share of total world exports, as expressed in Equation (1):

$$\boldsymbol{RCA_{ik}} = \frac{\boldsymbol{X_{ik}} / \boldsymbol{X_{wk}}}{\boldsymbol{X_{iN}} / \boldsymbol{X_{wN}}} \cdot 100 \qquad (1)$$

where RCA_{ik} is the RCA index of commodity k for country i, X_{ik} is the value of exports of commodity k by country i, X_{wk} is the value of world exports of commodity k, X_{iN} is the value of exports of all goods by country i, and X_{wN} is the value of world exports of all goods. The RCA index is calculated for 65 countries (Appendix, Figure A.1) which represent more that 70% of world trade. A ranking of the first ten industries with the highest positive RCA values is drawn up for

each country for the year 2000.[4] According to Equation (1), country i has a comparative advantage in exporting commodity k when RCA_{ik} is greater than one.

The Rauch Classification of goods is used to determine in what type of goods are countries specialised (Rauch, 1999). This classification has been widely used in other empirical studies using sectoral trade data such as Feenstra, Markusen and Rose (2001) and Tang (2006). Rauch (1999) divides internationally traded goods into three groups: those traded on organised exchanges, those not traded on organised exchanges but possessing what this author calls reference prices, and all other goods. The conventional wisdom is that there is a cost to setting up organised exchange markets that is independent of the volume of transactions; this will not allow a market to open if the expected volume of transactions at the price expected to prevail in equilibrium is too low. Having a reference price distinguishes homogeneous from differentiated products. As far as empirical analysis of matching international buyers and sellers is concerned, the reason to treat commodities traded on organised exchanges differently from commodities that only have reference prices is that the former have specialised traders that centralise price information, while the same is only potentially true for the latter. Thus, homogeneous commodities can be further divided into those whose reference prices are quoted on organised exchanges and those whose reference prices are quoted only in trade publications. By using the RCA values and the Rauch classification some patterns of specialisation across regions in the world can be obtained. The results indicate that developing Asian countries (China, India, Nepal and Pakistan) are mainly specialised in differentiated products, whereas developing African countries (Egypt, Mozambique and Sudan) are specialised in homogeneous goods. A number of high-income countries are specialised mainly in differentiated and reference-priced products, whereas others, Canada, France, Ireland, Hong Kong, Japan, Singapore, Switzerland-Liechtenstein, the United Kingdom and the United States, tend to be specialised in high-technology sectors. Finally, a number of medium-income countries that are mainly Mediterranean, Central-Eastern European and Latin American, are specialised in differentiated and reference-priced goods.

A classification matrix was constructed to choose a representative sample of countries for the sectoral analysis. Classifications by country (developed and developing countries) and by commodity (Rauch, 1999: differentiated, reference-priced and homogeneous) were considered. Information obtained from the RCA was used to determine whether countries were specialised in differentiated, reference-priced or homogeneous goods. For example, when a country was

[4] Results are available upon request from the authors.

relatively more specialised[5] in differentiated goods (ranked in the 10 most exported goods) than in reference-priced or homogenous goods, it was then considered to be specialised in differentiated goods. At least one representative country was chosen from each group (Table A.1, in bold). However, when more than ten countries were classified in the same group, two representative countries were chosen for the empirical analysis. The countries chosen per continent were the following: Bolivia, Brazil and Chile for Latin America; the United States for North America; China and Japan for Asia; the Czech Republic, Germany, Spain and the United Kingdom for Europe; Ghana and South Africa for Africa; and Australia for Oceania.

3.2 Data and sources

Bilateral trade data by commodity were obtained from Feenstra, Lipsey, Deng, Ma and Mo (2005). The level of disaggregation chosen was 4-digit SITC. The sample of countries considered included 13 exporters and 167 importers in the year 2000 (Appendix, Tables A.1 and A.2). The final sample included 146 categories with homogeneous goods, 349 categories with reference-priced goods, and 694 categories with differentiated goods.

Distance between capitals, common official language and the colonial dummy were taken from CEPII.[6] Income variables were from the World Development Indicators (2005) Database, and the World Integrated Trade Solution (WITS) was the source of tariffs. The Technological Achievement Index (TAI) was from UNPD (2001). The TAI was constructed using indicators of a country's achievements in four dimensions (creation of technology, diffusion of recent innovations, diffusion of old innovations and human skills), thus providing a summary of a society's technological achievements. Finally, trade facilitation variables were from the World Bank's Doing Business (2006) database. This database was recently created by the World Bank and compiles procedural requirements for exporting and importing a standardised cargo of goods. Since trade facilitation variables are the main interest of this research, we considered it appropriate to present a more detailed description concerning the data collection. Doing Business compiles procedural requirements for exporting and importing a standardised cargo of goods. Every official procedure for exporting and importing

[5] Specialisation can be defined as "producing more than you need of some things, and less of others, hence specialising in the first". Definition obtained from Deardorff's Glossary of International Economics (http://www-personal.umich.edu/~alandear/glossary/).

[6] The dist_cepii file was taken from http://www.cepii.fr/anglaisgraph/bdd/distances.htm. The language variable (comlang_off) takes the value of one when two countries share a common official language, zero otherwise and distances are calculated following the great circle formula, which uses latitudes and longitudes of the most important cities/agglomerations (in terms of population).

the goods is recorded (from the contractual agreement between the two parties to the delivery of goods) along with the time and cost necessary for completion. All documents required for the clearance of the goods across the border are also recorded. For exporting goods, procedures range from packing the goods at the factory to their departure from the port of exit. For importing goods, procedures range from the vessel's arrival at the port of entry to the cargo's delivery at the factory warehouse. Local freight forwarders, shipping lines, customs brokers and port officials provide information on required documents and costs, as well as the time to complete each procedure. To make the data comparable across countries, several assumptions about the business and the traded goods are used. The main assumptions refer to the business and types of goods traded. The business has to be located in the country's most populous city, and it must have 200 employees or more. It is a private, limited liability company that does not operate within an export processing zone, or an industrial estate with special export or import privileges. The business must be domestically owned with no foreign ownership and exports more than 10% of its sales.

The traded product has to travel in a dry-cargo, 20-foot, full container load, is not hazardous, and does not include military items. In addition, it does not require special conditions for transport, like refrigeration, and does not require any special phytosanitary or environmental safety standards other than accepted international standards. Finally, the product falls under the following Standard International Trade Classification (SITC) Revision categories: SITC 65 (textile yarn, fabrics and made-up articles); SITC 84 (articles of apparel and clothing accessories) or SITC 07 (coffee, tea, cocoa, spices and manufactures thereof).

Cost is recorded as the fees levied on a 20-foot container in US dollars. All the fees associated with completing the procedures to export or import goods are included. These, in turn, include costs of documents, administrative fees for customs clearance and technical control, terminal handling charges and inland transport. The cost measure does not include tariffs or trade taxes. Only official costs are recorded.

Table 1 presents a statistics summary of the trade facilitation variables: the average, maximum and minimum values of cost to export, cost to import, time to export, time to import, and documents to export and documents to import for the selected sample are shown. Several patters are observed. Transporting goods from factory to ship (exports) is relatively cheaper than transporting them from ship to factory (imports). The variation of costs across countries is also larger for imports, with an average cost of 333$ per container in Singapore and 4565$ per container in Zimbabwe. In terms of time, taking products from the factory to the port only takes 6 days on average in Germany, whereas it takes 31 days in South Africa. Taking products from the port to the factory takes only 3 days in Singapore, but 139 days in Uzbekistan.

Table 1. Trade facilitation, descriptive statistics.

Variable	Mean	Standard Deviation	Minimum	Maximum
Costs to export (US$ per container)	716.62	188.2899	335 (China)	1110 (Bolivia)
Costs to import (US$ per container)	1027	582.36	333 (Singapore)	4565 (Zimbabwe)
Time for export (days)	16.15	12.39	6 (Germany)	31 (South Africa)
Time for import (days)	20.72	16.53	3 (Singapore)	139 (Uzbekistan)
Documents for export (number)	6.069	2.11	4 (France, Germany, Spain)	12 (Bolivia)
Documents for import (number)	8.14	3.62	2 (Hong Kong, Kiribati)	20 (Rwanda)

3.3 Variables

Two types of variables are used. Income, geographical, cultural and integration dummies and trade facilitation variables, which vary across countries, whereas tariffs, high-technology and sectoral dummies vary across sectors. The high-technology dummy is based on the OECD (2001) and Eurostat (1999) classifications. The OECD's classification is based on R&D intensities, and Eurostat suggests a higher disaggregation level and defines goods using the Standard International Trade Classification (SITC) Revision 3 at the 4-digit level. Concordances from the Centre for International Data at UC Davis between SITC Revision 2 and Revision 3 are used to create the high-technology dummy[7] since trade data are defined according to SITC Revision 2. Finally, sectoral dummies are based on Rauch (1999) and were obtained from the Jon Haveman's International Trade Data web page.[8] Table A.3 provides a summary of the data and sources used in this paper.

[7] The list of high-technology sectors considered to create the technology dummy is available upon request from the authors.

[8] http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html

4. EMPIRICAL ANALYSIS

4.1. Model specification

One of the main devices used to analyse the determinants of international trade flows is the gravity model of trade. Recently, some authors have referred to this model as the "workhorse" of empirical trade studies (Eichengreen and Irwin, 1998; Cheng and Wall, 2005). First, a (traditional) gravity equation augmented with trade facilitation variables is specified and estimated for disaggregated data. The estimated equation is:

$$\begin{aligned}\ln X_{ijk} &= \alpha_0 + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \alpha_3 Adj_{ij} + \alpha_4 Land_i + \alpha_5 Land_j + \alpha_6 MERC + \\ &+ \alpha_7 NAFTA + \alpha_8 CAN + \alpha_9 EU + \alpha_{10} EMU + \alpha_{11} ECOWAS + \alpha_{12} CEFTA + \\ &+ \alpha_{13} \ln Dist_{ij} + \alpha_{14} Lang_{ij} + \alpha_{15} Colony_{ij} + \alpha_{16} TAI_i + \alpha_{17} TAI_j + \alpha_{18} \ln Tariff_{ik} \quad (2) \\ &+ \alpha_{19} \ln TC_i + \alpha_{20} \ln TC_j + \alpha_{21} ET_i + \alpha_{22} ET_j + \alpha_{23} hightech_k + \alpha_{24} \hom_k + \\ &+ \alpha_{25} ref_k + \alpha_{26} DP + \varepsilon_{ijk}\end{aligned}$$

where *ln* denotes natural logarithms.

X_{ijk} denotes the value of exports of commodity k from country i to j; Y_i and Y_j are income in the exporter's market and the destination market, respectively; Adj_{ij} is a dummy that indicates whether the trading partners are contiguous; $Land_i$ and $Land_j$ take the value of 1 when the exporting or importing countries are landlocked, respectively, and zero otherwise. MERC, NAFTA, CAN, EU, EMU, ECOWAS and CEFTA are integration dummies that take a value of one when the trading partners belong to a given agreement, otherwise values are zero. The integration agreements considered are: Mercosur (MERC); the North American Free Trade Area (NAFTA), Andean Community (CAN), the European Union (EU), the Economic and Monetary Union (EMU);[9] the Economic Community of West African States (ECOWAS) and the Central European Free Trade Agreement (CEFTA).

$Dist_{ij}$ is the geographical great circle distance in kilometres between the most important cities (in terms of population) of country i and j. $Lang_{ij}$ is a dummy for countries sharing a common official language. $Colony_{ij}$ is a dummy that takes the value of 1 when trading partners have had a colonial link at any time. TAI_i and TAI_j are Technological Achievement Indices in the exporting and importing country. $Tariff_{ik}$ is the simple average effectively applied tariff for all countries importing each commodity from the 13 exporters. TC_i and TC_j measure the cost to both export and import, respectively. ET_i and ET_j denote the time to

[9] Greece is also considered, since the Greek government announced on 15 January 2000 the drachma-euro exchange rate with which Greece would enter the third stage of EU Economic and Monetary Union (EMU) on 1 January 2001.

export and import, respectively (first specification). Alternatively, a second specification with the number of documents needed to export and import will be estimated. Finally, a third specification will include "easy to trade" indices instead, constructed as simple averages of the logarithm of time to export/import and the logarithm of the number of documents to export /import. $High\text{-}tech_k$ is a dummy that takes the value of 1 when the commodity is a high-technology commodity. Hom_k takes the value of 1 when a commodity is homogeneous, otherwise the value is zero, whereas ref_k takes the value of 1 when a commodity is reference-priced, according to the conservative Rauch Classification (1999).[10] The *DP* dummy takes the value of one when the trading partners are developed countries. Finally, ε_{ijk} is the error term which is assumed to be independently and identically distributed.

Equation (2) is first estimated using ordinary least squares. However, since the cross-section of the data is large, it is highly probable that the error term is heteroscedastic. In fact, the result of the Breusch-Pagan test indicates that the residual variance is not constant. There are several ways to handle heteroscedasticity. The simplest way consists in estimating the model by OLS and using heteroscedasticity-robust standard errors. The advantage of this method is that the computed standard errors produce asymptotically valid inferences, even if the form of the conditional variance function is unknown. The disadvantage is that the OLS estimator will have a larger variance than other estimators, at least asymptotically. The Harvey model[11] and the PPML estimator are used as alternative options to control heteroscedasticity. The Harvey model controls multiplicative heteroscedasticity, whereas the PPML method is robust to some kinds of model misspecification, such as heteroscedastic errors.

Harvey (1976) proposed a general formulation of a regression model with multiplicative heteroscedasticity that is more attractive than the usual "additive" model in which the variance of the disturbances is assumed to be related to a linear combination of known variables. Santos-Silva and Tenreyro (2006) pointed out that log-linearisation of the gravity model of trade leads to inconsistent estimates when heteroscedasticity is present. As a consequence, the role of geographical proximity and links is overstated. In addition, the zero values in the dependent variable cannot be considered in the OLS estimation. Since the database of Feenstra et al. (2005) includes only sectors with positive trade

[10] The "conservative" classification minimises the number of 4-digit goods that are classified as either organised-exchange or reference-priced.

[11] Harvey's model of multiplicative heteroscedasticity has been estimated since it is a very flexible model that includes most of the useful formulations as special cases. The general formulation is:

$$y_i = x_i^{'}\beta + \mu_i$$

$$\sigma_i^2 = \sigma^2 \exp\left(z_i^{'}\alpha\right)$$

volumes, the problem of zeros in the dependent variable is not an issue in our empirical estimation. However, the presence of heteroscedasticity could bias coefficients obtained in OLS regressions.

In line with the recent developments concerning the specification of the gravity equation, a second model is estimated. Anderson and van Wincoop (2003) showed that the key aspect of the gravity model is the dependence of trade on bilateral and multilateral resistance factors. Theoretically, this is because these models are determined by relative trade barriers and not only by absolute trade barriers between the exporter and the importer country. In order to control multilateral resistance factors, dummies for exporters and importers are added to the empirical model. The model specification is:

$$\begin{aligned}\ln X_{ijk} &= \delta_i + \lambda_j + \beta_0 + \beta_1 Adj_{ij} + \beta_2 MERC + \beta_3 NAFTA + \beta_4 CAN + \\ &+ \beta_5 EU + \beta_6 EMU + \beta_7 ECOWAS + \beta_8 CEFTA + \beta_9 \ln Dist_{ij} + \\ &+ \beta_{10} Lang_{ij} + \beta_{11} Colony_{ij} + \beta_{12} Tariff_{ik} + \beta_{13} \ln TC_i + \\ &+ \beta_{14} \ln TC_j + \beta_{15} ET_i + \beta_{16} ET_j + \beta_{17} hightech_k + \beta_{18} \hom_k + \\ &+ \beta_{19} ref_k + \beta_{20} DP + \eta_{ijk}\end{aligned} \quad (3)$$

where ln denotes natural logarithms. δ_i denotes exporter dummies and λ_j represents importer dummies.

However, since the trade facilitation variables are country specific, the effect of cost to export/import and the time to export/import cannot be directly evaluated by estimating Equation (3). Therefore, we estimate three versions of Equation (3). The first includes only country dummies for exporters and the traditional country-specific variables for importers (income and trade facilitation variables); the second includes only dummies for importers and country-specific variables for exporters; the third includes country dummies for exporters and importers, and assumes that the effect of the trade facilitation variables is of equal magnitude for exporter and importer countries (e.g. $ET_{ij}=ET_i*ET_j$). A way of validating the results is to observe whether they are robust for the different models (2) and (3), the different specifications (of Model 3), and the estimation techniques used. A number of versions of the proposed models are estimated for all goods, for three subgroups: differentiated, referenced priced and homogeneous goods, and for three specific products: SITC07, SITC65 and SITC84.[12]

[12] The products are coffee, tea, cocoa, spices and manufactures thereof (SITC07), textile yarn, fabrics, made-up articles (SITC65) and articles of apparel and clothing accessories (SITC84).

4.2. Main results

We first present and discuss the results obtained when the model is estimated for all goods. Table 2 shows the main estimation results obtained for the trade facilitation variables. Two versions of the gravity model are estimated using OLS, PPML and the Harvey model. Columns two, four and six refer to the "traditional" gravity equation with country-specific variables (Equation 2), whereas columns three, five and seven show the estimates of the gravity equation with the exporter/importer effects added (Equation 3). The full regression results are shown in the Appendix (Tables A.4-A.6). Equation (3) was also estimated with exporter and importer effects added. When the model was estimated using OLS with robust standard errors, the average effect for cost and time to trade were -0.1547 and -0.1588, respectively (significant at the 10% level), which are consistent with the values obtained for the "partial" model, with only exporter or importer effects. Since the main interest is to estimate the importer and exporter effects separately, we focus on the results obtained in columns three, five and seven.

Table 2. The effect of trade facilitation on trade flows.

Specification 1	**OLS**		**PPML**		**HARVEY**	
Variable	**Traditional**	**New**	**Traditional**	**New**	**Traditional**	**New**
Cost to export	-0.27*** (0.02)	-0.25*** (0.02)	-0.58*** (0.1)	-0.56*** (0.11)	-0.24*** (0.02)	-0.29*** (0.02)
Cost to import	-0.09*** (0.01)	-0.10*** (0.01)	-0.25*** (0.05)	-0.22*** (0.05)	-0.04*** (0.01)	-0.04*** (0.01)
Time for export	-0.11*** (0.01)	-0.04*** (0.01)	0.32*** (0.12)	0.40*** (0.13)	-0.07*** (0.01)	-0.04*** (0.01)
Time for import	-0.14*** (0.01)	-0.13*** (0.01)	-0.32*** (0.06)	-0.30*** (0.06)	-0.15*** (0.01)	-0.15*** (0.01)
Exporter's TAI	0.66*** (0.05)	1.22*** (0.05)	1.94*** (0.37)	4.16*** (0.46)	0.72*** (0.04)	1.21*** (0.05)
Importer's TAI	0.50*** (0.03)	0.42*** (0.03)	1.09*** (0.23)	0.83*** (0.22)	0.38*** (0.03)	0.30*** (0.03)
Specification 2	**OLS**		**PPML**		**HARVEY**	
Variable	**Traditional**	**New**	**Traditional**	**New**	**Traditional**	**New**
Cost to export	-0.27*** (0.02)	-0.27*** (0.02)	-0.70*** (0.11)	-0.64*** (0.11)	-0.22*** (0.02)	-0.31*** (0.02)
Cost to import	-0.16*** (0.01)	-0.16*** (0.01)	-0.37*** (0.05)	-0.36 *** (0.05)	-0.10*** (0.01)	-0.10*** (0.01)
No. doc. for export	-0.15 *** (0.03)	-0.13*** (0.03)	-0.16 (0.17)	-0.04 (0.16)	0.00 (0.03)	-0.16*** (0.03)
No. doc. for import	0.00 (0.01)	0.02 (0.01)	-0.09 (0.06)	0.00 (0.06)	-0.04*** (0.01)	-0.02** (0.01)
Exporter's TAI	0.81*** (0.04)	1.30*** (0.05)	1.48*** (0.28)	4.05*** (0.46)	0.85*** (0.04)	1.31*** (0.05)
Importer's TAI	0.78*** (0.03)	0.69*** (0.03)	1.68*** (0.21)	1.48*** (0.21)	0.65*** (0.03)	0.57*** (0.03)

Specification 3	**OLS**		**PPML**		**HARVEY**	
Variable	**Traditional**	**New**	**Traditional**	**New**	**Traditional**	**New**
Cost to export	-0.28***	-0.26***	-0.61***	-0.57***	-0.24***	-0.31***
	(0.02)	(0.02)	(0.11)	(0.11)	(0.02)	(0.02)
Cost to import	-0.13***	-0.14***	-0.32***	-0.30***	-0.07***	-0.07***
	(0.01)	(0.01)	(0.05)	(0.05)	(0.01)	(0.01)
Easy to export	-0.16***	-0.08***	0.32**	0.46**	-0.07***	-0.09***
	(0.02)	(0.02)	(0.16)	(0.18)	(0.02)	(0.02)
Easy to import	-0.09***	-0.08***	-0.25***	-0.18 ***	-0.13***	-0.12 ***
	(0.01)	(0.01)	(0.06)	(0.07)	(0.01)	(0.01)
Exporter's TAI	0.71***	1.23***	1.71***	3.98***	0.79***	1.22***
	(0.05)	(0.05)	(0.31)	(0.43)	(0.04)	(0.05)
Importer's TAI	0.64***	0.55***	1.31***	1.15***	0.49***	0.41***
	(0.03)	(0.03)	(0.22)	(0.22)	(0.03)	(0.03)

Note: *, **, *** denote significance at the 10%, 5% and 1% levels. Easy to export/import is the simple average of the variables, number of documents and time to export/import (in logarithms). Robust standard errors are in brackets.

Three specifications are considered in relation to the trade facilitation variables. Whereas the first includes cost and time variables, the second includes costs and the number of documents, and the third incorporates cost and '"easy to trade". The estimates for cost to import and cost to export always have the expected negative sign and are significant in all cases. Both the OLS and the Harvey model estimates show a smaller effect of transaction cost on trade than the Poisson results, and are more stable across specifications (traditional versus new). The magnitude of the elasticities varies between -0.22 and -0.70 and between -0.04 and -0.37 for exports and imports, respectively. The Harvey model offers the more conservative estimates. These elasticities can be translated in monetary terms by evaluating the marginal effect at the average values of transaction costs (C) and sectoral exports (X):

$$\frac{\partial X}{\partial C_{i(j)}} = \beta_{13(14)} * \frac{\overline{X}}{\overline{C}_{i(j)}} \qquad (4)$$

where the X and C bars denote average values, and β_{13} and β_{14} respectively denote the estimated coefficients in Equation (3) above using the Harvey model.

When considering the more conservative estimates obtained when estimating Equation (3), which are those obtained in the first specification, a decrease of one US dollar in the cost to export a 20-foot container yields an increase in exports of almost 11 thousand US dollars (0.29*25100T$/712). Regarding importers, the effect is somewhat smaller: a decrease of one US dollar in the cost to import a 20-foot container yields an increase in exports of almost 1 thousand US dollars (0.04*25100T$/1066).

In relation to the time for export/import variables, the estimates are always negative, apart from time for exports in the PPML estimation. A reduction in time for exports has a lesser effect on exports than a reduction in time for imports. According to the Harvey estimates, the effect of a one-day reduction on the average days required to export a good is an increase of exports of 0.22% [(1/18)*0.04], whereas the effect of a one-day reduction on the average days needed to import a good is an increase of exports of 0.83% [(1/22)*0.15].

The estimates for the number of documents needed for exports and imports indicate that the variables are not always significant across specifications. However, both are significant and show a negative effect on exports in the Harvey specification with exporter or importer dummies. The effect of reducing the number of documents (one document less) on trade is higher for documents needed for export (an increase in exports of 2.6%) than for documents needed for imports (an increase in exports of 0.25%). To summarise in terms of time, a time reduction to import a good has a greater effect on exports than a time reduction to export a good. On the other hand, a reduction in the number of documents to import has a lesser effect on exports than a reduction in the number of documents to export.

A way of combining both effects is to include a mixed variable, what we call "easy to trade". It is calculated as a simple average of both time and the number of documents. The results indicate that the "easy to import" variable has a slightly higher effect on exports than the "easy to export" variable.

A policy implication is that any efforts to improve trade facilitation in the trading partners will have positive effects on exports and therefore multilateral initiatives, as that in the WTO, are supposed to have positive effects on not only the country that improves trade facilitation, but also on its trading partners.

Next, the two last rows of the first specification (Table 2) also show the estimated coefficients for the Technological Achievement Indices TAI_i and TAI_j. Both are significant and higher in magnitude for exporters than for importers[13]. If we consider that these indices could be a proxy for the services infrastructure, then the potential effect on trade flows is important given the relatively high magnitude of the coefficients (0.30 and 1.21 for importer and exporter TAI, respectively, according to the Harvey-new-specification results). Table 3 presents the results when a quadratic term for the time variable is added, allowing the effect of trade facilitation on exports to be non-linear. The added quadratic term is statistically significant, which indicates that the elasticity of trade in relation to time decreases with the number of days needed to export/import. Additional days will have smaller marginal effects when time requirements are already high. We have calculated a "turning point" that indicates the time requirement (number of days for export/import) for which the lowering of border delays no longer has a positive effect on exports. Waiting more than 11 days and 74 days for exports and imports, respectively, at the border will no longer have a negative effect on exports (estimates in the last column have been used to compute these turning points). However, when the model with a quadratic term was estimated, which included the exporter and importer effects, the quadratic term was not statistically significant, thus favouring a linear relationship.

[13] As obtained when using aggregated exports (Martínez-Zarzoso and Márquez-Ramos, 2005).

Table 3. Non-linear effect of time to export/import and easy to export/import on trade.

Variable	OLS	PPML	HARVEY
Time for export	-1.94***	-2.24***	-1.93***
	(0.1)	(0.68)	(0.09)
Time for export square	0.39***	0.57***	0.39***
	(0.02)	(0.13)	(0.02)
Time for import	-0.49***	-1.53***	-0.43***
	(0.04)	(0.25)	(0.03)
Time for import square	0.07***	0.26***	0.05***
	(0.01)	(0.05)	(0.01)
Time for trade	-0.15***		-0.13***
	(0.01)		(0.02)
Time for trade square	-0.17		-0.02
	(0.14)		(0.02)
Easy to export	-5.72***	-5.66***	-5.34***
	(0.26)	(1.64)	(0.25)
Easy to export squared	1.45***	1.60***	1.34***
	(0.06)	(0.41)	(0.06)
Easy to import	-0.64***	-2.88***	-0.50***
	(0.06)	(0.38)	(0.05)
Easy to import squared	0.12***	0.64***	0.08***
	(0.01)	(0.08)	(0.01)
Exporter's TAI	1.64***	5.15***	1.61***
	(0.06)	(0.47)	(0.05)
Importer's TAI	0.50***	1.35***	0.35***
	(0.03)	(0.25)	(0.03)

Note: *, **, *** denote significance at the 10%, 5% and 1% levels. Easy to exports/import is the simple average of the variables, number of documents and time to export/import (in logarithms). The coefficients are those obtained when estimating the "new" model: the extended gravity model with exporter dummies and importer variables, and the extended gravity model with importer dummies and exporter variables. Time for trade and time for trade square are obtained when the model includes country dummies for exporters and importers and assumes that the effect of trade facilitation variables is of equal magnitude for the exporter and the importer. Robust standard errors are in brackets.

Next, the performance of the other variables in the model will be briefly discussed. Concerning the results obtained for both the OLS and Harvey estimations, results are very similar and stable across specifications (Tables A.4-A.6). All the variables included in the regression are significant, and present the expected sign, with the exception of the colonial ties and tariffs. With regard to regional integration, MERC, NAFTA, CAN, EU, EMU and CEFTA memberships have a positive effect on exports. The positive and significant high-tech dummy shows that technologically intensive goods are traded more than other goods,

whereas the dummies for different types of goods indicate that trade in differentiated products is higher than trade in referenced and homogeneous goods. In relation to tariffs, the coefficient is positive and significant. This result was unexpected since protection is supposed to have a negative effect on trade. A possible explanation may be that the structure of world tariffs benefits exports from the 13 exporting countries included in the regression. Another explanation could be that exporters (developing countries) are using tariffs as a source of revenue. Therefore, they set up high tariffs for the products being exported.[14]

Finally, the R-squared is around 0.25, significantly lower than that obtained when estimating aggregated data, but in line with previous literature. Unlike the OLS and Harvey results, the PPML estimates indicate that EMU, ECOWAS, language and colonial dummies are positive and not significant or that they have a negative sign and are significant. The result obtained of socio-cultural links having no effect (or a negative effect) on trade flows was unexpected since trade has been shown to increase with links (Rauch, 1999). Furthermore, the PPML results are less stable across specifications and show a worse performance in terms of forecasting accuracy (The inverse U-Theil index is lower for the PPLM estimations).

In order to address the question whether the trade facilitation effect on exports is similar for different products, Tables 4 and 5 show the results obtained when the model is estimated using only exports for the 3 SITC product categories considered to collect data on trade facilitation variables (SITC 65: textile yarn, fabrics and made-up articles; SITC 84: articles of apparel and clothing accessories; or SITC 07: coffee, tea, cocoa, spices and manufactures thereof). Given the above-mentioned considerations concerning estimation techniques, we focus on the OLS with robust standard errors and the Harvey results. The specification including cost and time variables is the most stable. The OLS and Harvey results are reassuring since the sign and significance of the coefficients on trade facilitation variables are similar to those found for all sectors (Table 2). The main difference is that the impact of transaction costs on exports almost doubled in comparison with the results for all industries. Similarly, a higher elasticity is found for the time to export, whereas the coefficients are almost the same for the time to import (OLS and Harvey results). Since the estimated elasticities may differ for each product, we show specific estimates for time and cost variables for each product in Table 5. The results show that there are only slight variations and,

[14] This is investigated by restricting the sample to developing countries as exporters to all the other countries. In this case, results show that the tariff coefficient takes a value of 0.42 in the OLS estimation, a value of 0.75 in the PPML estimation and a value of 0.36 in the Harvey estimation. When restricting the sample to developed countries as exporters to all the other countries, results show that the tariff coefficient takes a value closer to zero in the OLS (0.04) and Harvey (0.08) estimation and is not significant in the PPML estimation.

for each product, time and cost variables are significant. It is also worth noting that when the model was estimated for sectors SITC 65, 84 and 07 (Table 4), the estimated coefficients for both technological variables were not always statistically significant. Finally, the model is estimated for exports of differentiated, reference priced and homogeneous goods. The results obtained with the different estimation techniques indicate that exports are more time-sensitive when the products traded are differentiated and technology-intensive goods (The Harvey model results are reported in Table 6[15]). Exports of homogeneous and referenced price goods were less time-sensitive than exports of differentiated products.

Table 4. Common results for three sectors. New gravity model

Exports for SITC07, 65 and 84	**OLS**	**PPML**	**HARVEY**
Cost to export	-0.56***	-1.06***	-0.56***
	(0.06)	(0.19)	(0.05)
Cost to import	-0.16***	-0.22**	-0.16***
	(0.03)	(0.09)	(0.02)
Time for export	-0.12***	0.29**	-0.15***
	(0.04)	(0.12)	(0.04)
Time for import	-0.17***	-0.40***	-0.17***
	(0.03)	(0.08)	(0.01)
No. doc. for export	0.22***	1.83***	0.09***
	(0.06)	(0.28)	(0.02)
No. doc. for import	-0.08**	-0.22**	-0.07**
	(0.03)	(0.11)	(0.03)
Exporter's TAI	-0.18	1.15***	-0.46
	(0.15)	(0.44)	(0.30)
Importer's TAI	0.43***	1.32***	0.08
	(0.09)	(0.32)	(0.06)

Note: *, **, *** denote significance at the 10%, 5% and 1% levels. The coefficients are those obtained when estimating the "new" model: the extended gravity model with exporter dummies and importer variables, and the extended gravity model with importer dummies and exporter variables. The products are coffee, tea, cocoa, spices and manufactures thereof (SITC07), textile yarn, fabrics, made-up articles (SITC65) and articles of apparel and clothing accessories (SITC84). Robust standard errors are in brackets.

[15] Since the Harvey results with the traditional gravity model were remarkably similar to the Harvey results with the new gravity model, we present the first set of results. The results obtained using other estimation techniques are available upon request from the authors.

Table 5. Separate results for three sectors. New gravity model

Specific coeff. for each product	**SITC 07**	**SITC 65**	**SITC 84**
Cost to export	-0.54*** (0.06)	-0.54*** (0.06)	-0.54*** (0.06)
Cost to import	-0.19*** (0.03)	-0.18*** (0.03)	-0.18*** (0.03)
Time for export	-0.33*** (0.09)	-0.37*** (0.12)	-0.29*** (0.1)
Time for import	-0.24*** (0.03)	-0.20*** (0.02)	-0.23*** (0.02)
No. doc. for import	-0.11*** (0.04)	-0.06* (0.032)	-0.11*** (0.03)

Note: *, **, *** denote significance at the 10%, 5% and 1% levels. The coefficients are those obtained when estimating the "new" model: the extended gravity model with exporter dummies and importer variables, and the extended gravity model with importer dummies and exporter variables. The products are coffee, tea, cocoa, spices and manufactures thereof (SITC07), textile yarn, fabrics, made-up articles (SITC65) and articles of apparel and clothing accessories (SITC84). Robust standard errors are in brackets.

Table 6. The effect of trade facilitation on trade flows in different sectors and countries (Harvey estimates for the traditional gravity model).

Specification 1	**All**	**High Tech.**	**Differentiated**	**Referenced**	**Homogeneous**	**Developed**	**Developing**
Cost to export	-0.24*** (0.02)	-0.31*** (0.03)	-0.15*** (0.02)	-0.29*** (0.04)	0.22 (0.19)	-0.6*** (0.05)	-0.17*** (0.02)
Cost to import	-0.04*** (0.01)	-0.21*** (0.03)	-0.04*** (0.01)	-0.04** (0.02)	-0.10 (0.08)	-0.15*** (0.02)	-0.04*** (0.01)
Time for export	-0.07*** (0.01)	-0.18*** (0.02)	-0.16*** (0.02)	0.02 (0.02)	0.14 (0.10)	-0.22*** (0.02)	0.04** (0.02)
Time for import	-0.15*** (0.01)	-0.16*** (0.03)	-0.16*** (0.01)	-0.11*** (0.02)	-0.12 (0.09)	-0.15*** (0.01)	-0.14*** (0.01)
Exporter's TAI	0.72*** (0.05)	2.29*** (0.06)	0.59*** (0.05)	0.87*** (0.09)	0.09 (0.06)	0.53*** (0.14)	0.69*** (0.05)
Importer's TAI	0.38*** (0.03)	1.11*** (0.05)	0.39*** (0.04)	0.39*** (0.06)	0.22*** (0.08)	0.03 (0.05)	0.55*** (0.04)
Specification 2	**All**	**High Tech.**	**Differentiated**	**Referenced**	**Homogeneous**	**Developed**	**Developing**
Cost to export	-0.22*** (0.02)	-0.42*** (0.02)	-0.19*** (0.02)	-0.19*** (0.04)	0.42 (0.32)	-0.89*** (0.05)	-0.17*** (0.02)
Cost to import	-0.10*** (0.01)	-0.29*** (0.01)	-0.11*** (0.01)	-0.08*** (0.02)	-0.16 (0.11)	-0.27*** (0.01)	-0.07*** (0.01)
N.Doc. for export	0.00 (0.03)	-0.64*** (0.02)	-0.4*** (0.03)	0.44*** (0.05)	1.60 (1.12)	-0.91*** (0.06)	0.12*** (0.03)
N. Doc. for import	-0.04*** (0.01)	0.07 (0.06)	-0.04*** (0.01)	0.01 (0.02)	0.00 (0.00)	0.03** (0.01)	-0.9*** (0.02)

Note: *, **, *** denote significance at the 10%, 5% and 1% levels and ns indicates not statistically significant. Robust standard errors are in brackets.

4.3. Robustness

A number of robustness checks are presented in this section. Firstly, and based on Santos-Silva and Tenreyro (2006), a heteroscedasticity-robust RESET test was performed. The authors showed that by using aggregated exports, only the models estimated using the PPML regressions pass the RESET test. This test was performed by adding a regressor, constructed as $(x'b)^2$, where b is the vector of estimated parameters. The *linktest* available in STATA was used to test specification errors. The results showed that the variable square prediction was significant in all cases, indicating a misspecification of the PPML with sectoral data.

Secondly, the inversed U-Theil criterion was used to compare models with different scales in the dependent variable. Higher values of the inverse U-Theil indicated that one particular model was preferred. According to this criterion, the Harvey and the OLS models are better than Poisson in terms of forecasting accuracy (Tables A4-A7 in the Appendix).

Thirdly, the model was also estimated using the method recently proposed by Baier and Bergstrand (2006). They recommend applying a first-order Taylor expansion to the explanatory variables. The main shortcoming of this approach is the same found when using exporter and importer fixed effects: we can only estimate an average effect for each trade flow. Let x stand for any of the explanatory variables in Equation (2) and P_iP_j stands for multilateral trade resistance. Let there be N_i (N_j) observations of bilateral trade for countries *i* (*j*). The independent variables are transformed as follows:

$$(x_{ijk})_{P_iP_j} = \frac{1}{N_i}\sum_{i=1}^{N_i} x_{irk} + \frac{1}{N_j}\sum_{j=1}^{N_j} x_{jsk} - \frac{1}{N_i}\sum_{i=1}^{N_i} x_{irk}\,\frac{1}{N_j}\sum_{j=1}^{N_j} x_{jsk} \qquad (5.1)$$

$$(x_{ik}x_{jk})_{P_iP_j} = \frac{1}{N_i}\sum_{i=1}^{N_i} x_{ik} + \frac{1}{N_j}\sum_{j=1}^{N_j} x_{jk} - \frac{1}{N_i}\sum_{i=1}^{N_i} x_{ik}\,\frac{1}{N_j}\sum_{j=1}^{N_j} x_{jk} \qquad (5.2)$$

where *r* is an index of the country partners of *i* and *s* is an index of the country partners of *j*. Equation (5.1) refers to variables with bilateral variability (e.g. adjacency), whereas Equation (5.2) indicates the transformation required for variables with country or sectoral variability, but which are common for all the trading partners.

The estimated equation is:

$$\ln X_{ijk} = \alpha_0 + \alpha_1 \ln(Y_i Y_j)_{P_i P_j} + \alpha_2 (Adj_{ij} - Adj_{P_i P_j}) + \alpha_3 (Land_i Land_j)_{P_i P_j} +$$
$$+ \alpha_4 (MERC_{ij} - MERC_{P_i P_j}) + \alpha_5 (NAFTA_{ij} - NAFTA_{P_i P_j}) + \alpha_6 (CAN_{ij} - CAN_{P_i P_j}) +$$
$$+ \alpha_7 (EU_{ij} - EU_{P_i P_j}) + \alpha_8 (EMU_{ij} - EMU_{P_i P_j}) + \alpha_9 (ECOWAS_{ij} - ECOWAS_{P_i P_j}) +$$
$$+ \alpha_{10} (CEFTA_{ij} - CEFTA_{P_i P_j}) + \alpha_{11} (\ln Dist_{ij} - \ln Dist_{P_i P_j}) + \alpha_{12} (Lang_{ij} - Lang_{P_i P_j}) +$$
$$+ \alpha_{13} (Colony_{ij} - Colony_{P_i P_j}) + \alpha_{14} (TAI_i TAI_j)_{P_i P_j} + \alpha_{15} (\ln Tariffs_{ik})_{P_i P_j} +$$
$$+ \alpha_{16} (\ln TC_i \ln TC_j)_{P_i P_j} + \alpha_{17} (ET_i ET_j)_{P_i P_j} + \alpha_{18} \cdot (hightech_k)_{P_i P_j} + \alpha_{19} (\hom_k)_{P_i P_j} +$$
$$+ \alpha_{20} (ref_k)_{P_i P_j} + \alpha_{21} (DP_{ij} - DP_{P_i P_j}) + \varepsilon_{ijk}$$

(6)

The results were extremely similar to those found in the estimations with exporter and importer fixed effects in terms of delays at the border. The elasticity for cost to trade was -0.168 (0.006), and -0.156 (0.006) for time for trade[16].

Finally, the model was also estimated for developing and developed countries separately. The last two columns of Table 6 show the results. While developed countries exports are more sensitive to time to export, exports among developing countries were more sensitive to time to import. More mixed results were obtained for the specification including the number of documents to export/import.

5. EVALUATION OF THE RESULTS AND POLICY IMPLICATIONS

Comparing the results with the related literature[17], we obtain in general more moderate estimates for the elasticities of trade facilitation variables on export flows. Djankov, Freund and Pham (2006), also using the World Bank's Doing Business Database, focused only on the effects of time delays in the exporting country. They estimated a single-difference gravity equation on similar exporters that face the same trade barriers in foreign markets. They obtained a coefficient for the variable ratio-time of 0.40. A one day increase in the median country is equivalent to about a 1.3 increase in trade (1/27*0.35). A similar result (1 percent increase in trade due to one day saving time in the exporter) was obtained by Persson (2007) by estimating a gravity model for 22 EU countries and 100 developing countries using sample selection techniques. She found that imports increase by about 0.5 percent as a result of lowering border delays by one day. According to our results, the estimated elasticity is only 0.04 for exports delays when all products are considered. However it increases to 0.33 for SITC07 and to

[16] Robust standard errors in brackets.
[17] The estimates obtained by different authors are not strictly comparable since different samples, model specifications, explanatory variables and methodologies have been used.

0.37 for SITC 65. For import delays, the estimated elasticity is about 0.15 when all the products are considered, but it increases to 0.23 for SITC84, to 0.24 for SITC07 and to 0.20 for SITC 65.

Wilson (2007) estimated the effects of reductions in border delays, in number of documents and in number of signatures in the importing country on exports. The author obtained estimated elasticities of about 0.63, 1.11 and 0.99, respectively, when considering three products[18]. However, our results show that by adding fixed effects and additional covariates and by controlling for heteroscedasticity, the first and second elasticities are 0.17 and 0.07 for the same three products.

Using the estimated elasticities presented in Tables 4 and 5, we are able to simulate the increase in exports for several regions derived from taking the region to the sample average. Only developing countries whose trade facilitation measures are above the sample average are considered. Table 7 present the change in trade associated to reductions in days for imports and cost to imports for different groups of products. The first half of Table 7 presents the average days for imports, the average cost to import and the percentage reduction necessary to take the region to the sample average. The changes in trade flows for different types of products derived from taking the region to the sample averages are shown in the second half of Table 7. For example, if ECOWAS countries were to reduce the average days for imports to the world average (the reduction needed would be of 117%), trade flows would increase by 18%. High-tech and differentiated products would benefit from a larger increase than homogeneous products with referenced prices. With regard to the cost to import, a similar reduction would lead to an increase in trade flows of 24% for high-tech products and of 5% for differentiated and homogeneous products.

[18] The products are coffee, tea, cocoa, spices and manufactures thereof (SITC07), textile yarn, fabrics, made-up articles (SITC65) and articles of apparel and clothing accessories (SITC84).

Table 7. The change in trade flows with improvement in days and cost at the border (Imports)

Region Averages	**Days for Imports**	**% reduction to world average**			**Cost to Import**	**% reduction to world average**		
Mercosur	24.8	-19.69			1260	-22.69		
NAFTA	17.89				1492	-45.28		
CAN	40.5	-95.46			959			
EU	12.7				963			
ECOWAS	45	-117.18			1460	-42.16		
CEFTA	22.31	-7.67			1351	-31.55		
Average	20.72				1027			
Type of goods:	**All**	**High-tech**	**Diff**	**Ref**	**all**	**High-tech**	**Diff**	**Ref**
Elasticities	-0.15	-0.16	-0.16	-0.11	-0.04	-0.21	-0.04	-0.04
% increase in exports[(1)]								
Mercosur	2.95	3.15	3.15	2.17	0.79	4.14	0.79	0.79
NAFTA								
CAN	14.32	15.27	15.27	10.50	3.82	20.05	3.82	3.82
EU								
ECOWAS	17.58	18.75	18.75	12.89	4.69	24.61	4.69	4.69
CEFTA	1.15	1.23	1.23	0.84	0.31	1.61	0.31	0.31

Note: The elasticities used for the simulations are those in the Table 6. Empty cells indicate averages that are below the exporters' average. (1) % increase in exports if regional average fell to importers' average.

Table 8. The change in trade flows with days and cost reductions at the border (exports)

Exporters	Time for export (days)	Cost to export (US$ per container)
Germany	6	731
United States	9	625
United Kingdom	12	676
Japan	11	789
Australia	9	795
Spain	9	1,050
China	18	335
Czech Republic	20	713
Chile	20	510
Brazil	18	895
Ghana	21	822
South Africa	31	850
Bolivia	26	1,110
Average	**16.15**	**761.62**
% reduction to average		
Spain		-37.86
China	-11.46	
Czech Republic	-23.84	
Chile	-23.84	
Brazil	-11.46	-17.51
Ghana	-30.03	-7.93
South Africa	-91.95	-11.60
Bolivia	-60.99	-45.74
% increase in exports if country average fell to exporters' average		
Spain		21.20
China	1.72	
Czech Republic	3.58	
Chile	3.58	
Brazil	1.72	9.81
Ghana	4.50	4.44
South Africa	13.79	6.50
Bolivia	9.15	25.62

Note: The elasticities used for the simulations are those in the last column of Table 4 for cost to export (-0.56) and time for export (-0.15). Empty cells indicate averages that are below the exporters' average.

Finally, Table 8 shows the change in trade flows associated to days and cost reductions at the border in the exporting countries. Out of the thirteen exporters considered, seven show above-average values for time for export, and eight presented above-average values for cost to export. The last part of the table

presents the increase in trade flows which would take place if the countries were to reduce the time or cost to the sample average. It is worth noting that Bolivia and Spain would be the countries that benefit the most from a reduction in the cost to import with an associated increase on trade flows of 26 and 21 percent, respectively. South Africa and Bolivia would benefit the most from the considered reductions in time for exports; the implied increase in trade is 14 and 9%, respectively.

6. CONCLUSIONS

In this paper, the effect of trade facilitation on international trade flows was evaluated using disaggregated trade data. A gravity model extended with trade facilitation variables was estimated and three different estimation techniques, namely OLS, PPML, and the Harvey model, were used. The OLS and Harvey results were very similar and stable across specifications and showed a better performance in terms of forecasting accuracy than the PPML results.

On average, and in terms of transaction costs, a decrease of one US dollar in the cost to export a 20-foot container yields an increase in exports of almost 11 thousand US dollars, whereas a decrease of one US dollar in the cost to import a 20-foot container yields an increase in exports of almost 1 thousand US dollars.

In terms of time, the effect of a one-day reduction on the average days required to export a good is an increase of exports of 0.22%, whereas the effect of a one-day reduction on the average days required to import a good is an increase of exports of 0.83%. A time reduction to import a good has a greater effect on exports than a time reduction to export a good. On the other hand, a reduction in the number of documents to import has a lesser effect on exports than a reduction in the number of documents to export.

The enhancing effect on trade flows of a reduction in both the number of days and documents required to export/import differs across sectors (technology-intensive, differentiated) and countries (developed/developing). Exports of technology-intensive goods are more time-sensitive. Furthermore, Exports of homogeneous and referenced price goods are less time-sensitive than exports of differentiated products, while developed countries exports are also more sensitive to time to export than developing countries exports.

When the sample is restricted to specific products for which the data on trade facilitation were collected, the results show that time and cost elasticities are stable across the three products considered, and that the main difference is that the impact of transaction costs on exports almost doubled in comparison with the results for all industries. Similarly, a higher elasticity is found for the time to export, whereas the coefficients are almost the same for the time to import.

Overall, the results indicate that multilateral initiatives, as that in the WTO, are potentially beneficial in terms of increasing trade. Trade facilitation efforts are supposed to have positive effects on not only the country that improves trade facilitation, but also on its trading partners. Therefore, both trading partners have to make efforts in order to gain the greatest benefit from improving trade facilitation, but those efforts have to be higher for partners showing the longest delays on the border and the highest cost to trade.

The question whether the trade facilitation effect on exports can be generalised to other sectors is still open and requires further research.

APPENDIX

Figure A.1. Selected countries.

Algeria
Argentina
Australia
Austria
Belgium-Luxembourg
Bolivia
Brazil
Bulgaria
Canada
Chile
China
Colombia
Costa Rica
Croatia
Cyprus
Czech Republic
Denmark
Dominican Republic
Ecuador
Egypt, Arab Rep.
El Salvador
Finland
France
Germany
Ghana
Greece
Honduras
Hong Kong, China
Iceland
India
Ireland
Israel
Italy
Jamaica
Japan
Kenya
Korea, Rep.
Mexico
Mozambique
Nepal
Netherlands
Nicaragua
Norway
Pakistan
Panama
Paraguay
Peru
Poland
Portugal
Senegal
Singapore
Slovak Republic
South Africa
Spain
Sudan
Sweden
Switzerland
Syrian Arab Republic
Tanzania
Trinidad and Tobago
Turkey
United Kingdom
United States
Uruguay
Venezuela

Table A.1. Classification matrix and selected exporters.

	Differentiated	**Reference-priced**	**Homogeneous**
High-income	Austria Belgium, Luxembourg Finland France, Monaco **Germany** Hong Kong Ireland Italy **Japan** Sweden Switzerland, Liechtenstein	**Australia** Belgium, Luxembourg Canada Denmark Finland Iceland Ireland Netherlands Norway **United Kingdom** United States	France, Monaco Singapore **United States**
Medium-income	Bulgaria Colombia Costa Rica **Czech Republic** Dominican Republic Greece Mexico Panama Paraguay Portugal El Salvador Slovak Republic South Korea **Spain** Turkey	**Chile** Costa Rica Croatia Cyprus Israel Peru Poland **South Africa** Spain Syrian Arab Republic Trinidad and Tobago Turkey Venezuela	Algeria Argentina **Brazil** Bulgaria Uruguay
Low-income	**China** Honduras India Jamaica Kenya Nepal Nicaragua Pakistan Tanzania	Ecuador **Ghana** Nicaragua Senegal	**Bolivia** Egypt Mozambique Nicaragua Sudan

Note: Countries are classified into three groups as follows: countries are arranged in order from higher to lower income levels (GDP per capita, PPP in 1999. Source: WDI, 2005), then an upper level of GDP is composed by calculating the average of the first half of the sample, and an inferior level by calculating the average of the second half. Goods are classified according to Rauch (1999).

Table A.2. Importing countries.

	Country	Code		Country	Code		Country	Code		Country	Code
1	Afghanistan	AFG	43	Denmark	DNK	85	Kuwait	KWT	127	Rwanda	RWA
2	Albania	ALB	44	Djibouti	DJI	86	Kyrgyzstan	KGZ	128	Samoa	WSM
3	Algeria	DZA	45	Dominican Rep.	DOM	87	Lao P. Dem. Rep.	LAO	129	Saudi Arabia	SAU
4	Angola	AGO	46	Ecuador	ECU	88	Latvia	LVA	130	Senegal	SEN
5	Argentina	ARG	47	Egypt	EGY	89	Lebanon	LBN	131	Seychelles	SYC
6	Armenia	ARM	48	El Salvador	SLV	90	Liberia	LBR	132	Sierra Leone	SLE
7	Australia	AUS	49	Eq.Guinea	GNQ	91	Libya	LBY	133	Singapore	SGP
8	Austria	AUT	50	Estonia	EST	92	Lithuania	LTU	134	Slovakia	SVK
9	Azerbaijan	AZE	51	Ethiopia	ETH	93	Madagascar	MDG	135	Slovenia	SVN
10	Bahamas	BHS	52	Fiji	FJI	94	Malawi	MWI	136	Somalia	SOM
11	Bahrain	BHR	53	Finland	FIN	95	Malaysia	MYS	137	South Africa	ZAF
12	Bangladesh	BGD	54	France, Monaco	FRA	96	Mali	MLI	138	Spain	ESP
13	Barbados	BRB	55	Gabon	GAB	97	Malta	MLT	139	Sri Lanka	LKA
14	Belarus	BLR	56	Gambia	GMB	98	Mauritania	MRT	140	St.Kt-Nev An	KNA
15	Belgium-Lux.	BEL	57	Georgia	GEO	99	Mauritius	MUS	141	Sudan	SDN
16	Belize	BLZ	58	Germany	DEU	100	Mexico	MEX	142	Suriname	SUR
17	Benin	BEN	59	Ghana	GHA	101	Mongolia	MNG	143	Sweden	SWE
18	Bermuda	BMU	60	Gibraltar	GIB	102	Morocco	MAR	144	Switz.-Liecht.	CHE
19	Bolivia	BOL	61	Greece	GRC	103	Mozambique	MOZ	145	Syria	SYR
20	Bosnia Herzg	BIH	62	Greenland	GRL	104	Myanmar	MMR	146	TFYR Macedonia	MKD
21	Brazil	BRA	63	Guatemala	GTM	105	Nepal	NPL	147	Taiwan	TWN
22	Bulgaria	BGR	64	Guinea	GIN	106	Neth.Ant.Aruba	ANT	148	Tajikistan	TJK
23	Burkina Faso	BFA	65	Guinea Bissau	GNB	107	Netherlands	NLD	149	Tanzania	TZA
24	Burundi	BDI	66	Guyana	GUY	108	New Caledonia	NCL	150	Thailand	THA
25	Cambodia	KHM	67	Haiti	HTI	109	New Zealand	NZL	151	Togo	TGO
26	Cameroon	CMR	68	Honduras	HND	110	Nicaragua	NIC	152	Trinidad Tobago	TTO
27	Canada	CAN	69	Hungary	HUN	111	Niger	NER	153	Tunisia	TUN
28	Cent.Afr.Rep	CAF	70	Iceland	ISL	112	Nigeria	NGA	154	Turkey	TUR
29	Chad	TCD	71	Indonesia	IDN	113	Norway	NOR	155	Turkmenistan	TKM
30	Chile	CHL	72	Iran	IRN	114	Oman	OMN	156	UK	GBR
31	China	CHN	73	Iraq	IRQ	115	Pakistan	PAK	157	USA	USA
32	China HK SAR	HKG	74	Ireland	IRL	116	Panama	PAN	158	Uganda	UGA
33	China MC SAR	MAC	75	Israel	ISR	117	Papua N.Guinea	PNG	159	Ukraine	UKR
34	Colombia	COL	76	Italy	ITA	118	Paraguay	PRY	160	United Arab Em	ARE
35	Congo	COG	77	Jamaica	JAM	119	Peru	PER	161	Uruguay	URY
36	Costa Rica	CRI	78	Japan	JPN	120	Philippines	PHL	162	Uzbekistan	UZB
37	Cote d'Ivoire	CIV	79	Jordan	JOR	121	Poland	POL	163	Venezuela	VEN
38	Croatia	HRV	80	Kazakhstan	KAZ	122	Portugal	PRT	164	Viet Nam	VNM
39	Cuba	CUB	81	Kenya	KEN	123	Qatar	QAT	165	Yemen	YEM
40	Cyprus	CYP	82	Kiribati	KIR	124	Rep Moldova	MDA	166	Zambia	ZMB
41	Czech Rep	CZE	83	Korea D P Rep.	PRK	125	Romania	ROM	167	Zimbabwe	ZWE
42	Dem.Rep.Congo	ZAR	84	Korea Rep.	KOR	126	Russian Fed	RUS			

Table A.3. Variable descriptions and sources of data. Disaggregated analysis.

Variable	Description	Source
X_{ijk} : Exports from i to j of commodity k	Value of exports in thousands of US dollars in the year 2000	Feenstra et al. (2005)
Y_i : Exporter's income	Exporter's GDP, PPP (current international $)	World Bank (2005)
Y_j : Importer's income	Importer's GDP, PPP (current international $)	World Bank (2005)
Adj_{ij} : Adjacency dummy	Dummy variable = 1 if the trading partners share a common border, 0 otherwise.	CEPII (2006)
$Land_i$: Landlocked dummy	Dummy variable = 1 if the exporting country is landlocked, 0 otherwise.	CEPII (2006)
$Land_j$: Landlocked dummy	Dummy variable = 1 if the importing country is landlocked, 0 otherwise.	CEPII (2006)
MERC dummy	Dummy variable = 1 if the trading partners are members of MERC, 0 otherwise	World Trade Organization
NAFTA dummy	Dummy variable = 1 if the trading partners are members of NAFTA, 0 otherwise	World Trade Organization
CAN dummy	Dummy variable = 1 if the trading partners are members of CAN, 0 otherwise	World Trade Organization
EU dummy	Dummy variable = 1 if the trading partners are members of EU, 0 otherwise	World Trade Organization
EMU dummy	Dummy variable = 1 if the trading partners are members of EMU, 0 otherwise	World Trade Organization
ECOWAS dummy	Dummy variable = 1 if the trading partners are members of ECOWAS, 0 otherwise	World Trade Organization
CEFTA dummy	Dummy variable = 1 if the trading partners are members of CEFTA, 0 otherwise	World Trade Organization
$Dist_{ij}$: Distance	Great circle distances between the most important cities in trading partners	CEPII (2006) http://www.cepii.fr/anglaisgraph/bdd/distances.htm
$Lang_{ij}$: Language dummy	Dummy variable = 1 if the trading partners share the same official language, 0 otherwise.	CEPII (2006)
$Colony_{ij}$: Colony dummy	Dummy variable = 1 if the trading partners have ever had a colonial link, 0 otherwise.	CEPII (2006)

TAI_i : Exporter's TAI	Technological variable	UNDP (2001), author's calculations
TAI_j : Importer's TAI	Technological variable	UNDP (2001), author's calculations
$Tariffs_{ik}$	Effectively applied rates in sector k	WITS (2006) http://wits.worldbank.org/witsnet/StartUp
TC_i: Exporter's transport costs	Transport costs (US$ per container)	Doing Business (2006)
TC_j: Importer's transport costs	Transport costs (US$ per container)	Doing Business (2006)
ET_i: Exporter's trade facilitation	Days for export, number of documents for export	Doing Business (2006)
ET_j: Importer's trade facilitation	Days for import, number of documents for import	Doing Business (2006)
High-tech dummy	Dummy variable = 1 when commodity is a high-technology commodity, 0 otherwise	Eurostat and OECD
Hom_k dummy	Dummy variable = 1 when a commodity k is homogeneous, according to Rauch classification (1999), 0 otherwise	Jon Haveman's International Trade Data http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources
Ref_k dummy	Dummy variable = 1 when a commodity k is reference-priced, according to the Rauch Classification (1999), 0 otherwise	Jon Haveman's International Trade Data

Table A.4. OLS results.

	OLS				
	Traditional	New		New_with time square	
Variables		X effects	M effects	X effects	M effects
Constant Term	-6.00***	0.18	7.25	0.57***	8.29
	(-17.40)	(1.12)	(0.00)	(3.38)	.
Exporter's income	0.30***	-	0.29***	-	0.29***
	(39.45)	-	(36.46)	-	(36.17)
Importer's income	0.36***	0.36***	-	0.37***	-
	(103.93)	(105.27)	-	(105.79)	-
Adjacency dummy	0.56***	0.44***	0.54***	0.43***	0.53***
	(28.04)	(21.16)	(24.53)	(20.61)	(23.96)
Exporter's Landlocked dummy	-0.32***	-	-0.39***	-	-0.40***

	(-11.27)	-	(-13.66)	-	(-14.00)
Importer's Landlocked dummy	-0.09***	-0.08***	-	-0.10***	-
	(-6.48)	(-5.72)	-	(-7.14)	-
MERC dummy	0.25***	0.25***	0.05	0.27***	0.12*
	(4.73)	(4.52)	(0.79)	(4.96)	(1.89)
NAFTA dummy	1.09***	1.27***	0.91***	1.27***	0.94***
	(15.97)	(18.40)	(12.55)	(18.47)	(13.03)
CAN dummy	1.62***	1.00***	1.83***	0.98***	1.78***
	(6.31)	(3.70)	(7.27)	(3.64)	(7.09)
EU dummy	0.03	0.17***	0.01	0.15***	0.09***
	(1.11)	(7.14)	(0.25)	(5.98)	(3.11)
EMU dummy	0.24***	0.15***	0.25***	0.17***	0.22***
	(8.16)	(4.94)	(8.28)	(5.61)	(7.16)
ECOWAS dummy	-0.25	-1.10***	-0.44	-1.14***	-0.30
	(-0.66)	(-2.74)	(-1.14)	(-2.83)	(-0.76)
CEFTA dummy	0.26***	0.30***	0.31***	0.33***	0.32***
	(6.30)	(7.42)	(7.00)	(7.94)	(7.30)
Distance	-0.32***	-0.34***	-0.41***	-0.35***	-0.40***
	(-50.42)	(-52.33)	(-54.51)	(-53.06)	(-53.28)
Language dummy	0.28***	0.34***	0.14***	0.32***	0.11***
	(18.65)	(21.61)	(8.55)	(20.62)	(6.68)
Colonial dummy	-0.03*	0.10***	-0.05***	0.11***	0.02
	(-1.88)	(5.53)	(-2.86)	(6.00)	(1.14)
Exporter's TAI	0.66***	-	1.22***	-	1.64***
	(13.04)	-	(22.56)	-	(29.00)
Importer's TAI	0.50***	0.42***	-	0.50***	-
	(14.57)	(12.06)	-	(14.35)	-
Tariffs	0.10***	0.11***	0.11***	0.11***	0.11***
	(12.15)	(12.85)	(13.61)	(12.86)	(13.83)
Cost to export	-0.27***	-	-0.25***	-	-0.29***
	(-12.32)	-	(-11.74)	-	(-13.20)

Cost to import	-0.09***	-0.10***	-	-0.10***	-
	(-8.74)	(-9.26)	-	(-9.27)	-
Time for export	-0.11***	-	-0.04***	-	-1.94***
	(-7.63)	-	(-3.03)	-	(-19.08)
Time for export (Square)	-	-	-	-	0.39***
	-	-	-	-	(18.91)
Time for import	-0.14***	-0.13***	-	-0.49***	-
	(-13.34)	(-12.52)	-	(-13.27)	-
Time for import (Square)	-	-	-	0.07***	-
	-	-	-	(10.70)	-
High-tech dummy	0.39***	0.39***	0.39***	0.39***	0.39***
	(34.89)	(35.33)	(36.65)	(35.37)	(36.76)
Homogeneous goods dummy	-0.05**	-0.05**	-0.04*	-0.05**	-0.05**
	(-2.00)	(-2.12)	(-1.94)	(-2.11)	(-2.20)
Referenced goods dummy	-0.07***	-0.07***	-0.06***	-0.07***	-0.06***
	(-7.37)	(-7.35)	(-6.09)	(-7.31)	(-6.75)
DP dummy	0.06***	0.09***	-0.20***	0.09***	-0.29***
	(4.51)	(7.26)	(-10.01)	(7.59)	(-14.39)
Exporter's fixed effects	-	Yes	-	Yes	-
Importer's fixed effects	-	-	Yes	-	Yes
R-squared	0.25	0.25	0.27	0.26	0.27
1-U Theil	0.82	0.82	0.82	0.82	0.82
RMSE	1.62	1.62	1.60	1.61	1.60
Number of observations	149985	149985	160321	149985	160321

Notes: ***, **, *, indicate significance at 1%, 5% and 10%, respectively. T-statistics are shown in brackets. The OLS estimation uses White's heteroscedasticity-consistent standard errors; the dependent variable is the natural logarithm of exports in value (thousands of US$).

Table A.5. PPML results.

	Poisson				
	Traditional	New		New_with time square	
Variables		X effects	M effects	X effects	M effects
Constant Term	-12.50***	-7.29***	1.01	-6.50***	4.78**
	(-7.26)	(-7.35)	(0.60)	(-7.03)	(2.33)
Exporter's income	0.37***	-	0.28***	-	0.24***
	(10.79)	-	(7.62)	-	(6.35)
Importer's income	0.60***	0.61***	-	0.63***	-
	(25.91)	(26.02)	-	(24.94)	-
Adjacency dummy	1.15***	0.97***	1.07***	0.96***	1.06***
	(9.55)	(8.48)	(9.97)	(8.36)	(9.67)
Exporter's Landlocked dummy	-1.20***	-	-1.17***	-	-1.29***
	(-7.89)	-	(-7.74)	-	(-8.67)
Importer's Landlocked dummy	-0.05	-0.03	-	-0.02	-
	(-0.88)	(-0.49)	-	(-0.27)	-
MERC dummy	0.09	0.36**	0.34*	0.42**	0.35**
	(0.54)	(2.16)	(1.89)	(2.49)	(1.98)
NAFTA dummy	0.36**	0.73***	0.20	0.74***	0.25
	(2.03)	(4.16)	(1.06)	(4.25)	(1.31)
CAN dummy	3.41***	2.66***	4.13***	2.56***	4.04***
	(7.84)	(5.82)	(9.30)	(5.67)	(9.07)
EU dummy	-0.02	0.42***	0.05	0.42***	0.13
	(-0.20)	(3.77)	(0.41)	(3.79)	(1.13)
EMU dummy	0.12	-0.09	0.33***	-0.06	0.31**
	(1.09)	(-0.87)	(2.72)	(-0.55)	(2.50)
ECOWAS dummy	1.65*	0.68	1.37	0.49	1.52*
	(1.90)	(0.78)	(1.58)	(0.56)	(1.76)
CEFTA dummy	0.62***	0.65***	0.47***	0.64***	0.50***

	(4.79)	(4.94)	(3.52)	(4.90)	(3.68)
Distance	-0.20***	-0.17***	-0.37***	-0.19***	-0.36***
	(-5.43)	(-4.34)	(-10.48)	(-4.96)	(-10.19)
Language dummy	-0.04	0.18**	-0.29***	0.18**	-0.33***
	(-0.48)	(2.25)	(-4.07)	(2.36)	(-4.59)
Colonial dummy	-0.21***	-0.01	-0.23***	0.01	-0.16*
	(-2.67)	(-0.09)	(-2.69)	(0.17)	(-1.74)
Exporter's TAI	1.94***	-	4.16***	-	5.15***
	(5.29)	-	(9.02)	-	(10.90)
Importer's TAI	1.09***	0.83***	-	1.35***	-
	(4.75)	(3.71)	-	(5.49)	-
Tariffs	0.23***	0.24***	0.24***	0.24***	0.24***
	(3.02)	(3.04)	(3.28)	(3.04)	(3.29)
Cost to export	-0.58***	-	-0.56***	-	-0.60***
	(-5.42)	-	(-5.04)	-	(-5.27)
Cost to import	-0.25***	-0.22***	-	-0.22***	-
	(-4.47)	(-3.95)	-	(-3.91)	-
Time for export	0.33***	-	0.41***	-	-2.24***
	(2.67)	-	(3.06)	-	(-3.27)
Time for export (Square)	-	-	-	-	0.57***
	-	-	-	-	(4.24)
Time for import	-0.32***	-0.30***	-	-1.53***	-
	(-5.49)	(-5.21)	-	(-6.01)	-
Time for import (Square)	-	-	-	0.26***	-
	-	-	-	(4.94)	-
High-tech dummy	0.70***	0.69***	0.70***	0.69***	0.70***
	(17.88)	(17.75)	(18.44)	(17.80)	(18.44)
Homogeneous goods dummy	-0.19**	-0.16**	-0.21***	-0.16**	-0.21***
	(-2.42)	(-2.05)	(-2.76)	(-2.06)	(-2.82)
Referenced goods dummy	-0.64***	-0.63***	-0.62***	-0.63***	-0.62***
	(-16.58)	(-16.76)	(-16.56)	(-16.76)	(-16.67)

DP dummy	0.11	0.22**	-0.64***	0.20**	-0.85***
	(1.29)	(2.41)	(-5.87)	(2.25)	(-7.74)
Exporter's fixed effects	-	Yes	-	Yes	-
Importer's fixed effects	-	-	Yes	-	Yes
Pseudo R-squared	0.35	0.37	0.39	0.37	0.39
1-U Theil	0.58	0.58	0.58	0.58	0.58
RMSE	152870.70	152914.5	149855.7	152845.40	149855.00
Number of observations	149992	149992	160335	149992	160335

Notes: ***, **, *, indicate significance at 1%, 5% and 10%, respectively. Z-statistics are shown in brackets. The dependent variable is the exports in value (thousands of US$).

Table A.6. Harvey results.

	Harvey				
	Traditional	New		New_with time square	
Variables		X effects	M effects	X effects	M effects
Constant Term	-4.93***	0.02	2.19***	0.40	4.38***
	(-15.35)	.	(3.27)	.	(12.72)
Exporter’s income	0.27***	-	0.28***	-	0.28***
	(37.03)	-	(36.45)	-	(36.19)
Importer’s income	0.32***	0.32***	-	0.32***	-
	(100.39)	(101.72)	-	(101.78)	-
Adjacency dummy	0.56***	0.46***	0.51***	0.45***	0.49***
	(29.61)	(23.67)	(23.43)	(23.21)	(22.79)
Exporter's Landlocked dummy	-0.24***	-	-0.37***	-	-0.38***
	(-8.57)	-	(-13.01)	-	(-13.46)
Importer's Landlocked dummy	-0.08***	-0.07***	-	-0.10***	-
	(-5.87)	(-5.50)	-	(-7.15)	-
MERC dummy	0.19***	0.14***	0.07	0.16***	0.14**
	(3.62)	(2.74)	(1.16)	(3.12)	(2.28)
NAFTA dummy	1.33***	1.47***	0.94***	1.47***	0.98***

	(19.44)	(21.27)	(13.10)	(21.32)	(13.63)
CAN dummy	1.17***	0.78***	1.53***	0.76***	1.48***
	(4.80)	(2.99)	(6.32)	(2.94)	(6.13)
EU dummy	0.10***	0.23***	0.02	0.21***	0.10***
	(4.19)	(9.83)	(0.58)	(8.63)	(3.44)
EMU dummy	0.22***	0.13***	0.26***	0.15***	0.22***
	(7.71)	(4.46)	(8.46)	(5.08)	(7.36)
ECOWAS dummy	-0.34	-1.10***	-0.50	-1.12***	-0.36
	(-0.84)	(-2.65)	(-1.23)	(-2.71)	(-0.88)
CEFTA dummy	0.14***	0.17***	0.25***	0.19***	0.27***
	(3.49)	(4.18)	(5.86)	(4.70)	(6.15)
Distance	-0.28***	-0.31***	-0.42***	-0.31***	-0.42***
	(-47.11)	(-50.36)	(-56.97)	(-51.10)	(-55.73)
Language dummy	0.29***	0.31***	0.16***	0.30***	0.13***
	(20.71)	(21.61)	(10.22)	(20.66)	(8.46)
Colonial dummy	-0.07***	0.09***	-0.06***	0.10***	0.02
	(-4.79)	(5.28)	(-3.48)	(5.77)	(0.97)
Exporter's TAI	0.72***	-	1.21***	-	1.61***
	(15.18)	-	(22.92)	-	(29.08)
Importer's TAI	0.38***	0.30***	-	0.35***	-
	(11.90)	(9.47)	-	(10.78)	-
Tariffs	0.12***	0.13***	0.12***	0.13***	0.12***
	(15.20)	(16.26)	(15.18)	(16.29)	(15.33)
Cost to export	-0.24***	-	-0.30***	-	-0.32***
	(-11.78)	-	(-14.20)	-	(-15.43)
Cost to import	-0.04***	-0.04***	-	-0.04***	-
	(-4.06)	(-3.83)	-	(-4.06)	-
Time for export	-0.07***	-	-0.04***	-	-1.93***
	(-5.30)	-	(-3.08)	-	(-19.63)
Time for export (Square)	-	-	-	-	0.39***
	-	-	-	-	(19.51)

Time for import	-0.15***	-0.15***	-	-0.42***	-
	(-15.93)	(-15.65)	-	(-12.21)	-
Time for import (Square)	-	-	-	0.05***	-
	-	-	-	(8.22)	-
High-tech dummy	0.26***	0.27***	0.33***	0.27***	0.33***
	(25.73)	(26.82)	(32.13)	(26.88)	(32.23)
Homogeneous goods dummy	0.10***	0.06***	0.06***	0.06***	0.05**
	(4.37)	(2.70)	(2.78)	(2.70)	(2.44)
Referenced goods dummy	-0.04***	-0.05***	-0.03***	-0.05***	-0.03***
	(-4.29)	(-5.04)	(-2.90)	(-5.01)	(-3.55)
DP dummy	0.06***	0.09***	-0.19***	0.09***	-0.27***
	(5.32)	(7.76)	(-9.56)	(7.98)	(-13.73)
Exporter's fixed effects	-	Yes	-	Yes	-
Importer's fixed effects	-	-	Yes	-	Yes
Pseudo R-squared	0.09	0.09	0.08	0.09	0.08
VWLS R2	0.24	0.24	0.27	0.24	0.27
1-U Theil	0.82	0.82	0.82	0.82	0.82
RMSE	1.62	1.62	1.6	1.62	1.6
Number of observations	149985	149985	160321	149985	160321

Notes: ***, **, *, indicate significance at 1%, 5% and 10%, respectively. Z-statistics are provided in brackets. The dependent variable is the natural logarithm of exports in value (thousands of US$). The pseudo-R2 in the output is obtained by computing 1 – LL (full model)/LL (constant only model), which in this case varies between 0.08 and 0.09. This is McFadden's pseudo-R2 and it may not be the best measure of fit. The VWLS (variance-weighted least squares) R2 is obtained by using the inverse of the estimated variances in the heteroscedastic model as weights in the corresponding regression model.

Table A.7. Harvey results. 3 sectors.

	3 sectors: Harvey			
	New		New_with time square	
Variables	X effects	M effects	X effects	M effects
Constant Term	2.91	4.60	2.93	2.32
	.	.	.	.
Exporter's income	-	0.28	-	0.28
	-	.	-	.
Importer's income	0.28	-	0.28	-
	.	-	.	-
Adjacency dummy	0.52***	0.58***	0.53***	0.58***
	(10.57)	(11.03)	(10.93)	(11.10)
Exporter's Landlocked dummy	-	-0.46***	-	-0.49***
	-	(-9.51)	-	(-10.11)
Importer's Landlocked dummy	-0.17***	-	-0.15***	-
	(-4.74)	-	(-4.31)	-
MERCO dummy	-0.26*	-0.45***	-0.27*	-0.46***
	(-1.75)	(-2.71)	(-1.85)	(-2.78)
NAFTA dummy	1.73***	1.18***	1.73***	1.19***
	(7.81)	(5.64)	(7.90)	(5.73)
CAN dummy	0.23	1.17**	0.26	1.22**
	(0.37)	(2.05)	(0.47)	(2.13)
EU dummy	0.03	0.08	0.05	0.07
	(0.59)	(1.41)	(0.99)	(1.33)
EMU dummy	0.23***	0.32***	0.22***	0.32***
	(3.42)	(5.02)	(3.26)	(5.10)
ECOWAS dummy	-1.80	0.19	-1.77	0.18
	.	.	.	.
CEFTA dummy	0.00	-0.19*	-0.01	-0.19*

	(-0.02)	(-1.78)	(-0.12)	(-1.74)
Distance	-0.46	-0.57	-0.45	-0.57
	.	.	.	.
Language dummy	0.42	0.20	0.43	0.21
	.	.	.	.
Colonial dummy	0.03	0.14***	0.03	0.14***
	(0.85)	(3.92)	(0.74)	(3.89)
Exporter's TAI	-	-0.47	-	-0.49
	-	.	-	.
Importer's TAI	0.09	-	0.02	-
	(1.39)	-	(0.36)	-
Tariffs	-0.03	0.01	-0.03	-0.06
	.	.	.	.
Cost to export	-	-0.56	-	-0.56
	-	.	-	.
Cost to import	-0.09	-	-0.09	-
	.	-	.	-
Time for export	-	-0.15	-	2.33
	-	.	-	.
Time for export (Square)	-	-	-	-0.57
	-	-	-	.
Time for import	-0.17	-	0.07	-
	.	-	.	-
Time for import (Square)	-	-	-0.05	-
	-	-	.	-
High-tech dummy	(dropped)	(dropped)	(dropped)	(dropped)
Homogeneous goods dummy	0.07*	0.09*	0.07*	0.05
	(1.65)	(1.90)	(1.64)	(1.08)
Referenced goods dummy	0.25***	0.30***	0.25***	0.33***
	(8.12)	(10.16)	(8.22)	(11.09)

DP dummy	-0.04	-0.71***	-0.05	-0.71***
	(-1.31)	(-17.99)	(-1.59)	(-17.99)
Exporter's fixed effects	Yes	-	Yes	-
Importer's fixed effects	-	Yes	-	Yes
Pseudo R-squared	0.10	0.11	0.10	0.11
VWLS R2	0.29	0.39	0.45	0.40
1-U Theil	0.83	0.83	0.83	0.83
RMSE	1.44	1.41	1.44	1.40
Number of observations	15860	17056	15860	17056

Notes: ***, **, *, indicate significance at 1%, 5% and 10%, respectively. Z-statistics are provided in brackets. The dependent variable is the natural logarithm of exports in value (thousands of US$). The pseudo-R2 in the output is obtained by computing 1 – LL (full model)/LL (constant only model), which in this case varies between 0.10 and 0.11. This is McFadden's pseudo-R2 and it may not be the best measure of fit. The VWLS (variance-weighted least squares) R2 is obtained by using the inverse of the estimated variances in the heteroscedastic model as weights in the corresponding regression model.

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