Does Trade Facilitation Matter in Bilateral Trade?

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Abstract

This paper estimates an augmented gravity model incorporating different aspects of trade facilitation in developed and developing countries. Trade facilitation is defined as measures that aim at making international trade easier by eliminating administrative delays, simplifying commercial procedures, increasing transparency, security and incorporating new technologies in trade. This paper provides new theoretical and empirical enhancements. On the one hand, the model is based on theoretical foundations related to monopolistic competition and border effects. The originality of this paper is that trade facilitation facets are included in the model. On the other hand, the empirical achievement of the paper is that it takes into account many features of trade facilitation using the Doing Business database (World Bank) in two steps. First, the transaction time to import and to export is estimated and then is introduced in the gravity model. The results show that internet, bureaucracy and geographic variables affect the transaction time to import and to export. Time to import has a higher negative impact on trade then that to export. When sectoral characteristics are taken into account, some perishable (food and beverages), seasonal (wearing apparels) and high-value added products appear to be more sensitive to transaction time than other products.

JEL classification: F10, F12, F15

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1 Introduction

"**Making international trade *easier***" is the most straight forward definition of trade facilitation. However, the term "trade facilitation‘" encompasses various important aspects such as: simplification of commercial procedures; harmonization of commercial rules; transparent information and procedures; the recourse to new technologies to promote trade and make the payment more secure and reliable as well as quicker so that to accelerate the delivery of exchanged goods. For the World Customs Organization, trade facilitation is: "*the avoidance of unnecessary trade restrictiveness. This can be achieved by applying modern techniques and technologies, while improving the quality of controls in an internationally harmonized manner*". Therefore, it is noteworthy that trade facilitation does not take into account traditional barriers: neither tariffs, nor non-tariff barriers. It incorporates new transaction costs, institutional costs, administrative delays, etc. In summary, these barriers can be called "*Non-official barriers*" because they are not classified in an official framework between governments and organizations. They are also non-tariff ones because they do not incorporate any tariff barriers.

Two group of reasons help explain the importance of incorporating trade facilitation in gravity models, starting with economic ones. After reducing tariff and non-tariff barriers, trade partners have discovered that there exists other impediments to trade (OECD, 2002a). Reduction of such non-official non-tariff barriers is likely to have more impact on trade than the reduction of classical ones. Moreover, the increased commercial regimes complexity, often referred as a "Spaghetti Bowl", the increased interdependency of supply chains as well as the delays of import delivery have turned into a severe constraint on production. On the other side, the cost of non-facilitation is very high. Non-official barriers account for 2 to 15% of the value of the exchanged goods. A number of previous papers have evidenced the importance of non-visible barriers. Cernat (2001) supports the idea that the key to the African trade enigma lies in trade facilitation. Finally, as trade facilitation measures may be largely resource wasting and redundant, the welfare coming from their elimination is greater the more the restrictions being addressed waste real resources rather than generate rents that are captured by interest groups (quota rents) or governments (tariff revenues). Hence, if there is neither rents nor revenues for a country

to loose by removing restrictions, which is the case in trade facilitation aspects, benefits would be greater from eliminating them than if the measures would be creating rents.

These economic reasons explain why a majority of countries that are part of the World Trade Organization (WTO) have launched trade facilitation initiatives. In November 2001, during the Doha Development Round, many issues have been negotiated such as improving market access for developing countries, Singapore issues, liberalization of environmental goods and services and the access of developing countries to medicines. This is why trade facilitation as one of the Singapore issues was included in the cycle agenda. More specifically, the focus was on the following aspects: the simplification of trade procedures, the promotion of technical assistance and the limited capacities of developing countries. Hence, Doha Ministerial Declaration recognizes the importance of "*further acceleration of expedition, delivery and clearance of goods, including goods in transit, and the need for technical assistance and an increased capacity-building in this area*" (WTO, 2001). Furthermore, at the Fourth Ministerial Conference in Doha, ministers agreed that "*negotiations will take place after the Fifth Session of the Ministerial Conference on the basis of a decision to be taken, by explicit consensus, at that session on modalities for negotiations*" (OECD, 2003). In Hong Kong, there was not a real success regarding the trade facilitation process. This is due to the fact that developing countries are not ready to adopt a legal draft on the substantive provisions of the agreement before more progress is made on technical assistance and capacity building. These successive meetings show to what extent trade facilitation represents a quite important and debatable issue in the WTO agenda.

I order to assess the impact of trade facilitation on bilateral trade, this paper uses a gravity model. The latter has become an essential tool for measuring the impact of tariff and non-tariff barriers on services and goods commercial flows. The literature on trade facilitation measures has had so far two shortcomings: studies are either descriptive such as the ones undertook by the Organization of Economic Cooperation and Development (OECD), or they exhibit a strong legal orientation (OECD, 2002a, 2002b, 2003 and WTO, 2002). Besides, the empirical literature on trade facilitation could be classified in three main groups. The first one includes studies that emerged in the wake of Mc Callum's work (1995) where models were used to quantify border effects. This literature has been

improved theoretically by Bergstrand (1989 and 1990), Baier and Bergstrand (2001), Head and Mayer (2001a and 2001b), Feenstra (2002), Anderson and van Wincoop (2003) and Fontagné et al (2004 and 2005) who introduced the "Border Related Costs" a term called that takes into account tariff and non-tariff barriers (quantitative restrictions, administrative barriers, technical barriers and sanitary as well as phytosanitary measures). All these improvements have enforced the theoretical base of gravity models, narrowing the gap between theoretical and empirical findings. The second group is characterized by models treating only one aspect of trade facilitation, which are referred to as "Mono-dimensional models" in this paper. For instance, Freund and Weinhold (2000) examined the impact of the Internet on trade, Hummels (2001) and Djankov et al. (2006) investigated the effect of time on trade, Limao and Venables (2000) analyzed the effect of efficient infrastructure on bilateral trade and last but not least, Dutt and Traca (2007) studied the effect of corruption. The last group of empirical studies gathers models incorporating several aspects of trade facilitation, named "Multi-dimensional models". Wilson, Mann and Otsuki (2003, 2004) pioneered this kind of studies by quantifying the impact of trade facilitation measures through a gravity model by adding ports efficiency, e-business intensity, regulatory and customs environments. They first applied this model on APEC countries, then extended it to a larger sample of countries.

In this paper, I conduct a theory-based empirical analysis of the impact of trade facilitation on trade. First of all, I use a gravity model based on theoretical foundations related to monopolistic competition and border effects, including trade facilitation facets. Obviously, poor theoretical foundations lead to some difficulties in the coefficients interpretation[1]. Secondly, I take into account several aspects of trade facilitation to avoid an overestimation of the impact of classical barriers. Moreover, neglecting some aspects of trade facilitation yields to misleading coefficients in the sense they reflect not only their effect, but also the effect of other aspects. Therefore, it is important to study the impact of numerous trade facilitation measures. To do so, I perform an analysis in two steps. First, I estimate the transaction time to import and to export where I shed the light on four important aspects of transaction time: documents (capturing the impact of bureau-

[1]For instance, in this model, the impact of trade facilitation aspects can be decomposed in two parts: the impact of trade facilitation itself and the impact of the elasticity of substitution. If this point is not taken into account, the effect of trade facilitation aspects will be underestimated.

cracy that increases time), the Internet (as a proxy for the technological intensity reducing time), geographic variables (like the fact of being landlocked that hinders trade) and the number of procedures to start a business (that shows to what extent the institutional environment is efficient). In a second step, I introduce the estimated time to export and to import in the gravity to determine their effect on trade. Such a mechanism helps avoid endogeneity and multicollinearity problems. The empirical implications of the model are investigated on bilateral and sectoral trade data in order to assess which products are more sensitive than others. Clearly, such impediments hinder trade as they increase exports and imports delays which may cause many losses (imported or exported products may perish, tastes may change, etc.), that is why it is quite important to assess the effect of trade facilitation on different sectors. Finally, I use the coefficients obtained from the regressions to calculate the precise impact of transaction time and then to compute ad valorem tariff equivalent of time to export and that to import. For the sake of robustness, I use the factor analysis method to assess the impact of several trade facilitation aspects on bilateral trade.

This paper is organized as follows: section 2 is devoted to some stylized facts of trade facilitation. Section 3 develops the theoretical foundations and exposes the econometric specification of the model. Section 4 presents the data. Section 5 discusses the results. Section 6 estimates the ad valorem tariff equivalents for the time to export and to import. Section 7 is devoted to robustness check and section 8 concludes.

2 Stylized Facts

The sample includes 175 countries. Following the World Bank classification, 28% of the sample are low-income countries, 50% are lower- and upper-middle income ones and finally 22% are high-income ones, distributed between OECD and non-OECD countries. The difference in countries incomes allows to take into account the state of trade facilitation in developing and developed countries.

I use the Doing Business database developed by the World Bank. It contains several sections, the largest being "Trading Across Borders" as it brings together seven indicators related to procedures incorporated in trade. These indicators are: number of days of

exports and imports, number of documents required for exports and imports, the cost of imports and exports and the ease of doing business. Only the time and document aspects are taken into account. Figure 1 shows the relationship between the number of documents to be filed and the transaction time for exports and imports in some selected countries of the sample. Thus, a country with an important bureaucracy involving many documents, has a long delay to export or to import. For instance, in Zimbabwe, an exporter needs to submit 9 documents in order to go ahead with his transaction while an importer needs to file 15 of them. The time to export is about 42 days and 66 days to import. In contrast, all these aspects are much lower in Hong Kong. Hence, trade facilitation aspects are correlated among them. Moreover, such customs procedures may also be duplicative as paperwork and data requirements have already been required by local authorities in the home country. That is why it is very important to take into account such aspects for the exporter and for the importer simultaneously and not only one of them.

[Figure 1 about here]

Table 3 exhibits to what extent developed and developing countries are heterogenous with respect to trade facilitation aspects through the average number of days and number of documents. Regarding the number of documents for exports, the gap between them is not very significant (7.1 and 6.9 respectively). By contrast, there is a pronounced difference between developed and developing countries on the time to import as the latter is three times bigger in a developing country with respect to a developed one.

[Table 3 about here]

Obviously, the fact of being landlocked increases transaction costs due to many delays until the product reaches its destinations. In other terms, the imported (exported) product transits in many countries from its origin (or its landlocked origin) to its landlocked destination (its destination). A large part of this cost may be explained by bureaucracy and time length of trade. Table 4 shows evidence on the differences between landlocked and not landlocked countries. The average time to export of the former is 36 days versus 22 days for the latter. It is even worse for the time to import with 44 days for landlocked countries and 26 days for the others. The same analysis applies to the number of documents.

[Table 4 about here]

Here, a serious issue rises. Time and documents are highly correlated as they both reflect more complicated procedures. Their correlations varies between 0.6 to 0.8. The exclusion of documents in the regressions may cause time variation across countries to reflect both time and documents inefficiencies channel of influence. Hence, an omitted variables bias may be present. Furthermore, if the document variables are introduced in the regression to distinguish between bureaucracy and the length impact on trade, a serious problem of multicollinearity reduces the estimator efficiency by increasing its standard error. That is why I suggest two ways to avoid biased (if I omit documents) or non-efficient (if I introduce them in the regression) results. The first way is to undertake an estimation in two steps. As transaction time depends on many aspects, the first step predicts the time to import (and the time to export) as a function of the number of documents to import (to export), the Internet widespread of the importer (exporter) and its geographic situation. In a second step, I introduce the predicted values of the time to import and that to export in the gravity model. A second way to deal with the multicollinearity issue is to use the factor analysis method. The latter allows us to estimate an index called "TF" for trade facilitation taking into account the previous aspects, namely the documents to export and to import, the time to export and to import, the Internet widespread of the exporter and the importer as well as their geographic situation. The advantage of the first method is that it allows us to estimate the ad valorem tariffs equivalent for administrative barriers. As to the second way, it eliminates completely the problem of multicollinearity as it summarizes all of the trade facilitation aspects in a one index.

3 Theory

3.1 Theoretical Model

This paper uses the model initially developed by Fujita et al. (2000) and Head and Mayer (2002a) and extends it to take into account trade facilitation aspects. The authors develop a gravity model from a monopolistic competition framework that has been slightly modified by Fontagné et al. (2007) by introducing a term called "Border Related Costs".

This term includes all tariff and non-tariff barriers. The originality of this paper is that it disaggregates this term into several parts. The first part is related to tariff barriers, the second one is dedicated to the impact of preferential trade agreements and the third one incorporates explicitly the trade facilitation aspects.

The theoretical foundation of the gravity model is the Dixit-Stiglitz-Krugman model of trade under monopolistic competition. The main assumptions of the monopolistic competition model relies on a representative consumer that maximizes a Constant Elasticity of Substitution (CES) utility function. The consumption basket in i is defined by the bilateral preference term a_{ij} and the consumption c_{ijh} of variety h from country j with σ being the elasticity of substitution between varieties, n_j the number of varieties coming from country j and p_{ij} the consumer price. Therefore, the maximization problem is given by:

$$maxU_i = [\sum_{j=1}^{N}\sum_{h=1}^{n_j}(a_{ij}c_{ijh})^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \quad (1)$$

s.c.

$$y_i = \sum_{i}\sum_{h=1}^{n_j} p_{ij}c_{ijh} \quad (2)$$

Hence, the CIF value of imports m_{ij} of country i coming from country j is given by $m_{ij} = c_{ij}p_{ij}$. The price term can be disaggregated into two parts, the plant price p_j of country j to which are added the transaction costs τ_{ij} between countries i and j as follows $p_{ij} = p_j\tau_{ij}$. Finally, the expenditure m_i on all goods coming from all countries including the home country are given by $m_i = \sum_k m_{ik}$

The solution of the maximization problem in (1) subject to the constraint (2) gives:

$$m_{ij} = \frac{a_{ij}^{\sigma-1}n_j p_{ij}^{1-\sigma}}{\sum_k a_{ik}^{\sigma-1}n_k p_{ik}^{1-\sigma}}m_i \quad (3)$$

$$m_{ii} = \frac{a_{ii}^{\sigma-1}n_i p_{ii}^{1-\sigma}}{\sum_k a_{ik}^{\sigma-1}n_k p_{ik}^{1-\sigma}}m_i \quad (4)$$

Dividing these two equations then disaggregating the price term into two parts, i.e.

plant price and transaction costs yields the relative imports term $\frac{m_{ij}}{m_{ii}}$:

$$\frac{m_{ij}}{m_{ii}} = (\frac{a_{ij}}{a_{ii}})^{\sigma-1}\frac{n_j}{n_i}(\frac{p_j}{p_i})^{1-\sigma}(\frac{\tau_{ij}}{\tau_{ii}})^{1-\sigma} \tag{5}$$

Turning to the supply side of the model, firms are characterized by a production function with increasing returns to scale and identical technology. The firm j uses labor l_j as a simple production factor $l_j = F + \gamma q_j$ with F being the fixed cost of labor, γ the inverse of the firm productivity and q_j the production of firm j. Finally, the profits π_j of firm $j$are given by:

$$\pi_j = p_j q_j - w_j l_j \tag{6}$$

where w_j represents the wage paid by firm j. Replacing the labor cost equation in (6), and through the pricing equation and the free-entry condition, the representative firm output equilibrium is given by the following equation:

$$q_j = \frac{F(\sigma-1)}{\gamma} \tag{7}$$

With identical technologies $q_j = q \ \forall j = 1, ..., N$, the production value ν_j of industry j is calculated as follows:

$$\nu_j = qp_j n_j \tag{8}$$

$$\nu_i = qp_i n_i \tag{9}$$

Dividing (8) by (9) and rearranging yields:

$$\frac{n_j}{n_i} = \frac{\nu_j p_i}{\nu_i p_j} \tag{10}$$

Transaction costs include transport costs measured by the bilateral distance between the countries i and j (d_{ij}), some dummies capturing whether one country was a colony of the other at some point in time, whether the two have been colonized by a same third country ($Comcol_{ij}$), whether the two countries share a common border ($Conti_{ij}$), whether the exporter or the importer are landlocked ($Land_j$ and $Land_i$) or whether they are islands

($Isld_i$ and $Isld_j$). The last part of transaction costs is border related one (brc_{ij}) between two countries :

$$\begin{aligned}\tau_{ij} &= d_{ij}^{\delta}\exp(\rho_1 Col_{ij} + \rho_2 Comcol_{ij} + \rho_3 Conti_{ij} + \rho_4 Land_j + \rho_5 Land_i \\ &\quad +\rho_6 Isld_j + \rho_7 Isld_i)(1+brc_{ij}) \end{aligned} \tag{11}$$

These border related costs consist of tariff costs t_{ij} between i and j, non-tariff barriers which are composed of the presence of a Preferential Trade Agreement PTA_{ij} between i and j (equals 1 if i and j belong to the same PTA), and the trade facilitation aspects $\ln(\widehat{Time}_{imp,i})$ and $\ln(\widehat{Time}_{exp,j})$ (estimated logarithms of the time to import and that to export respectively):

$$\begin{aligned}(1+brc_{ij}) &= (1+t_{ij})[\exp(\eta E_{ij} + \theta PTA_{ij} \\ &\quad +\mu_1 \ln(\widehat{Time}_{imp,i}) + \mu_2 \ln(\widehat{Time}_{exp,j}))] \end{aligned} \tag{12}$$

with E_{ij} is the intercept.

As to preferences, they are twofold: a random one e_{ij} and a systematic one showing the home bias β.

$$a_{ij} = \exp(e_{ij} - (\beta - \lambda L_{ij})(E_{ij} + PTA_{ij})) \tag{13}$$

A dummy variable L_{ij} is added, being equal to 1 if i and j share the same language and zero otherwise. If L_{ij} changes from 0 to 1, the home bias changes from β to $\beta - \lambda$.

3.2 Econometric Specification

Combining the natural logarithm of equation 5 with the elements developed above will result in the following equation:

$$\begin{aligned}\ln(\frac{m_{ij}}{m_{ii}}) &= (\sigma-1)\ln(\frac{a_{ij}}{a_{ii}}) + \ln(\frac{n_j}{n_i}) \\ &\quad +(1-\sigma)\ln(\frac{p_j}{p_i}) + (1-\sigma)\ln(\frac{\tau_{ij}}{\tau_{ii}}) \end{aligned} \tag{14}$$

Then preferences and transaction costs in (14) are replaced by their values in (11), 12 and 13. I further simplify by stating that $L_{ii} = 0$; $E_{ii} = 0$; $PTA_{ii} = 0$; $t_{ii} = 0$; $Conti_{ii} = 0$,

$Col_{ii} = 0$; $Comcol_{ii} = 0$ and suppose that $\ln(\widehat{Time}_{imp,i}) = 0$ for internal flows. Indeed, such impediments only concern international flows. Furthermore, internal flows are not affected by the geographical characteristics of the country ($Land_i = 0$ and $Isld_i = 0$). Finally, I multiply $(1-\sigma)$ by the terms in brackets. The estimable model that is used in the second step of estimation is then given:

$$\begin{aligned}\ln(\frac{m_{ij}}{m_{ii}}) &= \ln(\frac{\nu_j}{\nu_i}) - \sigma\ln(\frac{p_j}{p_i}) + \delta(1-\sigma)\ln(\frac{d_{ij}}{d_{ii}}) + (1-\sigma)\ln(1+t_{ij}) + (\sigma-1)\lambda L_{ij} \\ &\quad -(\sigma-1)(\theta-\eta)PTA_{ij} + (\sigma-1)[\rho_1 Col + \rho_2 Comcol + \rho_3 Conti_{ij} + \rho_4 Land_j \\ &\quad +\rho_5 Land_i + \rho_6 Isld_j + \rho_7 Isld_i] + (1-\sigma)\mu_1\ln(\widehat{Time}_{imp,i}) \\ &\quad +(1-\sigma)\mu_2\ln(\widehat{Time}_{exp,j}) - (\sigma-1)(\eta+\beta)E_{ij} + \epsilon_{ij} \qquad (15)\end{aligned}$$

where: $(1-\sigma)$: is a negative coefficient when σ is greater than 1 implying that higher transaction costs decrease trade flows.

$(\sigma-1)(\eta-\beta)$: the border effects which are not related to a PTA membership,

$(\sigma-1)(\theta-\beta)$: the supplementary trade due to a PTA membership,

$(\sigma-1)\mu_1$ and $(\sigma-1)\mu_2$: the variation in trade due to trade facilitation aspects.

ϵ_{ij}: the error term equals to $(\sigma-1)(e_{ij}-e_{ii})$.

In the first step concerning the estimation of time to export and to import, I regress the former (the latter) on many control variables, namely the number of documents of the exporter $Doc_{exp,j}$ (of the importer $Doc_{imp,j}$), the Internet widespread in the exporter $Internet_{exp,j}$ (in the importer $Internet_{imp,i}$), the fact that the exporter (importer) is being landlocked or an island and the number of procedures requested to start a business for the exporter $Proc_{exp,j}$ (for the importer $Proc_{imp,i}$). A dummy variable for tariffs Tar_{ij} (equals to 1 when there are tariff barriers between i and j, 0 otherwise) is added to the determinants of the time to import. Hence, the equations I estimate is given by:

$$\begin{aligned}\ln(Time_{exp,j}) &= \ln(Doc_{exp,j}) + \ln(Internet_{exp,j}) + \ln(Proc_{exp,j}) \\ &\quad +Land_{exp,j} + Isld_{exp,j} + \omega_j \qquad (16) \\ \ln(Time_{imp,i}) &= \ln(Doc_{imp,i}) + \ln(Internet_{imp,i}) + \ln(Proc_{imp,i}) \\ &\quad +Land_{imp,i} + Isld_{imp,i} + Tar_{ij} + \omega_i \qquad (17)\end{aligned}$$

where ω is the discrepancy term. Once the time to export and the time to import are predicted, they are introduced in equation (15) to estimate their impact on bilateral trade. Hence, the multicollinearity problem is resolved.

4 Data

Data have been collected from several sources. To begin with, my dependent variable in the first step is the logarithm of the time to export (to import) taken from the "Doing Business" database constructed by the World Bank. Regarding the time determinants, the number of documents to export (to import) and the number of procedures to start a business for the exporter (the importer) are taken also from "Doing Business". The Internet widespread is taken from the World Development Indicators (WDI). Geographic variables are taken from the CEPII[2] database.

For the gravity model, the dependant variable is the ratio between bilateral and internal flows. It is constructed from the "Trade and Production" dataset available on the CEPII website. The same database has been used for the other independent variables, namely relative production and tariffs. Other classic gravitational variables, for instance contiguity, common language, distance, common colonizer, etc. come from the CEPII Distance database[3]. Recall that once the time to export and to import are estimated from the first step, they are introduced in the gravity equation as independent variables. For more details on the definition, the construction and the sources of variables, see Appendix 1.

5 Estimation Results

5.1 Determinants of Transaction Time: Bureaucracy Matters

Table 5 presents the determinants of transaction time. It is quite obvious that bureaucracy increases significantly the time to trade. A 10% increase in the number of documents to import (to export) increases the time to import by 6.8% (to export by 7.5%). This

[2]Centre d'Etudes Prospectives et d'Informations Internationales.

[3]This dataset is available on the CEPII website: `http://www.cepii.fr/francgraph/bdd/distances.htm`

shows to what extent the initiative of trade facilitation of making "*paperless world*" is crucial in order to simplify procedures and reduce the time of delivery and clearance of traded goods. To capture the institutional environment in the country, I also introduce the number of procedures to start a business. The latter has a significant and negative, although low, effect: an increase in the number of procedures in the exporter or the importer country by 10% raises the time to export (by 0.5%) or to import (by 1.5%). The trade policy variable (tariff dummy) is also positive and significant showing that if tariff barriers may exist between trade partners, the time to clear and to deliver exchanged goods should be higher. This conclusion shows to what extent trade liberalization and trade facilitation are two complementary processes.

[Table 5 about here]

Moreover, the fact of being landlocked makes commercial transactions lengthier due to many transit costs that waste time and generate additional costs, implying that ocean transportation is significantly cheaper. However, the fact of being landlocked may be overcome if landlocked countries improve their trade facilitation aspects, especially through infrastructure improvements which is the case in Sub-Saharan Africa. As to fact of being an island, it should decrease time thanks to maritime facilities and the presence of many ports. Yet, it does not guarantee lower level of time without good infrastructure and efficient ports to facilitate the transport of exported products from production locations to ports and the imported ones from ports to local markets.

Finally, the Internet widespread reduces significantly the time to trade: an increase in the Internet intensity by 10% reduces the time to import by 1.5% (to export by 1.3%). Hence, trade facilitation would have an important contribution to reducing the transaction time and hence to increasing trade through computerized customs authorities.

In conclusion, this model has a high explanatory power as the independent variables taken into account explain 77% and 86% of the variation of the time to export and to import respectively.

5.2 To What Extent Trade Facilitation Aspects Do Affect Bilateral Trade?

The results presented in Column 1 in Table 6 show the effect of trade facilitation aspects on bilateral trade. The analysis will be divided into two parts. The first one includes usual results in line with the literature on gravity (same sign and almost similar coefficient values). The second one will discuss trade facilitation results. It is noteworthy that sectoral dummies have been added to the regressions in order to capture sectoral specific characteristics.

[Table 6 about here]

Regarding the first group of results, I find a coefficient equals to 0.78 for relative production, a negative impact of distance (-0.71), of relative prices (-0.29), a positive effect of contiguity, PTA, colonial links, common colonizer and common languages (with coefficients equal to 1.7, 0.85, 1.33, 1.17 and 0.26 respectively). Tariffs have a significant negative impact on relative imports (-0.16). This coefficient is relatively low comparing to the one obtained in other studies for two reasons. First, the data set I use has not sufficiently disaggregated level of flows because I use the 3-digits level. Secondly, other studies neglected trade facilitation aspects and consequently, the tariffs coefficient captures not only the effect of tariff barriers but also other impediments to trade. Interestingly, this coefficient that gives the substitution elasticity is crucial to the analysis as all the coefficients of the trade facilitation variables result from the interaction between the trade facilitation measure and the substitution elasticity. Such a point should be taken into account to compute the precise effect of Trade Facilitation aspects which will be done in section 5.4. Finally, the constant is very high. This coefficient gives the border effect and it is significantly high because it reports the border effect among countries that do not belong to a PTA.

As for Trade Facilitation aspects, we can figure out that the most relevant impediments to trade is transaction time. Column 1 shows that, generally, time has a significant and negative effect on trade. More specifically, the impact of the time to import is almost the double of that to export. A one day increase in the number of days to import (to export) reduces trade by 1.17% (0.69%). My results are stronger than Hummels (2001) who found

that each day saved in shipping time is worth 0.8% ad-valorem for manufactured goods. This is explained by the fact that Hummels (2001) did not take into account all of the trade facilitation aspects that could affect time, especially the number of documents that explains almost 70% of the transaction time variation. The analysis I undertake here is done on the whole data set. The next section exhibits the specific effect of trade facilitation on each sector.

5.3 Which Products Are the Most Sensitive to Trade Facilitation Aspects?

As a matter of fact, not all products are affected in the same way by trade facilitation. Some products are more sensitive to trade facilitation than others, such as perishable goods (foods and agricultural goods), seasonal products (garments), products with short market lifetime (high technology products) and intermediate goods used in the production process. Consequently, I found it more convenient to run the regressions for different manufacturing sectors. The arising problem concerns the product coverage of the two databases. "Trade and Production" covers manufacturing sectors (300), while "Doing Business" only covers some specific products[4]. However, the regressions are performed even for the sectors that are not included in the Doing Business database. The intuition here is to use the Doing Business variables as a proxy for those sectors in order to evaluate the impact of trade facilitation aspects on exchanged products.

Generally, it is worth noting that the time to import has a stronger effect on many sectors than the time to export. More particulary, beverages and food are highly sensitive to import time. Undoubtedly, such perishable products need fast clearance and quick delivery in order to use them before they perish. One of the most interesting results regarding food, as well as textiles and wearing apparels, is the one associated with the impact of contiguity. It is evident that, as time matters for such products, the trade of food and garments will increase if two countries share a common border. The reason is simple: food will perish and garments must be quickly delivered in order to be used in the corresponding season, not after. By contrast, the results show that many products

[4]For more details about the product assumptions, see Appendix 1. It is noteworthy that the results do not change even if the products that are not compatible with Doing Business assumptions are eliminated.

are either not sensitive to trade facilitation such as tobacco, or weakly sensitive such as furniture.

[Tables 7 and 8 about here]

Last but not least, many high value-added products, like transport, professional and scientific equipments, are found to be highly affected by the transaction time. This result seems to be a bit paradoxical because, presumably, those products should not be sensitive to trade facilitation. Moreover, they are neither perishable, nor seasonal, nor with a short market lifetime. Nonetheless, they have a crucial role in the production process as they are used to transport intermediate inputs and exported goods from production locations to ports and imported ones from ports to markets. Finally, in the same line as transport equipments, electrical machines are impacted by the time to import and to export, for the same reason. Some of these sectors (that are either intermediate or high value-added products) need a lot of documents in order to guarantee their conformity to the international norms of high-technology products, which in turn increases the transaction time and consequently decreases trade.

In sum, it is quite clear that the impact of trade facilitation is greater for highly value-added products, for perishable, for seasonal and for intermediate goods. Thus, it covers a quite important range of products. That is why it will generate many gains through quicker (less time and documents) and more computerized (more technology) trade procedures.

5.4 Calculating Consistent Estimates for the Impact of Trade Facilitation

The objective of this part is to calculate the precise estimates of trade facilitation. The Trade Facilitation coefficient ($\mu(1-\sigma)$) is divided by the tariff coefficient (1-σ) to get μ_1 and μ_2 which represents the real impact of trade facilitation aspects.

[Table 9 about here]

The results show that the elasticity of substitution has, on average a value of 1.2. The most interesting results are the one regarding trade facilitation aspects. For instance, when

the coefficient of the time to export is 0.69, its μ is 4.3. Similarly, while the coefficient of the time to imports coefficient is 1.16, its μ is 7.2. Thus, it is quite obvious that the impact of Trade Facilitation aspects is underestimated because their coefficients resulting from OLS regressions are not deflated by the substitution elasticity term. By doing so, their impact increases. Table 9 displays the results of this exercise for some selected sectors. The impact of food, beverages, textiles and garments witness a high and significant increase.

6 Estimating Tariff Equivalents for Time and Documents

Many studies underlined the fact that developing countries would capture two thirds of the gains from a Doha Development Agreement on trade facilitation. In order to evaluate the impact of trade facilitation, tariff equivalents for the time to export and to import should be calculated. To do so, I follow the methodology adopted by Olarreaga, Nicita and Kee (2009) where they estimate ad-valorem tariff equivalents for non-tariff barriers based on a gravity model. Similarly, I rely on my gravity model to compute ad-valorem tariff equivalents for these two variables. To make trade facilitation aspects comparable with ad-valorem tariff equivalents, I have to transform the quantity impact into price equivalents. This yields the ad-valorem equivalent of the time to export $ave^{Time}_{exp,j,n}$ and the time to import $ave^{Time}_{imp,i,n}$ noted as $ave^{Time}_{exp,j,n} = dlog(p_{i,n})$ and $ave^{Time}_{imp,i,n} = dlog(p_{i,n})$ respectively. Hence, the gravity equation is differentiated with respect to $\widehat{Time_{imp,i,n}}$ and $\widehat{Time_{exp,j,n}}$:

$$\frac{d\ln(\frac{m_{ij,n}}{m_{ii,n}})}{d\ln(\widehat{Time_{imp,i,n}})} = \frac{d\ln(\frac{m_{ij,n}}{m_{ii,n}})}{d\ln(p^d_{i,n})} . \frac{d\ln(p^d_{i,n})}{d\ln(\widehat{Time_{imp,i,n}})} = \varepsilon_{i,n}.ave^{Tim}_{imp,i,n} \tag{18}$$

$$\frac{d\ln(\frac{m_{ij,n}}{m_{ii,n}})}{d\ln(\widehat{Time_{exp,j,n}})} = \frac{d\ln(\frac{m_{ij,n}}{m_{ii,n}})}{d\ln(p^d_{j,n})} . \frac{d\ln(p^d_{j,n})}{d\ln(\widehat{Time_{exp,j,n}})} = \varepsilon_{j,n}.ave^{Time}_{exp,j,n} \tag{19}$$

where $\varepsilon_{j,n}$ is the import demand elasticity of good n in country j and $p^d_{j,n}$ the domestic price in country j.

Hence, solving (18) and (19) for $ave^{Time}_{exp,j,n}$ and $ave^{Time}_{imp,i,n}$, I get:

$$ave^{Time}_{imp,i,n} = \frac{1}{\varepsilon_{i,n}}.\frac{d\ln(\frac{m_{ij,n}}{m_{ii,n}})}{d\ln(\widehat{Time}_{imp,i,n})} \tag{20}$$

$$ave^{Time}_{exp,j,n} = \frac{1}{\varepsilon_{j,n}}.\frac{d\ln(\frac{m_{ij,n}}{m_{ii,n}})}{d\ln(\widehat{Time}_{exp,j,n})} \tag{21}$$

In other terms, the ad-valorem tariff equivalent can be computed by dividing the coefficient by the demand elasticity as follows:

$$ave^{Time}_{imp,i,n} = \frac{(\sigma-1)\mu_1^{Time_{imp,i,n}}}{\varepsilon_{i,n}} \tag{22}$$

$$ave^{Time}_{exp,j,n} = \frac{(\sigma-1)\mu_2^{Time_{exp,j,n}}}{\varepsilon_{j,n}} \tag{23}$$

I have calculated the ad-valorem tariff equivalents for manufacturing products at the 3-digits level (ISIC-3) for some 175 countries[5]. Table 10 in Appendix 4 presents the aggregated tariff equivalents.

[Tables 10 and 11about here]

It is quite obvious that some sectors have higher ad-valorem tariffs than others. Perishable and seasonal products are more impacted by the time to import than the time to export. For instance, the figures for food (perishable) are respectively 21% and 45% for the time to export and the time to import. Similarly, garments (seasonal goods) are highly sensitive to the time to import with 138%. High value-added and intermediate products are more affected by the time to export than the time to import. For professional and scientific equipments as well as electrical machines, the time to export is about 42.5% and 69% respectively, with lower figures for the time to import (24.5% and 62.7% respectively). Finally, products not belonging to any of the previous groups are not sensitive to trade facilitation, such as tobacco which is neither sensitive to the time to export nor to the time to import. On the country level, the calculated AVE shown in Table 11 shows that the difference between developed and developing countries is very pronounced as the mean of the AVE of the time to export is 17.18% for the latter and 41.32% for the latter. The

[5]Ad valorem tariff equivalent for the whole sample are available upon request

best practise among developed countries is Singapore with 4.1% and 5.68% for the time to import and to export respectively. For developing countries, Panama is found to be the best practise with 8.91% and 10.58% for the time to import and to export respectively. By contrast, the figures of the worst performances are found in the cases of Japan (with 107.40% and 148.59% for the time to export and to import respectively) among developed countries and Tanzania (with 201.74% and 411.74% respectively) among developing ones.

7 Robustness Check

As mentioned before, in order to eliminate multicollinearity and endogeneity issues, two methods have been suggested. This first one has been presented previously with the two steps estimation. Another technique consists of using the factor analysis method. The idea behind is to calculate one index taking into account all of the trade facilitation aspects. The results are displayed in column 2 in Table 6. It is quite obvious that my results remain robust as trade facilitation aspects have a highly significant and negative effect on bilateral trade. The coefficients of the other variables remain significant, with the same sign and almost the same values[6].

[6]For the sake of robustness check and studying the impact of further aspects of trade facilitation, the Institutional Profiles database have been used. Regarding trade facilitation aspects, information and customs efficiency have a positive and significant effect on trade. By contrast, transaction security appears to reduce trade by 11% as predicted after the 9-11 events. Actually, developed countries imposed many constraints in order to secure trade. These constraints reduced trade flows coming from developing countries as shown in the regression results. Fraud has a significant negative effect on trade. The Internet widespread remains significant and boosts trade. A very important result is the one concerning geographical variables (being landlocked or an island). Once I control for many trade facilitation aspects, these variables become non-significant. Hence, more trade facilitation means overcoming trade barriers induced by geographical impediments. The results using the Institutional Profiles database are available upon request.

8 Conclusion

The present paper quantifies the impact of numerous trade facilitation aspects on bilateral trade. It makes both theoretical and empirical contributions to the impact of trade facilitation aspects on bilateral trade. From a theoretical standpoint, a gravity model that includes in its derivation trade facilitation aspects has been developed. From an empirical standpoint, the impact of trade facilitation variables on trade is assessed in several ways avoiding econometric issues like multicollinearity and endogeneity. The main findings are that the transaction time to import and to export decreases trade significantly. Moreover, the former has a higher effect than the latter. Finally, I conclude that some perishable (food and beverages), seasonal (garments), intermediate and high-value added products are sensitive to the time to import and to export. To check the robustness of the model, the factor analysis method has been used and it turns out that the results remain robust, especially those of trade facilitation aspects.

From a policy implication point of view, this study gives quite important results. First, as more documents imply lengthier time, the initiative of a "paperless world" is crucial for trade facilitation. Reducing or even eliminating documents that could be replaced by electronic ones and submitted through a single window would highly simplify trade procedures, reduce the time of inspection as well as the delivery of imported products. Recall that impediments induced by red tape costs do not have any rent or revenue loss once they are dismantled. Thus, welfare implications are quite high as administrative costs are a real "deadweight loss". Last, trimming down such impediments would benefit to all trade partners, which is not the case of tariff elimination.

The main shortcomings of this paper are strictly related to data issues. First, regarding the infrastructure quality, many aspects must be taken into account such as port efficiency, paved roads, and so on, in order to have a more precise estimation of their impact on trade flows. Furthermore, this model should be estimated using panel data if data availability allows this. Finally, ad-valorem tariff equivalents of the time to export and to import should be estimated for agriculture and services in order to determine to what extent such products are more or less sensitive to trade facilitation. The latter could hence be used in policy modeling, especially computable general equilibrium models. These are

very interesting areas for future research.

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Appendix 1: Data Description

This appendix presents the definition as well as the source of each variable used in the database. Data have been collected from several sources. Regarding the trade facilitation variables, "Doing Business"[7] has been used. This dataset compiles procedural requirements for exporting and importing a standardized cargo of goods by ocean transport. Every official procedure for exporting and importing 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 clearance of the goods across the border are also recorded. For further details, check `www.doingbusiness.org`.

First Step: Time Determinants

Dependent Variable

The logarithm of the **Time** to export and to import have been used in the first step estimation. It is recorded in calendar days. The time calculation for a procedure starts from the moment it is initiated and runs until it is completed. If a procedure can be accelerated for an additional cost, the fastest legal procedure is chosen. It is assumed that neither the exporter nor the importer wastes time and that each commits to completing each remaining procedure without delay. Procedures that can be completed in parallel are measured as simultaneous.

Independent Variable

For trade bureaucracy, **documents to export and to import** have been used. "Doing Business" defines them as all documents required to export and import the goods. It is assumed that the contract has already been agreed upon and signed by both parties. Documents include bank documents, customs declaration and clearance documents, port filing documents, import licenses and other official documents exchanged between concerned parties. Documents filed simultaneously are considered different documents but with the same time frame for completion.

[7]This part presents the scope and the description of Doing Business. It is available on www.doingbusiness.org

The number of procedures to start a business is taken from the Doing Business database. It gives all the procedures that an entrepreneur needs to carry out to obtain all the necessary permits, to notify and file with all requisite authorities and hence to begin legally operating a firm involved in industrial or commercial activity.

The Internet variable comes from the World Development Indicators database available on the World Bank web site. This variable determines the number of Internet users per 1000 people and is the best proxy for technological intensity as well as for the intensity of e-commerce.

Geographic variables (the fact of being landlocked or an island) are taken from the Distance dataset available on the CEPII website.

Second Step: Gravity Model

Dependant Variable

My dependant variable is the ratio between bilateral and internal trade flows as explained below:

Bilateral Flows: Regarding trade data, the mirror inflows, available in Nicita and Olarreaga (2001), were used along with the CEPII database on international trade (BACI)[8], which is also based on COMTRADE data. The data used is a cross section in 2004. It comes comes from CEPII's[9] "Trade and Production" database[10].

Internal Flows: Internal trade flows are in current US$ and are calculated as the difference between domestic primary and secondary sector production minus exports. This variable comes also from "Trade and Production"

Explanatory Variables

Tariff and Production Data: First, the original data (Nicita and Olarreaga, 2001) come from the United Nations sources: COMTRADE and UNIDO. Despite a wide covering, the World Bank files contain a lot of missing values for production figures in recent

[8]BACI is the new CEPII world database for international trade analysis at the product-level.

[9]They are available on CEPII's website.

[10]As the available data from "Trade and Production" end in 2004 and the available data from "Doing Business" begin in 2006, these two databases have been merged under the following assumption: institutional variables of "Doing Business" would not vary much between 2004 and 2006, making their combination possible.

years. This is the reason why the Trade and Production database was largely extended using more recent versions of the UNIDO CD-ROM together with OECD STAN data for OECD members.

Distance Variable: it comes from the distance database developed by the CEPII. The methods used in this database allow to generate many indicators on internal distance, weighted distance, etc. This allows us to estimate the model derived in section 5. In my model, I use the relative distance defined as the ratio between bilateral and internal distance. The former is the distance between two capitals and the latter is a proxy of average distance between producers and consumers in a country. It is computed as follows $dii = 0.67\sqrt{area/\pi}$. For more on this measure, see Head and Mayer (2002).

Other Classical Gravitational Variables: They come from the CEPII dataset, namely dummy variables indicating whether the two countries are contiguous, share a common language, have had a common colonizer after 1945, have ever had a colonial link. Some other variables are not bilateral but country specific. They are dummies indicating whether a country is landlocked and an island. The variable of belonging to the same FTA comes from the dataset developed by Martin et al. (2008) available on `http://team.univ-paris1.fr/teamperso/mayer/data/data.htm`.

Robustness Check Variables: The second database, Institutional Profiles (2001), that is used for robustness check, is a survey conducted by researchers based at the French Ministry of the Economy, Finance and Industry (MINEFI) and the French Development Agency (AFD) based on a survey conducted by MINEFI and AFD agencies in the countries covered (51 countries both developed and developing). Data have been collected through a questionnaire describing the institutional characteristics of these countries and was split in 4 sections: section A is related to the institutional environment, section B to the market for goods and services, section C concerns the financial system and section D the labor market as well as social interactions. Out of the legion of indicators included in the database, only 14 have been chosen based on their appropriateness to trade facilitation.

Appendix 2: Lists of Countries and Sectors

Table 1: List of countries by code iso-3

Country	Country	Country	Country	Country
Afghanistan	Costa Rica	India	Mongolia	Sao Tome and Principe
Angola	Czech Rep.	Ireland	Mozambique	Suriname
Albania	Germany	Iran	Mauritania	Slovakia
United Arab Emirates	Djibouti	Iraq	Mauritius	Slovenia
Argentina	Dominica	Iceland	Malawi	Sweden
Armenia	Denmark	Israel	Malaysia	Swaziland
Antigua and Barbuda	Dom. Rep.	Italy	Namibia	Seychelles
Australia	Algeria	Jamaica	Niger	Syria
Austria	Ecuador	Jordan	Nigeria	Chad
Azerbaijan	Egypt	Japan	Nicaragua	Togo
Burundi	Eritrea	Kazakstan	Netherlands	Thailand
Belgium and Luxembourg	Spain	Kenya	Norway	Tajikistan
Benin	Estonia	Kyrgyzstan	Nepal	East Timor
Burkina Faso	Ethiopia	Cambodia	New Zealand	Tonga
Bangladesh	Finland	Kiribati	Oman	Trinidad and Tobago
Bulgaria	Fiji	Saint Kitts and Nevis	Pakistan	Tunisia
Bosn. and Herzeg.	France	Korea	Panama	Turkey
Belarus	Micronesia	Kuwait	Peru	Taiwan
Belize	Gabon	Lao Rep.	Philippines	Tanzania
Bolivia	United Kingdom	Lebanon	Palau	Uganda
Brazil	Georgia	Liberia	Papua New Guinea	Ukraine
Brunei Darussalam	Ghana	Saint Lucia	Poland	Uruguay
Bhutan	Guinea	Sri Lanka	Puerto Rico	United States of America
Botswana	Gambia	Lesotho	Portugal	Uzbekistan
Cen. Afr. Rep	Guinea-Bissau	Lithuania	Paraguay	St Vinc. and Grenad
Canada	Greece	Luxembourg	Romania	Venezuela
Switzerland	Grenada	Latvia	Russia	Viet Nam
Chile	Guatemala	Morocco	Rwanda	Vanuatu
China	Guyana	Moldova, Rep.of	Saudi Arabia	Samoa
Côte d'Ivoire	Hong Kong	Madagascar	Sudan	Yemen
Cameroon	Honduras	Maldives	Senegal	Serbia and Mont.
Congo	Croatia	Mexico	Singapore	South Africa
Colombia	Haiti	Marshall Isl.	Solomon Islands	Congo Demo. Rep.
Comoros	Hungary	Macedonia	Sierra Leone	Zambia
Cape Verde	Indonesia	Mali	El Salvador	Zimbabwe

Source: Constructed by the author from Trade and Production database.

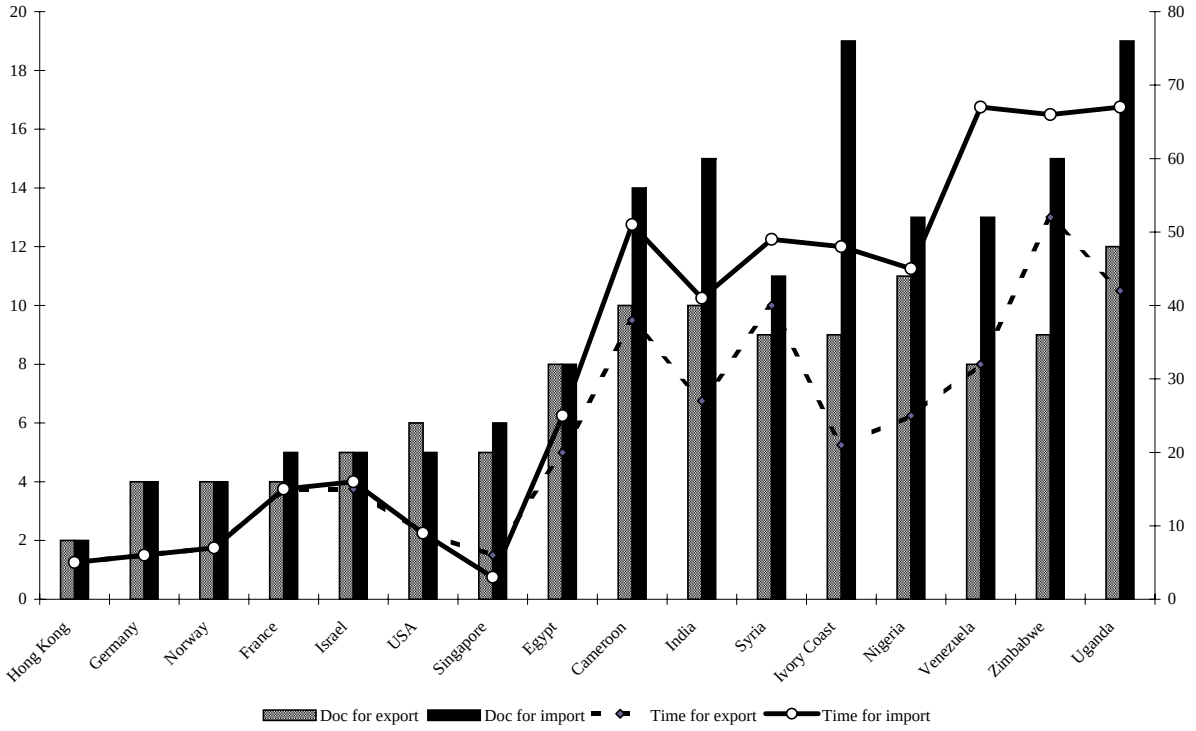
Table 2: List of manufacturing sectors by code

Code	Sector	Code	Sector
311	Food products	354	Misc. petrol./coal prod.
313	Beverages	355	Rubber products
314	Tobacco	356	Plastic products
321	Textiles	361	Pottery china earthenware
322	Wearing apparel	362	Glass and products
323	Leather products	369	Other non-metal min. prod.
324	Footwear	371	Iron and steel
331	Wood products except furniture	372	Non-ferrous metals
332	Furniture except metal	381	Fabricated metal products
341	Paper and products	382	Machinery except electrical
342	Printing and publishing	383	Machinery electric
351	Industrial chemicals	384	Transport equipment
352	Other chemicals	385	Prof. and sci. equipment
353	Petroleum refineries	390	Other manufactured products

Source: Constructed by the author from Trade and Production database

Appendix 3: Descriptive Statistics

Figure 1:
Document and Time for Export and Import



Source: Doing Business, the World Bank.
Notes: (i.) Documents are defined as all documents required to export and import the goods. It is assumed that the contract has already been agreed upon and signed by both parties. Documents include all official documents exchanged between the concerned parties. For more details, see appendix 1.
(ii.) Time is recorded in calendar days. The time calculation for a procedure starts from the moment it is initiated and runs until it is completed. It is assumed that neither the exporter nor the importer wastes time and that each one commits to completing the remaining procedures without delay. For more details, see appendix 1.

Table 3: Time and Documents for Developed and Developing countries

Variable	Developing	Developed
Exporter Doc for Exp.	6.96	7.16
Importer Doc for Imp.	9.89	6.04
Exporter Time for Exp.	25.65	27.42
Importer Time for Imp.	37.96	12.93

Source: Constructed by the author from "Doing Business", the World Bank, 2006.

Table 4: Time and Document for Landlocked and Not landlocked countries

	Landlocked			Not Lanlocked		
Variable	Mean	Min	Max	Mean	Min	Max
Doc. for exp.	7.47	4	14	6.66	3	14
Time for exp.	36.37	6	89	21.83	5	102
Doc. for imp.	9.35	4	19	8.47	1	18
Time for imp.	43.55	6	104	26.1	3	101

Source: Constructed by the author from "Doing Business", the World Bank, 2006.

Appendix 4: Regressions Results

Table 5: First Step: Estimating Time of Export and Import

	Ln(Time Exp.)	Ln(Time Imp.)
Landlocked Imp.		0.0773***
		(0.000989)
Island imp.		0.0345***
		(0.00171)
Ln(Internet Imp.)		-0.155***
		(0.000325)
Ln(Doc. Imp.)		0.680***
		(0.00116)
Ln(Procedure Imp.)		0.147***
		(0.000964)
Tariff Dummy		0.0141***
		(0.00133)
Landlocked Exp.	0.241***	
	(0.00109)	
Island Exp.	-0.0233***	
	(0.00136)	
Ln(Internet Exp.)	-0.131***	
	(0.000319)	
Ln(Doc. Exp.)	0.752***	
	(0.00178)	
Ln(Procedure Exp.)	0.0478***	
	(0.000942)	
Constant	1.587***	1.523***
	(0.00391)	(0.00351)
Country Pair Dummies	YES	YES
Observations	30625	30625
R-squared	0.77	0.86

Notes: (i.)Robust standard errors in parentheses.
(ii.) ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

Table 6: Second Step: Impact of Trade Facilitation on Bilateral Trade

	Ln (Rel. Imp.)	Ln (Rel. Imp.)
Ln(Rel. Prod.)	0.777***	0.752***
	(0.00374)	(0.00327)
Ln(Rel. Dist.)	-0.709***	-0.688***
	(0.0113)	(0.0111)
Ln(Rel. Price)	-0.293***	-0.321***
	(0.0357)	(0.0348)
Ln(Tariff+1)	-0.161***	-0.300***
	(0.0115)	(0.00964)
Contiguity	1.694***	1.770***
	(0.0681)	(0.0649)
Common Lang.	0.256***	0.288***
	(0.0402)	(0.0403)
Colony	1.333***	1.260***
	(0.0486)	(0.0489)
Com. Col.	1.173***	1.185***
	(0.0652)	(0.0624)
PTA	0.851***	1.034***
	(0.0467)	(0.0454)
Ln($\widehat{TimeImp.}$)	-1.165***	
	(0.0246)	
Ln($\widehat{TimeExp.}$)	-0.691***	
	(0.0231)	
TF factor		-0.683***
		(0.0118)
Constant	-2.298***	-7.979***
	(0.142)	(0.118)
Sectoral Dummies	YES	YES
Observations	56127	57317
R-squared	0.59	0.59

Notes: (i.)Robust standard errors in parentheses.
(ii.) ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

Table 7: Impact of Trade Facilitation variables on the sectoral level (1)

	Food	Beverages	Tobacco	Textiles	Wearing	Leather prod.	Furniture	Paper prod	Chemicals	Petro. Ref.
	311	313	314	321	322	323	332	341	352	353
	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)
Ln(Rel. Prod.)	0.737***	0.795***	0.769***	0.765***	0.886***	0.641***	0.638***	0.791***	0.798***	0.704***
	(0.0190)	(0.0248)	(0.0433)	(0.0162)	(0.0199)	(0.0206)	(0.0225)	(0.0158)	(0.0218)	(0.0302)
Ln(Rel. Dist.)	-0.213***	-0.537***	-0.698***	-0.922***	-0.809***	-0.620***	-0.600***	-0.950***	-0.641***	-0.864***
	(0.0491)	(0.0493)	(0.134)	(0.0492)	(0.0735)	(0.0687)	(0.0647)	(0.0425)	(0.0547)	(0.0941)
Ln(Rel. Price)	-0.364	-0.252	0.286	-2.080***	-2.083***	-0.252	-0.0597	-0.447**	-0.114	0.258
	(0.239)	(0.159)	(0.221)	(0.170)	(0.241)	(0.158)	(0.129)	(0.185)	(0.186)	(0.232)
Ln(Tariff+1)	-0.250***	-0.174***	0.0571	-0.207***	-0.292***	-0.580***	-0.198***	-0.186***	-0.443***	0.121
	(0.0532)	(0.0514)	(0.0979)	(0.0414)	(0.0424)	(0.0631)	(0.0597)	(0.0490)	(0.0611)	(0.0846)
Contiguity	2.714***	2.045***	1.572*	1.890***	1.209**	0.703	0.925**	1.486***	2.396***	2.538***
	(0.281)	(0.366)	(0.809)	(0.328)	(0.492)	(0.591)	(0.392)	(0.211)	(0.457)	(0.414)
Common Lang.	0.639***	-0.211	-0.947***	0.0713	-0.375*	-0.464***	1.183***	-0.788***	0.743***	-1.354***
	(0.186)	(0.189)	(0.317)	(0.150)	(0.200)	(0.174)	(0.250)	(0.195)	(0.189)	(0.285)
Colony	1.096***	2.466***	2.035***	1.262***	0.384**	2.287***	0.779**	1.770***	0.848***	-0.319
	(0.224)	(0.254)	(0.417)	(0.197)	(0.165)	(0.210)	(0.304)	(0.210)	(0.219)	(0.476)
Com. Col.	1.619***	1.126***	1.988***	0.122	1.709***	1.708***	1.024***	1.754***	0.479	0.497
	(0.223)	(0.318)	(0.754)	(0.220)	(0.424)	(0.500)	(0.324)	(0.236)	(0.337)	(0.414)
PTA	1.330***	0.638***	0.424	0.630***	0.403	0.772***	0.993***	1.086***	1.054***	0.357
	(0.274)	(0.228)	(0.909)	(0.220)	(0.260)	(0.296)	(0.245)	(0.127)	(0.264)	(0.431)
Ln($\widehat{TimeImp.}$)	-0.889***	-1.246***	0.0322	-1.786***	-2.253***	-0.823***	-1.635***	-0.807***	-0.931***	-1.156***
	(0.0909)	(0.102)	(0.238)	(0.0853)	(0.135)	(0.131)	(0.160)	(0.115)	(0.136)	(0.210)
Ln($\widehat{TimeExp.}$)	-0.458***	-0.948***	-0.391	-1.034***	0.344**	-0.258**	-0.177	-0.977***	-1.628***	-0.969***
	(0.109)	(0.119)	(0.278)	(0.0888)	(0.137)	(0.117)	(0.141)	(0.0956)	(0.105)	(0.179)
Constant	-3.167***	-1.036**	-7.339***	4.610***	2.848***	-0.0560	0.0813	0.681*	2.546***	-1.924**
	(0.464)	(0.456)	(1.146)	(0.346)	(0.566)	(0.554)	(0.606)	(0.362)	(0.477)	(0.858)
Observations	2610	2475	688	2713	1309	1896	1659	3310	2428	1378
R-squared	0.47	0.42	0.47	0.62	0.66	0.41	0.42	0.58	0.67	0.40

Notes: (i.)Robust standard errors in parentheses.
(ii.) ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

Table 8: Impact of Trade Facilitation variables on the sectoral level (2)

	Rubber prod 355	Plastic 356	Iron steel 371	Non-fer Met 372	Fab. Metal 381	Machinery 382	Elect mach 383	Transport 384	Prof sci equi 385	Other 390
	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)
Ln(Rel. Prod.)	0.976***	0.728***	0.787***	0.608***	0.784***	0.752***	0.736***	0.870***	0.739***	0.663***
	(0.0162)	(0.0150)	(0.0234)	(0.0277)	(0.0164)	(0.0166)	(0.0162)	(0.0188)	(0.0186)	(0.0265)
Ln(Rel. Dist.)	-0.985***	-0.940***	-1.020***	-0.613***	-0.903***	-0.639***	-0.678***	-0.871***	-0.285***	-0.0695
	(0.0433)	(0.0444)	(0.0708)	(0.0912)	(0.0439)	(0.0518)	(0.0607)	(0.0676)	(0.0728)	(0.0766)
Ln(Rel. Price)	0.339*	-1.755***	-0.0422	1.429***	-0.567***	-0.115	-1.629***	0.0994	0.0960	-1.096***
	(0.204)	(0.162)	(0.277)	(0.325)	(0.150)	(0.167)	(0.218)	(0.233)	(0.164)	(0.201)
Ln(Tariff+1)	0.0135	-0.206***	0.222***	0.272***	-0.245***	-0.138**	-0.282***	0.203***	0.0306	-0.294***
	(0.0527)	(0.0439)	(0.0759)	(0.0947)	(0.0528)	(0.0631)	(0.0730)	(0.0696)	(0.0747)	(0.101)
Contiguity	0.838***	2.288***	1.361***	2.998***	1.473***	1.061***	1.004***	1.049**	0.957**	1.719***
	(0.247)	(0.266)	(0.420)	(0.312)	(0.277)	(0.265)	(0.383)	(0.535)	(0.398)	(0.450)
Common Lang.	0.0900	0.889***	-0.479	0.820***	0.349*	0.544***	-0.356	-0.202	0.353	1.938***
	(0.176)	(0.140)	(0.294)	(0.291)	(0.207)	(0.163)	(0.256)	(0.234)	(0.299)	(0.335)
Colony	1.445***	1.454***	1.286***	1.645***	1.327***	1.162***	1.550***	0.965***	1.371***	0.712*
	(0.228)	(0.176)	(0.283)	(0.343)	(0.214)	(0.193)	(0.305)	(0.276)	(0.279)	(0.398)
Com. Col.	1.108***	1.410***	1.935***	2.934***	1.344***	1.560***	0.877***	-0.447	1.448***	1.454***
	(0.300)	(0.244)	(0.562)	(0.477)	(0.270)	(0.295)	(0.301)	(0.386)	(0.375)	(0.331)
PTA	-0.0349	1.170***	0.751	0.150	0.684***	0.853***	0.535***	0.720**	0.334*	1.896***
	(0.180)	(0.153)	(0.596)	(0.330)	(0.141)	(0.183)	(0.191)	(0.354)	(0.194)	(0.300)
Ln($\widehat{TimeImp.}$)	-2.194***	-0.976***	-0.779***	-2.089***	-1.044***	0.306**	-1.244***	-2.363***	-0.527***	-1.281***
	(0.120)	(0.0961)	(0.153)	(0.168)	(0.111)	(0.134)	(0.140)	(0.154)	(0.143)	(0.198)
Ln($\widehat{TimeExp.}$)	-0.745***	-0.932***	-0.615***	-0.806***	-0.775***	-1.759***	-1.511***	-1.357***	-0.984***	-1.728***
	(0.0991)	(0.0868)	(0.141)	(0.153)	(0.0940)	(0.130)	(0.124)	(0.126)	(0.119)	(0.165)
Constant	5.020***	0.451	-0.312	3.578***	0.675*	0.500	4.866***	6.441***	-0.552	3.079***
	(0.426)	(0.345)	(0.646)	(0.625)	(0.350)	(0.488)	(0.583)	(0.568)	(0.537)	(0.650)
Observations	2691	3200	1541	986	2791	2064	1914	1873	1262	1527
R-squared	0.66	0.61	0.54	0.47	0.63	0.78	0.61	0.66	0.75	0.45

Notes: (i.)Robust standard errors in parentheses.
(ii.) ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

Table 9: Calculating Consistent Estimates for the Impact of Trade Facilitation

	Time to Import	Time to Export
Food	3.56	1.83
Beverage	7.16	5.45
Tobacco	1.00	1.00
Textiles	8.63	5.00
Wearing Apparel	7.72	0.00
Leather	1.42	0.44
Furniture	8.26	0.01
Paper	4.34	5.25
Other Chemicals	2.10	3.67
Plastic	4.74	4.52
Fabricated Metal	4.26	3.16
Machinery expect electric	0.01	12.75
Machinery electric	4.41	5.36
Other Industries	4.36	5.88

Notes: Constructed by the author from the regressions results

Table 10: Estimating Ad Valorem Equivalents For Time of Trade: By Sectors

Sector	AVE Time Exp. (%)	AVE Time Imp. (%)
Food	20.72	44.73
Beverage	22.42	32.54
Tobacco	0.02	0.02
Textiles	39.00	74.71
Wearing Apparel	0.06	138.11
Leather	17.98	60.04
Footwear	18.94	36.12
Wood	29.30	54.08
Furniture	0.04	73.91
Paper	30.12	29.01
Printing and Publishing	36.25	69.33
Industrial chemicals	22.79	42.81
Other Chemicals	91.83	74.46
Petroleum refineries	27.89	50.27
Misc. Petro./ coal	10.78	44.20
Rubber	23.95	79.44
Plastic	71.50	83.68
Machinery expect electric	54.71	0.03
Machinery electric	69.01	62.74
Prof and Scientific equi	42.52	24.58
Other Industries	59.07	47.99

Notes: Constructed by the author from the regressions results

Table 11: Estimating Ad Valorem Equivalents For Time of Trade: By Countries

	Developed	Developing
Mean		
AVE Time to Exp. (%)	17.18	41.32
AVE Time to Imp. (%)	21.92	55.80
Min		
AVE Time to Exp. (%)	8.91	5.68
AVE Time to Imp. (%)	4.10	10.58
Max		
AVE Time to Exp. (%)	107.40	201.74
AVE Time to Imp. (%)	148.59	411.74

Notes: Constructed by the author from the regressions results