

Does Trade Facilitation matter in Bilateral Trade?*

Chahir ZAKI[†]
Preliminary version

March, 2008

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 the place of 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 uses different databases allowing us to take into account many features of Trade Facilitation. We use several databases coming from different sources: Doing business (World Bank), Institutional Profiles (CEPII) and other indicators coming from the World Bank databases. Our main findings are that documents to be filed for export and import are an important determinant of transaction time. Moreover, transaction time, PTA, landlockness and fraud are crucial factors for customs efficiency. Regarding relative imports, transaction time and number of documents decrease trade more significantly for importers than for exporters. Transaction time is found not to be endogenous. Customs efficiency suffers from an endogeneity problem. Finally, our sample is split into sub-samples in order to take into account the impact of development level. It turns out that Trade Facilitation aspects have not the same impact on developed and developing countries.

JEL classification: F10, F12, F15

Keywords: Border Effects, Gravity Models, Trade Facilitation.

*I would like to thank my Phd supervisor Lionel Fontagné for his important comments. I am also grateful to Catherine Bros, Fabian Gouret, Rodrigo Paillacar, Fida Karam and Rémi Bazillier.

[†]Centre d'Economie de la Sorbonne, UMR8174, Pôle TEAM, Université Paris I Panthéon Sorbonne, 106-112 Bd de l'Hôpital 75647 Paris Cedex 13, FRANCE. Email: chahir.zaki@univ-paris1.fr.

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 allowing trade promotion; more secured ways of payment (more reliable, quicker, which will accelerate the delivery of exchanged goods). It is noteworthy that Trade Facilitation does not take into account traditional barriers: neither tariffs, nor non-tariff barriers. Thus, Trade Facilitation incorporates new transaction costs, institutional costs, administrative delays, etc. In summary, these barriers can be called “*Non-tariff non-official barriers*”. They are non tariff because they do not incorporate any tariff barriers and non official because they are not classified in an official framework between governments and organizations.

Three reasons explain the importance of taking into account 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. That explains why a majority of countries that are part of the World Trade Organization (WTO) have launched Trade Facilitation initiatives. Moreover, the increased commercial regimes complexity, often referred as a “Spaghetti Bowl”, the increased supply chains interdependency as well as the imported products delivery delays have turned into a severe constraint on production. Secondly, the cost of non-facilitation is very high. *Non-tariff non-official barriers* account for 2 to 15% of the exchanged goods value. A number of previous papers have evidenced the importance of non-visible barriers or (as we name them) the non-facilitated barriers. Cernat (2001) supports the idea that the key to the African trade enigma lies in Trade Facilitation. Thirdly, empirical literature on Trade Facilitation measures has had so far two shortcomings: studies are either descriptive such as the ones undertaken by the Organization of Economic Cooperation and Development, or they exhibit a strong juridical orientation (OECD, 2002c, 2002d, 2003a and 2003b et WTO, 2002). Besides, empirical studies suffer from two problems: on the one hand, models used have poor theoretical foundations that make results interpretation difficult. On the other hand, these studies have neglected some aspects of trade facilitation such as transaction security, harmonization of norms, etc.

Hence, this paper provides new theoretical and empirical enhancements. First of all, the model is based on theoretical foundations related to monopolistic competition and border effects. The originality of this paper is that it also includes Trade Facilitation facets. Secondly, the empirical achievement of the paper is that it uses different databases allowing us to take into account many features of Trade Facilitation. We use databases coming from different sources: Doing business (World Bank), Institutional Profiles (CEPII) and other indicators coming from the World Bank databases.

A gravitational analysis is run. It is worth noting that, since Tinbergen's 1962 model, gravity models have become essential tools for measuring the impact of tariff and non-tariff barriers on services and goods commercial flows. Many authors have developed the theoretical foundations of the model. The first attempt was Anderson's (1969) who developed a gravity model from a linear expenditure system. Later on, many other studies improved the theoretical foundation of gravity models such as Bergstrand (1989 and 1990) and Bayer and Bergstrand (1999). After that, three studies have made crucial improvements in the gravity theory. First of all, Head and Mayer (2001a) derived a gravity model from a monopolistic competition model. Then, Feenstra (2002) derived a gravity model estimating border effects using a fixed-effect technic. Finally Anderson and van Wincoop (2003) introduced the concept of "Multilateral Resistance" in the gravitational literature. All these improvements have enforced the theoretical base of gravity models narrowing the gap between theoretical and empirical findings as they became increasingly used in empirical studies. The innovation of the model developed in this paper, with respect to the works mentioned above, is that it introduces in the gravity model Trade Facilitation in an explicit way.

This paper is organized as follows: section 2 analyzes Trade Facilitation process. Section 3 presents a review of the empirical literature on Trade Facilitation. Section 4 develops theoretical foundations of the model used. Section 5 exposes the econometric specification of the model. Section 6 is devoted to data analysis. Section 7 discusses the results and section 8 concludes.

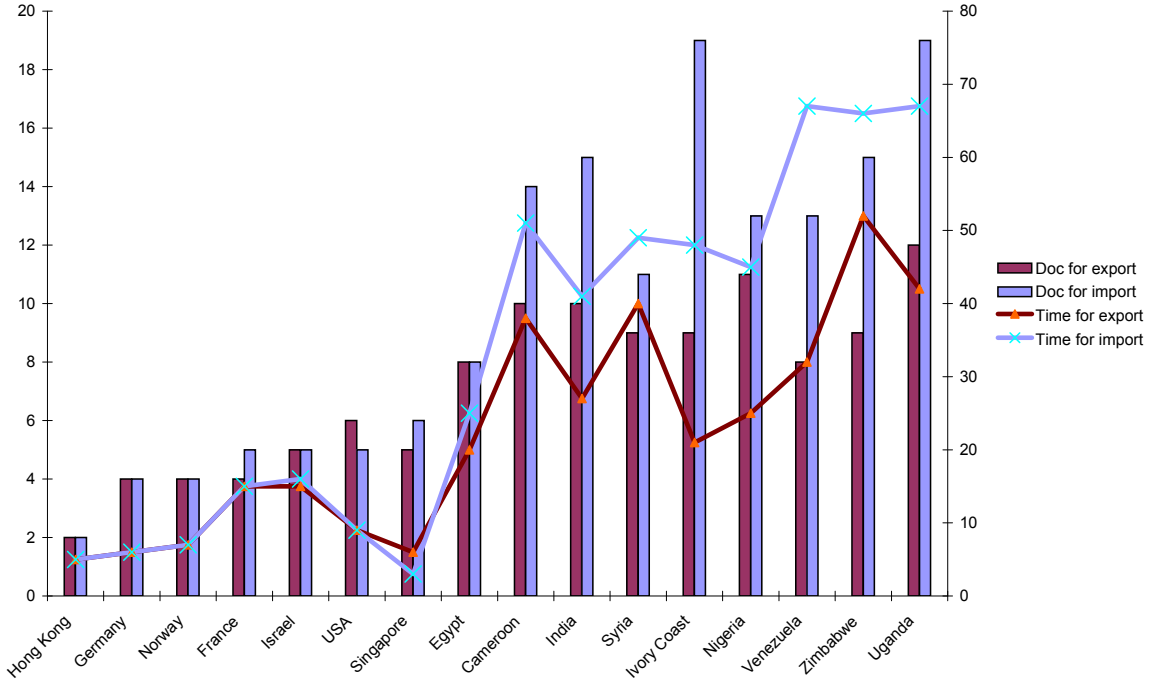
2 Some Stylized Facts: Heterogeneity of Countries

The sample used includes 48 countries. Following the World Bank classification, 17% of the sample are low income countries, 54% are lower and upper middle income ones and finally 29% are high income ones distributed between OECD and non OECD countries. The differences in countries incomes allow us to take into account the state of Trade Facilitation in developing as well as developed countries.

Intuition tells us that Trade Facilitation aspects are correlated among them. Figure 1 shows the relationship between number of document to be filed and transaction time for exports and imports in 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 file 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 .

With regard to the quality of information available concerning the goods and the services exchanged, a positive correlation between this variable and the level of development is observed. Table 1 shows that high-income countries have either less satisfactory or satisfactory level of arrangements organizing the availability of such

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 commits to completing each remaining procedure without delay. For more details, see appendix 1.

information.

Table 1: Quality of information available vs. level of development

Quality of information	No arrangement	Low	Medium	Less Satisfactory	Satisfactory	Total number of countries in the sample
Low income	0	2	4	2	0	8
Lower middle income	1	4	5	3	0	13
Upper middle income	0	1	3	7	2	13
High income non-OECD	0	0	0	2	2	4
High income OECD	0	1	1	2	6	10
Total number of countries in the sample	1	8	13	16	10	48

Source: Constructed by the author from "Institutional Profiles", Ministry of Economy, Finance and Industry (MINEFI), France, 2001.

Note: Information is defined as information on the quality of exchanged goods and services - from 0 (no system for norms and standards) to 4 (efficient system). For more details, see appendix 1.

Similarly, table 2 reveals another aspect of Trade Facilitation which is the degree of customs fraud. As the level of development increases, customs corruption diminishes. Indeed, high-income countries (either OECD or non-OECD) show the lowest level of corruption.

Table 2: Level of fraud vs. level of development

	Fraud	High	Medium	Low	Lowest	Total number of countries in the sample
Low income		6	2	0	0	8
Lower middle income		9	4	0	0	13
Upper middle income		3	8	0	2	13
High income non-OECD		0	0	3	1	4
High income OECD		0	2	2	6	10
Total number of countries in the sample		18	16	5	9	48

Source: Constructed by the author from "Institutional Profiles", Ministry of Economy, Finance and Industry (MINEFI), France, 2001.

Note: Fraud is defined as the importance of customs fraud (corruption, sub-declaration, etc.) from 1 to 4. For more details, see appendix 1.

It is worth noting that most developed countries have implemented strong security measures after the 9/11 events in order to secure trade. That explains why developing countries exports face more barriers since 2001 in developed countries. Table 3 exhibits the relationship between the level of development and transaction security measures. As the former increases, the latter becomes more significant. However, these measures were enhanced in many countries, even those with a low level of development. The reason behind is that when developed countries implemented those measures, developing ones had to implement them as well in order to harmonize their trade standards.

Table 3: Relationship between the evolution of the level of transaction security and the level of development

Evolution of Transaction security	Deteriorated	Remained Stable	Moderately improved	Substantially improved	Total number of countries in the sample
Low income	0	0	2	6	8
Lower middle income	1	1	3	8	13
Upper middle income	0	3	2	8	13
High income non-OECD	0	0	0	4	4
High income OECD	0	3	2	5	10
Total number of countries in the sample	1	7	9	31	48

Source: Constructed by the author from "Institutional Profiles", Ministry of Economy, Finance and Industry (MINEFI), France, 2001.

Note: The evolution of transaction security is defined as the security of transaction evolution for the past 3 years ranging from 0 (deterioration) to 4 (improvement)

Table 4 exhibits the relation between the level of development and infrastructure quality. As the level of development increases, so does the infrastructure quality indicator. Obviously, infrastructure is crucial to enhance trade as it facilitates the transport of exported goods from production locations to ports and imported products from ports to local markets.

Table 4: Correlation between the quality of infrastructure and the level of development

Quality of infrastructure	Poor	Medium	Good	Excellent	Total number of countries in the sample
Low income	7	0	1	0	8
Lower middle income	11	1	1	0	13
Upper middle income	5	6	1	1	13
High income non-OECD	1	3	0	0	4
High income OECD	0	6	3	1	10
Total number of countries in the sample	24	16	6	2	48

Source: Constructed by the author from “Institutional Profiles”, Ministry of Economy, Finance and Industry (MINEFI), France, 2001.

Note: The quality of infrastructure is a synthetical indicator

3 Trade Facilitation: Review of Empirical Studies

The gravitational literature on Trade Facilitation is not very rich. This section provides a detailed analysis of this literature while presenting its limitations. Works on Trade Facilitation may be grouped in 3 categories. The first one includes studies that emerged in the wake of Mc Callum’s work where models were used to quantify border effects. The second group is characterized by models treating only one aspect of Trade Facilitation, which are referred in this paper as “Mono-dimensional models”. The last group gathers models incorporating several aspects of Trade Facilitation, named “Multi-dimensional models”.

3.1 Border Effect Models

The pioneer of the literature on border effect is Mac Callum (1995) who quantified the border effect existing between American states and Canadian provinces. He showed that the volume of trade between Canadian provinces is 20 times larger than the volume of trade between a Canadian province and an American state. This study was followed by many others criticizing and extending the adopted methodology in order to better evaluate the border effect. These studies shed light on two aspects:

(a) *The distance measure* particularly studied by Head and Mayer (2002b). In fact, “border effect” can be broken down into three components: non tariff barriers, an imprecise measure of distance and a home bias. The second component is an issue that can lead to an overestimation of the distance impact on the border and an inflation of the home bias. That is why, Head and Mayer developed a new measure for the intra and inter-national distance which is “the effective distance” satisfying the following condition: the bilateral flows between two nations are equal to the sum of flows between the sub-units constituting them. This measure was tested on American and European data and the authors found that the border effect is divided by a factor of 6 or more in the case of the European Union. Certainly, a better calculation of the distance allows to avoid an overestimation of the distance impact on international trade. Hence, this let the gravity model to be more consistent in estimating border effects on trade as well as other impediments to international exchanges.

(b) ***The theoretical foundations of the gravity models***: the gravity equation should be derived from a theoretical model in order to avoid adding variables randomly. One of the first theoretical models was the one of Anderson (1979) who derived a gravity model from a linear model of expenditures, and Anderson and van Wincoop (2003) who derived it from a Constant Elasticity of Substitution (CES) expenditure system. They introduced in the gravitational literature the concept of “Multilateral Resistance” which is a price index taking into account commercial barriers. In an another paper, Head and Mayer (2001a and 2001b) derived a gravity equation from a monopolistic competition model while taking into account a precise measure of distance. Finally, Fontagné et al (2004 and 2005) added a term called “*BRC*” which is the “Border Related Costs” and that takes into account tariff and non-tariff barriers (quantitative restriction, administrative barriers, technical barriers and sanitary and phytosanitary measures). The main shortcoming of all these studies is that they neglect the aspects of barriers directly or explicitly related to Trade Facilitation, and such an omission leads to an overestimation of the impact of classical barriers.

3.2 Mono-dimensional models

The mono-dimensional models mean those model that take into consideration only one dimension of Trade Facilitation such as: new technology, efficiency of transport means, time reduction, corruption, etc. For instance, we have:

(a) **Regarding the technological dimension**, the study of Freund and Weinhold (2000) shows, via a gravity model applied to 56 countries, that a 10% increase in the relative number of web-hosts within a country increases commercial flows by 1% during the 1998-1999 period.

(b) **As for time dimension and delivery delays**, Hummels (2001) argue, through a model of firm choice, that a delay of one day in the delivery of manufactured goods equals, on average, to a 0.5 percent loss in the value of the good.

(c) **Regarding the transport costs and infrastructure**, Limao and Venables (2000) simulate a country’s move from the average to the sample’s top quartile. The result was a reduction in transport costs by an amount equivalent to 481 kilometers of earth transport and by 3,989 kilometers in the case of maritime transport. The enhanced volume of trade is 68%, which corresponds to a geographical closeness to other countries by 2,500 kilometers.

(d) **The corruption effect**: Dutt and Traca (2007) analyze the impact of corruption on trade through an augmented gravity model. They found that trade flows are an inverted-U shaped function of corruption. In fact, trade enhancing effects are found for about 23% of the observations.

The most crucial limitation of such studies is that it doesn’t take into consideration the entirety of Trade Facilitation aspects as they consider only one aspect

in each study. However, we argue that the various Trade Facilitation aspects are interrelated and must be studied simultaneously.

3.3 Multi-dimensional models

This group of studies takes into account numerous aspects or dimensions of indicators related to Trade Facilitation. This is why these models are called multi-dimensional. 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 and the variables taken into account were those of the importer country only. In a more global paper, they amended the model in two ways: they introduced the 4 variables not only for the importer but also for the exporter (except the variable concerning the customs environment which was introduced only for the importer). The sample was also enlarged as it included not only a specific region but 75 countries across the globe. In the two papers, they simulated a scenario through which countries whose Trade Facilitation indicators were below the APEC average (or the world average in the second paper) are led to enhance their indicators mid-way the APEC (the world) average.

The achievement of these two papers has been to consider more than one Trade Facilitation aspect in a large sample of countries and especially in the second paper. However, these models exhibit 3 shortcomings. First of all, the model has not been theoretically derived, which, in turn, leads to specification and interpretation difficulties. Secondly, the authors have neglected some aspects of Trade Facilitation such as the degree of harmonization, transaction security, corruption in customs services, number of documents required, and some aspects related to customs efficiency. Obviously, such aspects are crucial for Trade Facilitation and must be taken into account. Finally, the variable of customs efficiency for the exporter has been considered neither in the first nor in the second paper. This failure to account for custom efficiency faced by the exporter is a serious issue as this variable probably has a similar impact on bilateral trade as customs efficiency encountered by the importer.

4 Theoretical Foundations of the Model

This paper extends the model that has been initially developed by Fujita et al. (1999) and Head and Mayer (2001a). The authors develop a gravity model from a monopolistic competition model that has been slightly modified by Fontagné et al (2005) 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 preferential trade agreements impact and finally a term incorporating explicitly the Trade Facilitation aspects.

The main assumptions of the monopolistic competition model used in this paper are as follows :

- Constant Elasticity of Substitution (CES) utility function,
- A production function with increasing returns to scale,
- Firms have identical technology,
- Commercial transactions costs are: transport cost measured by distance, tariffs cost, non-tariff barriers which is composed of the presence of a Preferential Trade Agreement (PTA) between two countries, efficiency of customs environment, time and documents required for exports and for imports, harmonization degree, transparency, administrative reforms, landlockness of a country (to capture the intensity of transit in a country) and finally the degree of transaction security.

The problem of maximization is given by:

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

$$s.c. y_i = \sum_i \sum_{h=1}^{n_j} p_{ij} c_{ijh} \quad (2)$$

$$m_{ij} = c_{ij} p_{ij}$$

$$p_{ij} = p_j \tau_{ij}$$

$$m_i = \sum_k m_{ik}$$

where

σ : substitution elasticity,

p_j : plant price of country j,

m_{ij} : CIF value of imports of country i coming from country j,

m_i : expenditure on all goods coming from all countries including the home country.

By resolving the maximization problem in (1) subject to the constraint in (2), we have:

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

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

Dividing them by m_{ii} :

$$\frac{m_{ij}}{m_{ii}} = \frac{a_{ij}^{\sigma-1} n_j p_{ij}^{1-\sigma}}{a_{ii} n_i p_{ii}} \quad (4)$$

$$(5)$$

By disaggregating the price term into two parts, i.e. plant price and tariffs, we obtain:

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

For the firm j:

$$l_j = F + \gamma q_j \quad (6)$$

$$\pi_j = p_j q_j - w_j l_j$$

$$\pi_j = p_j q_j - w_j (F + \gamma q_j) \quad (7)$$

where

l_j : labor in firm j,

F: fixed labor cost,

γ : the inverse of firms productivity,

q_j : firm j production,

π_j : firm j profits,

w_j : wage in firm j.

Through the pricing equation and the free-entry condition, the representative firm output equilibrium is given by the following equation:

$$q_j = \frac{F(\sigma - 1)}{\gamma} \quad (8)$$

with identical technologies,

$$q_j = q \forall j = 1, \dots, N \quad (9)$$

Hence, the production value is calculated as follows:

$$\nu_j = qp_j n_j \quad (10)$$

$$\nu_i = qp_i n_i \quad (11)$$

where ν_j : value of production of industry j.

Dividing (9) by (10), we obtain:

$$\frac{\nu_j}{\nu_i} = \frac{qp_j n_j}{qp_i n_i} \quad (12)$$

Then,

$$\frac{n_j}{n_i} = \frac{\nu_j p_i}{\nu_i p_j} \quad (13)$$

Regarding transaction costs:

$$\tau_{ij} = d_{ij}^\delta (1 + brc_{ij}) \quad (14)$$

The term brc equals to:

$$(1 + brc_{ij}) = (1 + t_{ij})(\exp(\eta E_{ij} + \theta PTA_{ij} + \zeta Conti_{ij} + \mu_1 TF_i + \mu_2 TF_j)) \quad (15)$$

where

t_{ij} : ad valorem bilateral tariff

PTA_{ij} : a dummy variable = 1 if i and j belong to the same regional integration agreement. PTA stands for Preferential Trade Agreement.

$Conti_{ij}$: a dummy variable equals to 1 if the two countries are contiguous.

E_{ij} : intercept.

TF_i and TF_j : indicators related to trade facilitation aspects faced by the importer and the exporter respectively. As mentioned earlier, Trade Facilitation measures take several forms. The following one are included in our analysis : number of documents needed for exports and imports, time for exports and imports, infrastructure, financial systems harmonization degree, availability of information concerning the exchanged goods, efficiency of customs authorities, landlockness, use of the Internet, technological environment, transaction security, transparency, customs fraud and finally administrative reforms.

As to the preferences:

$$a_{ij} = \exp(e_{ij} - (\beta - \lambda L_{ij})(E_{ij} + PTA_{ij})) \quad (16)$$

where

e_{ij} : the random part of preferences.

β : the systematic part of preferences or the home bias.

L_{ij} : dummy variable = 1 if i and j share the same language. If L_{ij} changes from 0 to 1, the home bias changes from β to $\beta - \lambda$

5 Econometric Specification of the Model

Combining the natural logarithm of equation (4) with the elements developed above will result in the following equation:

$$\begin{aligned} \ln\left(\frac{m_{ij}}{m_{ii}}\right) &= (\sigma - 1) \ln\left(\frac{a_{ij}}{a_{ii}}\right) + \ln\left(\frac{n_j}{n_i}\right) \\ &+ (1 - \sigma) \ln\left(\frac{p_j}{p_i}\right) + (\sigma - 1) \ln\left(\frac{\tau_{ij}}{\tau_{ii}}\right) \end{aligned} \quad (17)$$

By disaggregating the preference term as well as the transaction cost one, we obtain:

$$\begin{aligned} \ln\left(\frac{m_{ij}}{m_{ii}}\right) &= (\sigma - 1) \ln\left(\frac{\exp(e_{ij} - (\beta - \lambda L_{ij})(E_{ij} + PTA_{ij}))}{\exp(e_{ii} - (\beta - \lambda L_{ii})(E_{ii} + PTA_{ii}))}\right) + \ln\left(\frac{\nu_j p_i}{\nu_i p_j}\right) \\ &+ (1 - \sigma) \ln\left(\frac{p_j}{p_i}\right) + (\sigma - 1) \ln\left(\frac{d_{ij}^\delta (1 + t_{ij})}{d_{ii}^\delta (1 + t_{ii})}\right) + (\sigma - 1) \\ &\ln\left(\frac{\exp(\eta E_{ij} + \theta PTA_{ij} + \zeta Conti_{ij} + \mu_1 TF_i + \mu_2 TF_j)}{\exp(\eta E_{ii} + \theta PTA_{ii} + \zeta Conti_{ii} + \mu_1 TF_i + \mu_2 TF_i)}\right) \end{aligned} \quad (18)$$

Simplifying the natural logarithm with the exponential function, a simplified

form is found out in this way:

$$\begin{aligned}
\ln\left(\frac{m_{ij}}{m_{ii}}\right) &= \ln\left(\frac{\nu_j}{\nu_i}\right) - \sigma \ln\left(\frac{p_j}{p_i}\right) \\
&+ (\sigma - 1)[(e_{ij} - (\beta - \lambda L_{ij})(E_{ij} + PTA_{ij})) - (e_{ii} - (\beta - \lambda L_{ii})(E_{ii} + PTA_{ii}))] \\
&+ \delta(\sigma - 1) \ln\left(\frac{d_{ij}}{d_{ii}}\right) + (\sigma - 1) \ln\left(\frac{1 + t_{ij}}{1 + t_{ii}}\right) \\
&+ (\sigma - 1)[(\eta E_{ij} + \theta PTA_{ij} + \zeta Conti_{ij} + \mu_1 TF_i + \mu_2 TF_j \\
&- (\eta E_{ii} + \theta PTA_{ii} + \zeta Conti_{ii} + \mu_1 TF_i + \mu_2 TF_i))] \tag{19}
\end{aligned}$$

After simplifying, i.e. $L_{ii} = 0$, $E_{ii} = 0$, $PTA_{ii} = 0$; $t_{ii} = 0$; $E_{ij} + PTA_{ij} = 1$; $Conti_{ii} = 0$ and finally removing the repeated terms of the importer which are $\mu_1 TF_i$, we have the following equation:

$$\begin{aligned}
\ln\left(\frac{m_{ij}}{m_{ii}}\right) &= \ln\left(\frac{\nu_j}{\nu_i}\right) - \sigma \ln\left(\frac{p_j}{p_i}\right) - \delta(\sigma - 1) \ln\left(\frac{d_{ij}}{d_{ii}}\right) \\
&- (\sigma - 1) \ln((1 + t_{ij}) + (\sigma - 1)(e_{ij} - e_{ii})) \\
&- (\sigma - 1)[(\beta - \lambda L_{ij})(E_{ij} + PTA_{ij})] + (\sigma - 1)(\eta E_{ij} + \theta PTA_{ij} + \zeta Conti_{ij}) \\
&+ (\sigma - 1)[\mu_2(TF_i + TF_j)] \tag{20}
\end{aligned}$$

Multiplying $(\sigma - 1)$ by the terms in brackets yields the following estimable model:

$$\begin{aligned}
\ln\left(\frac{m_{ij}}{m_{ii}}\right) &= \ln\left(\frac{\nu_j}{\nu_i}\right) - \sigma \ln\left(\frac{p_j}{p_i}\right) + \delta(\sigma - 1) \ln\left(\frac{d_{ij}}{d_{ii}}\right) \\
&- (\sigma - 1) \ln(1 + t_{ij}) + (\sigma - 1)\lambda L_{ij} + (\sigma - 1)(\theta - \beta)PTA_{ij} \\
&+ (\sigma - 1)\zeta Conti_{ij} + (\sigma - 1)(\eta - \beta)E_{ij} + (\sigma - 1)\mu_2(TF_i + TF_j) \\
&+ \epsilon_{ij} \tag{21}
\end{aligned}$$

where

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

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

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

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

The model shows that each variable should have a specific impact on bilateral trade. The effect of each variable will be analyzed through 2 parts. The first one will take into account the classical variables present in any gravity model. The second part presents the effect of Trade Facilitation aspects on bilateral trade.

- Concerning the **classical variables** of gravity model, it could be predicted that the coefficient of the production ratio will be one. This is due to the functional form introduced in the model as it is the ratio between the importer production and the exporter one. The distance impact would be negative as it measures transport cost, which discourages trade. Furthermore, the presence

of PTA, a common language or colonial linkages encourage trade. This has been proven by a large literature that stressed the effect of culture on trade. Meanwhile, presumably, tariffs have a negative effect on trade. However, some empirical studies revealed a positive effect of tariff on trade. This is due either to multicollenarity between tariff and other variables or the way sectors were disaggregated. Finally, the contiguity has a positive impact as two contiguous countries do not face the difficulties induced by long distance and the related transport costs. Moreover, contiguous countries may share common languages, common preferences which may increase the potential of exports between them.

- On the other side, regarding the **Trade Facilitation aspects**, we suppose that: the aspects related to customs inefficiencies should have a negative effect on trade. By disaggregating them, we should also have a negative effect of the number of days of exports and imports, of the number of documents needed for exports and imports and of the customs fraud. All these items discourage trade as they increase exports and imports delays which may cause many losses (imported or exported products may perish, tastes may change, etc.). Customs efficiency is expected to enhance trade as this variable reflects the way custom authorities fulfill their commitments, take advantage of specific trade agreements and collaborate with other custom authorities. As for transaction security , it is worth mentioning that empirical studies have found that it reduces trade as it poses constraints that can not be satisfied by developing countries and therefore reduces trade. Nevertheless, as developing countries implement these rules and satisfy these constraints, the transaction security may increase trade. Hence, we may have a U shaped curve. Similarly, regarding the financial systems harmonization, we notice that it may have the same effect as transaction security with the U shaped curve. The fact of being landlocked reduces trade as it increases transit time generating time waste and additional cost. Finally, infrastructure is supposed to increase trade because it facilitates the transport of exported products from production locations to ports and the imported products from ports to local markets. Appendix 4 summarizes the effect of each variable on trade.

6 Data

6.1 Sources of the Database

Data have been collected from several sources. First, data on bilateral trade as well as tariff and production were aggregated from CEPII's ¹ "Trade and Production" database . This database is constructed from several sources. First of all, the original data (Alessandro Nicita and Marcelo Olarreaga (2001)) come from the United Nations sources: COMTRADE and UNIDO. Though a wide covering, the World Bank files contains a lot of missing values for production figures in recent

¹Centre d'Etudes Prospectives et d'Informations Internationales. They are available on CEPII's website

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. Regarding trade data, the mirror inflows, available in Alessandro Nicita and Marcelo Olarreaga (2001), were used along with the CEPII database on international trade (BACI)², which is also based on COMTRADE data.

The distance variable 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.

Finally, as for the variables related to Trade Facilitation, we used three databases: Institutional Profiles constructed by the French Ministry of Economy, Finance and Industry (MINEFI) as well as Doing Business developed by the World Bank and finally the World Bank database (general indicators):

1. The first database, Institutional Profiles 2001, 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 were collected through a questionnaire describing the institutional characteristics of these countries and was split in 4 sections: section A was related to the institutional environment, section B to the market for goods and services, section C concerned the financial system and section D the labor market and social interactions. Out of the legion of indicators included in the database, only 14 were chosen based on their appropriateness to Trade Facilitation.
2. The second database is Doing Business 2006. As data for 2003 and 2004 were not available, only data for the year 2006 were used. It contains several sections, the largest being “Trading Across Borders”. 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 ease of doing business. Only the time and document aspects are taken into account.
3. The final database is one built by the World Bank. The only variable drawn from this base is the number of internet users per 1,000 people.

Out of these 21 indicators, 2 variables were created and 12 indicators were used directly as variables.

²BACI is the new CEPII world database for international trade analysis at the product-level.

6.2 Indicators Harmonization and Variables Creation

As shown in the last subsection, the database used has many sources with different units of measure. This is due to the fact that the MINEFI's database is a survey, while the "Doing Business" one contains numbers of days, numbers of documents and dollar values. Thus, these indicators with several units of measure can not be used together to create one variable associated with one aspect of Trade Facilitation. To this end, these two bases had to be harmonized in order to generate the indicators later used in the creation of variables.

The adopted method was developed in Wilson et al (2003). The harmonization was done by dividing each indicator by the average of the 48 country-specific indicators (π) using the following formula:

$$\bar{\pi}_j = \frac{\pi_j}{\frac{\sum_{j=1}^{48} \pi_j}{48}} \quad (22)$$

This formula is systematically applied to indicators whenever the variable is generated from different databases. Should the generated variable contains solely indicators from MINEFI, it is not harmonized.

(a) Variable of technological environment:

We use a variable related to technology intensity which is the number of Internet users per 1,000 people. It is more significant and relevant for our analysis. This variable comes from the World Bank database.

(b) Variable of efficiency of customs environment:

Regarding the customs efficiency, the following indicators have been averaged: capacity of the customs administration to fulfill its commitments (rules of origin, valuation rules of customs), capacity of the customs administration to take advantage of the arrangements (preferences, regional agreements, etc.), the degree of cooperation between local customs administrations and other countries customs administrations (rules of origin, fraud detection, etc.) and the ease of granting import licenses. Table 5 represents the correlation matrix between these indicators. It shows that the first three indicators are more correlated among them than the fourth one (i.e. the one related to imports licences).

(c) Variables related to customs inefficiency:

5 aspects are included in our analysis regarding the customs authorities inefficiency: number of days for exports, number of days required for imports, number of documents needed for exporting, number of documents needed for importing and the size of customs fraud (smuggling, bribes, etc.). We will use these indicators in two ways: first, we compute a variable named "document" that is a simple average of the number of documents needed to export by the exporter and the documents needed to import by the importer. A time variable is also computed. It is a simple average of the time needed for export and import. The second way is that each indicator is introduced as a variable in the regressions. Thus we end up with 5 variables related to customs inefficiencies. Table 6 exhibits the correlation matrix among these

Table 5: Correlation among the indicators constituting the variable of customs efficiency

Variables	Cap. eng.	Cap. adv.	Cust. coll.	Imp. Lic.
Cap. eng.	1.000			
Cap. adv.	0.769	1.000		
Cust. coll.	0.710	0.731	1.000	
Imp. Lic.	0.365	0.354	0.499	1.000

Source: Constructed by the author from "Institutional Profiles", Ministry of Economy, Finance and Industry (MINEFI), France, 2001.

Notes: (i.) Cap. eng.: customs administration capacity to fulfill its customs commitments (rules of origin, evaluation rules) rated from 1 (low) to 4 (high).

(ii.) Cap. adv.: customs administration capacity to take advantage of the agreements (preferential and regional agreements).

(iii.) Cust. coll.: level of collaboration between local customs authorities and other countries ones (rules of origin, detection of fraud).

(iv.) Imp. Lic.: automatic grant of import licences (=4), or grant subject to simple, restrictive and respected conditions (=3), restrictive conditions (=2), many restrictions (barrier to entry , huge corruption..=1).

For more details, see appendix 1

indicators. It reveals that all the aspects associated with customs inefficiencies are highly correlated.

Table 6: Correlation among the variables related to customs inefficiency

Variables	# day (exp)	# day (imp)	# doc. (exp)	# doc. (imp)	fraud
# day (exp)	1.000				
# day (imp)	0.861	1.000			
# doc. (exp)	0.679	0.685	1.000		
# doc. (imp)	0.651	0.756	0.772	1.000	
fraud	0.549	0.577	0.526	0.545	1.000

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

Note: Document and transaction time are defined previously. For further details, see appendix 1

(d) Harmonization variable:

With regard to the degree of harmonization and conformity to international standards and norms, five indicators are used to reflect the harmonization degree of the financial system, which is one of the most neglected indicators in many models quantifying the impact of Trade Facilitation. Hence, the five indicators are: the standardization degree of the banks accounting system, of SMEs and of large firms (LF), the involvement degree of international audit firms, and the share of the elite that commonly use one of the international languages (i.e. English, German, French and Spanish as a foreign language) ranging from 1 (small part) to 4 (large part). Table 7 displays the correlation matrix between the harmonization indicators. It reveals that these variables are moderately correlated among them.

(e) Variables related to transparency:

With regard to transparency, 3 aspects have been taken into account. The first one is the evolution of public action transparency in the economic field, followed by the reforms aiming at simplifying administrative procedures, and finally the economy transparency level in the country. Table 8 shows that the highest correlation is the one between administrative reform and transparency degree.

Table 7: Correlation among the indicators of the harmonization degree

Variables	Norm. Bank	Norm. SME	Norm. LF	Interv. aud.	Lang.
Norm. Bank	1.000				
Norm. SME	0.404	1.000			
Norm. LF	0.343	0.813	1.000		
Interv. aud.	0.452	0.542	0.435	1.000	
Lang.	0.261	0.160	0.229	0.300	1.000

Source: Constructed by the author from “Institutional Profiles”, Ministry of Economy, Finance and Industry (MINEFI), France, 2001.

Notes: (i.) Norm. Bank: Banks normalized accounting system.

(ii.) Norm. SME: Small and Medium Enterprises normalized accounting system.

(iii.) Norm. LF: Large firms normalized accounting system.

(iv.) Interv. Audit: intervention of international audit firms.

(v.) Lang. : Fraction of elites using an international language (English, German, French, Spanish).

For more details, see appendix 1

Table 8: Correlation among the indicators of the transparency degree

Variables	Trans. Evo	Trans.	Adm. Reform
Trans. Evo	1.0000		
Trans.	0.1399	1.0000	
Adm. Reform	0.2692	0.5038	1.0000

Source: Constructed by the author from “Institutional Profiles”, Ministry of Economy, Finance and Industry (MINEFI), France, 2001.

Note: (i.) Trans. Evo: what has been the evolution of the public action transparency in the economic activity for the past 3 years.

(ii.) Trans.: transparency level in the country.

(iii.) Adm. Reform : the reforms in the simplification of administrative procedures.

For more details, see appendix 1

(f) *Other variables:*

The 3 remaining variables are indicators that are introduced directly into the regressions. They include:

- A synthetic indicator of infrastructure development level,
- An indicator for the evolution of the transaction security,
- A variable showing the level of information regarding the quality of exchanged goods and services.

7 Estimations Results

In this section, we will discuss the regression results. First, we look at the determinants of time. Second, the determinants of customs efficiency will be examined and finally the gravity model determining the impact of each of Trade Facilitation aspects on bilateral trade. Two other regressions are run: the first one controls for the endogeneity problem and the second takes into consideration the impact of the development level on Trade Facilitation features.

7.1 Which Aspects Explain Transactions Length?

This section presents our results regarding the determinants of transaction length. Although the literature on time and trade is rich, the relationship between time and documents requested for trade has been almost never analyzed so far. The results shown in table 14 present the determinants of delays in delivery and customs clearance. All the elements we introduce are significant at high level (1%). Admittedly, documents required for exports and imports are one of the most important determinants as they increase time by 1.74% and 0.98% respectively. These percentages show that a country's own reforms (reducing the number of documents requested for exports) generates higher effect on time and trade than the partner's reforms. Nonetheless, the impact of being landlocked is even higher than the documents impact. Indeed, the fact that the importer is landlocked increases transaction length by 3.83%. This percentage is 4.82% for the exporter. This could be due to the transit time required to reach the destination country. Another important effect is the one due to the Internet's widespread which reduces time by 0.3%. Certainly, the impact of the information quality is very significant as it reduces time by 1.17%. This may be explained by the fact that more transparent information concerning exchanged goods makes trade easier and gives the customs authority the ability to obtain any information they may need.

On the other side, some results may appear controversial, especially fraud and infrastructure. One could predict a positive impact of fraud on transaction length as customs corruption may induce many delays in customs clearance and reduces the customs efficiency. In reality, and particularly in developing countries, customs fraud may reduce time as customs functionaires may accelerate the customs clearance when they receive bribes. Hence, a positive effect of corruption on trade is somewhat found out. We found a similar result as fraud reduces time by 1.77%. On the other hand, the paradoxical result is the one related to infrastructure as it has

a positive effect on transaction length. The overall significance of the model is high as fraud, documents, infrastructure, landlockness, Internet and information explain 66% of the variability in the time needed to export and import.

This analysis shows that institutional aspects are important factors in delivery delays and customs clearance. These aspects are related to requested documents and information transparency. Improvements in such aspects would significantly reduce time and increase trade. Hence, it is noteworthy that institutional factors reduces transaction length which, in turn, enhance trade flows between different countries.

7.2 What are the determinants of customs efficiency?

After analyzing the determinants of trade length, we have to find out what are the determinants of customs efficiency. They are presented in table 15. First of all, the model we adopted is highly significant as the elements taken into account explain 82% of the customs efficiency variation. Several aspects are highly significant and have the predicted sign and are grouped in 2: the first group includes those having a positive effect on customs efficiency and the second one those having a negative effect. The participation in a preferential trade agreement, the transparency level, the Internet widespread usage and the quality of information available have positive and significant impact on customs efficiency. Negative and significant effect is due essentially to the fact that the importer is landlocked, to time and to fraud. This analysis shows that 50% of the 15 elements we took into account have the right sign and are significant. The other 50% are either non-significant or have the a non-predicted sign. The first case is verified for tariffs, transaction security, harmonization degree and the exporter's landlockness. The case of significant results with a non-predicted sign concerns essentially infrastructure, administrative reforms, transparency evolution and documents needed for exchanged products.

In a second regression (column 2), time and documents are disaggregated into two components: the exporter's ones and the importer's ones. This disaggregation does not change the overall significance of the model but reveals an interesting element for our analysis. Import time has a slightly stronger effect than export time on customs efficiency as table 14 shows. The former reduces customs efficiency in a larger scale because when imported products wait more in the ports, they occupy a certain place and so prevent the ports from receiving new products. This lessens the customs authority efficiency by inducing management problems related to products that arrive and do not find a suitable place where they can be discharged from cargos.

7.3 Trade facilitation vs. Trade: which aspects are relevant?

7.3.1 Which aspects of Trade Facilitation do affect bilateral trade?

The results presented in table 16 show two regressions. The first one incorporates time and document as an aggregated variable. The second one disaggregates time into time for exportation and time for importation as well as document into documents for export requested by the exporter and documents for imports requested by

the importer. The second disaggregated model is more adequate as it generates more precise results. We will divide our analysis into two parts. The first one includes usual results in line with the abundant literature on gravity (same sign and almost similar coefficients values). The second one will discuss Trade Facilitation results.

Regarding the first group of results, we find a coefficient equals to 0.64 for relative production, a negative impact of distance (-0.25), a positive effect of contiguity, PTA, colonial links and common languages (with coefficients equal to 1.5, 0.91, 0.75 and 1.45 respectively). Tariffs have a significant negative impact in relative imports (-2.79). This coefficient is very important as it represents the substitution elasticity. This elasticity is crucial to our analysis as all the coefficients of the Trade Facilitation variables result from the interaction between the Trade Facilitation measure and the substitution elasticity.

As for Trade Facilitation aspects, being landlocked is found not to be significant for the importer. As for the exporter, it has a significant positive impact on bilateral trade. This result is slightly controversial as we may predict a negative impact of landlockness on trade. However, these two results are interpreted as follows: once we control for the impact of infrastructure and other Trade Facilitation variables, the fact of being landlocked becomes insignificant. Thus, a country may overcome the negative impact induced by its landlockness by improving its infrastructure and its Trade Facilitation aspects. This fact is proved by the significant positive impact of infrastructure (38%) and information (37%) on relative imports. On the other hand, we find that transaction security reduces trade by 20% as predicted after the 9-11 events. Actually, developed countries fixed many constraints in order to secure trade. These constraints reduced trade flows coming from developing countries as shown in the regressions results. Fraud has not a significant effect on trade. Another result that may appear paradoxical to the reader, is the harmonization one: in fact, norms harmonization and standardization may at first reduce trade to a certain point. Later on, when all countries underpin the standardization fixed cost, harmonization would have a significant positive effect on trade. This same analysis applies to administrative reforms. Aspects that significantly enhance trade are: infrastructure, information quality and internet.

The following aspects of Trade Facilitation are not significant: customs efficiency, transparency, time and documents (for both exporter and importer). These results are due to multicollinearity problems specially regarding the customs efficiency variable. That is why we repeat the previous regressions but with disaggregating customs efficiency into its components (table 17): customs administration capacity to fulfill its customs commitments, customs administration capacity to take advantage of the agreements, level of collaboration between local customs authorities and other countries ones and automatic grant of import licences. It turns out that only one aspect has a significant positive effect on trade which is the customs administration capacity to fulfill its customs commitments (26.8%). Obviously, the customs efficiency suffers also from an endogeneity problem. Hence, we try to control for this problem in the following section.

7.3.2 What about endogeneity?

Admittedly, our model may suffer from endogeneity. Time and customs efficiency may be endogenous. After controlling for this problem, it is found out that time is not endogenous but customs efficiency is. Thus, customs efficiency may not be exogenous and depend on determinants that potentially affect trade and that may be unobservable. That is why instrumental variables (IV) can be conceived to solve this problem. The instrument used for customs efficiency is the customs administration capacity to fulfill its customs commitments. The relation is quite obvious: the higher the the customs administration capacity to fulfill its customs commitments, the greater the customs efficiency which, in turn, accelerates the imports delivery.³

The results of instrumentation are presented in table 18. We find a significant positive impact of customs efficiency on relative imports with a coefficient of 0.77 and 0.79. The effect of customs efficiency increases from 0.77 to 0.79 when we distinguish between exporter and importer documents. Certainly, we can not assess each model performance based on the criteria of R-squared. Indeed, R-squared is seriously decreased in our IV regressions as it is reduced by the introduction of IV⁴(where R-squared between is, on average 0.61). Thus, it can be concluded that, on average, a large part of customs efficiency are due to unobservable characteristics. When we control for such unobservable features, we find out that the time coefficient is, on average, 0.78, showing a higher positive and significant effect on relative imports than in OLS regressions.

Once we control for this endogeneity problem, we conclude that many results improved especially those related to time and documents. Actually, it is noticed that time for imports and number of documents for imports have a significant negative effect on relative imports. Fraud has a positive impact on relative imports: this may be explained by the fact that customs fraud may reduce time as customs functionnaires may accelerate the customs clearance when they receive bribes particularly in developing countries. Hence, a positive effect of corruption on trade is somewhat found out. Landlockness remains insignificant for the same reason presented above. In conclusion, we notice that controlling for endogeneity problem highly improves our results.

7.4 Trade Facilitation vs. Level of Development: What are the differences between developed and developing countries?

In this section, the regression results show to what extent our findings are changed by the trade partners level of development. 4 regressions are run: the first one

³In fact, we found that the correlation coefficients between customs efficiency and customs administration capacity to fulfill its customs commitments is 0.85. Furthermore, the correlation coefficient between relative imports and customs administration capacity to fulfill its customs commitments is 0.34

⁴OLS regressions minimize the sum of squared residuals, while IV regressions do not. That is why R-squared is decreased in IV regressions

between developed exporters⁵ and importers, the second one between developed exporters and developing importers countries, the third one between developing exporters and developed importers and the last one between developing exporters and importers.

Tables 19 and 20 show the regression results. The analysis will be split in two parts. The first one is related to the impact of usual variables on trade and the second one focuses on the impact of Trade Facilitation measures. It is important to notice that the results regarding the flows between developed countries will not be taken into account as these flows are not the subject of our analysis.

- Regarding **the usual variables**: it is worth noting that *distance* has a higher impact on trade between developing countries than between a developing and a developed one. This can be explained by the fact that high income countries use developed means of transportation which reduce the distance cost. It is also found that *tariffs* have a more significant negative impact between a low income exporter and a high income importer country than between a high income exporter and a low income importer country. It is intuitive as developing countries are more impacted by tariffs than developed countries. Similarly, *common languages* and *contiguity* enhance trade more between developed and developing countries than between developing ones only. Developing countries do not take advantage of their contiguity due to political conflicts that impeded trade between them. The *colony* variable is more significant when the flow is between a developed and a developing country. Obviously, this is due to the fact that most developed countries were colonizers and developing ones were colonies. It is noteworthy that *PTA* also has a higher effect on bilateral trade between developed and developing countries than between developing ones. Two reasons explain such a result: on the one hand, numerous political conflicts discourage trade between developing countries and reduce PTA effect. On the other hand, the higher the PTA members income, the greater the impact of PTA on trade between them.
- As for **Trade Facilitation measures**: it is noticed that transaction security and harmonization degree reduce trade more between developed and developing countries than between developing ones only. Regarding administrative reforms, table 19 and 20 show that administrative reforms have a higher negative effect between developing ones than between developing and developed countries.

Similarly, information and Internet usage spread are significant for all types of bilateral flows but more significant for flows between high income countries and low income ones than for flows between low income ones. Undoubtedly, information and Internet usage spread in the former are greater than in the latter and they improve trade more significantly. Information has a higher

⁵Developed countries are defined as being high income OECD and high income non-OECD. Developing countries are those belonging to one of the following categories: upper middle income countries, lower middle income ones and low income ones

coefficient (0.4) in the case of bilateral flows between a high income exporter and a low income importer. This aspect is not significant between two low income countries showing how these countries need to enhance their information transparency regarding exchanged goods and services. Hence, we conclude that: the higher the countries income, the greater the impact of information quality on trade between them as they have efficient systems making the information more transparent and more available.

The most remarkable result is the one associated with the impact of customs efficiency. It has a higher positive effect between developed and developing ones than between developing ones. Therefore, low income countries should improve their customs efficiency in order to enhance trade like as the high income countries do. Moreover, we notice that fraud has the highest positive effect between developing countries. This effect confirm our previous results regarding the impact of fraud in developing countries. Finally, we deduce that time severely impede trade between developed and developing countries or between developing ones only. When time and document are disaggregated, it is found out that time for imports, time for exports and documents for exports have a negative effect on flows between low and high income countries

8 Conclusion

The present paper quantifies the impact of numerous Trade Facilitation aspects on bilateral trade. This paper makes both theoretical and empirical contributions to the study of 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 using several databases.

Our main findings are that documents to be filed for export and import are an important determinant of transaction time. Moreover, transaction time, PTA, land-lockness and fraud are crucial factors for customs efficiency. Regarding relative imports, transaction time and number of documents decrease trade more significantly for importers than for exporters. Transaction time is found not to be endogenous. Customs efficiency suffers from an endogeneity problem. Once customs efficiency is instrumented by customs capacity to fulfill its commitments, our results are highly improved. Finally, our sample is split into sub-samples in order to take into account the impact of development level. It turns out that Trade Facilitation aspects have not the same impact on developed and developing countries.

The main shortcomings of this paper are strictly related to the quality of some of the data used, including the quality of infrastructure and harmonization degree. Regarding the infrastructure quality latter, many aspects must be taken into account such as ports efficiency, paved roads, and so on, in order to have a more precise estimation of their impact on trade flows. Besides this database issue, it is necessary to implement the same model on more disaggregated data, i.e. by sector, in order to determine the sectors that are the most affected by Trade Facilitation.

9 Bibliography

1. Anderson, James E. (1979) "A Theoretical Foundation for the Gravity Equation", *American Economic Review* 69: p.106-116.
2. Anderson, James E. and Eric VAN WINCOOP (2003) "Gravity with Gravitas: A Solution to the Border Puzzle", *American Economic Review* v93, n1: 170-92.
3. Alaba, Olumuyiwa (2006) "EU-ECOWAS: Regional Integration, Trade Facilitation and Development in West Africa", presented at the GTAP conference, United Nations Economic Commission for African, May.
4. Asia Pacific Economic Co-operation (APEC) (1999) "Assessing APEC Trade Liberalization and Facilitation: 1999 Update", Economic Committee, September. APEC: Singapore.
5. APEC (2002), "APEC Economies: Realising the Benefits of Trade Facilitation", a report prepared for the APEC Ministerial Meeting, Los Cabos, Mexico, October.
6. Baldwin, Richard and Frédéric Robert-Nicoud (2006) "Offshoring and Globalization: What is new about the new paradigm", *Graduate Institute of International Studies*, Geneva; London School of Economics, October.
7. Balistreri, Edward J. and Russell H. Hillberry (mimeo)(2001) "Trade Friction and Welfare in the Gravity Model: How Much of the Iceberg Melts?" U.S. International Trade Commission, Washington, D.C.
8. Batra, G., D. Kaufmann, and A.H.W. Stone (2003) "Investment Climate Around the World: Voices of the Firms from the World Business Environment Survey." Washington, D.C.: World Bank.
9. Baier, Scott L. and Jeffrey H. Bergstrand (2001) "The growth of world trade: tariffs, transport costs, and income similarity" *Journal of International Economics*, Elsevier, vol. 53(1), pages 1-27, February.
10. Bergstrand, Jeffrey H. (1989) "The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade" *The Review of Economics and Statistics*, MIT Press, vol. 71(1), pages 143-53, February.
11. Bergstrand, Jeffrey H. (1990) "The Heckscher-Ohlin-Samuelson Model, the Linder Hypothesis and the Determinants of Bilateral Intra-industry Trade" *Economic Journal*, Royal Economic Society, vol. 100(403), pages 1216-29, December.
12. Blonigen, Bruce A. and Wesley W. Wilson (2006) "New Measures of Port Efficiency Using International Trade Data", *NBER Working Paper Series*, Working Paper 12052, February.

13. Cernat, Lucian (2001) "Assessing Regional Trade Arrangements: Are South-South More Trade Diverting?", Division on International Trade in Goods and Services, and Commodities, *Study Series No. 16*, United Nations Conference on Trade and Development, United Nations, New York and Geneva.
14. Djankov, Simeon, Caroline Freund and Cong S. Pham (2006), "Trading on Time", World Bank, January.
15. Dollar, D., M. Hallward-Driemeier and T. Mengistae (2003) "Investment Climate, Infrastructure and Trade: A Comparison of Latin America and Asia", a paper prepared for the Conference of sectoral reform in Latin America, Stanford Center for international development, from 13 to 15 November 2003.
16. Duval, Yann (2006) "Costs and Benefits of Implementing Trade Facilitation Measures under Negotiations at the WTO: an Explanatory Survey", *Asia-Pacific Research and Training Network on Trade Working Paper Series*, No.3, January.
17. Feaver Donald and Kenneth Wilson, (2005) "Preferential Trade Agreements and their Implications for Customs Services", Economic Policy Research Unit, *Working Paper Series*, Working Paper No. 05-03, Decembre.
18. Feenstra, Robert (2002) "Border Effects and the Gravity Equation: Consistent Methods for Estimation", *Scottish Journal of Political Economy*, Vol. 49, No. 5, Novembre.
19. Földvári, Péter (2006) "Chapter 4: On the Theory and Application of Gravity Models" in "The Economic Impact of the European Integration on the Netherlands: A Quantitative Analysis of Foreign Trade and Foreign Direct Investments", Universiteit Utrecht.
20. Fontagné, Lionel, Thierry Mayer and Soledad Zignago (2004) "Trade in the Triad: How Easy is the Access to Large Markets?", *CEPII Working Paper*, No. 2004-04, April.
21. Fontagné, Lionel, Thierry Mayer and Soledad Zignago (2005) "A Re-evaluation of the Impact of Regional Agreements on Trade Patterns", September.
22. Freund, Caroline and Diana Weinhold (2000) "On the Effect of the Internet on International Trade", *International Finance Discussion Papers*, No. 693, Board of Governors of the Federal Reserve System.
23. Fujita, Masahisa; Paul Krugman and Anthony J. Venables (2000) "The Spatial Economy: Cities, Regions, and International Trade", *Southern Economic Journal*, Vol. 67, No. 2, pp. 491-493, October.
24. Greenaway, David and Chris Milner (2002) "Regionalism and Gravity", *Scottish Journal of Political Economy*, Vol. 49, No. 5, Novembre.
25. Head, Keith, and Thierry Mayer (2002a) "Effet frontière, intégration Economique et Forteresse Europe", *Economie et Prévision* 136(2): 285-314.

26. Head, Keith, and Thierry Mayer (2002b) “Illusory Border Effects: Distance Mismeasurement Inflates Estimates of Home Bias in Trade”, *CEPII discussion paper* 2002-01.
27. Hummels, David (2001) “Time as a Trade Barrier.”, Department of Economics, Indiana: Purdue University, Mimeo.
28. Hummels, David, Ishii, Jun and Yi, Kei-Mu (2000) “The Nature and Extent of Vertical Specialization in International Trade”, *Journal of International Economics*.
29. Iwanow, Tomasz and Colin Kirkpatrick (2007), “Trade Facilitation, Regulatory Quality and Export Performance”, *Working Paper Series* No. 19/2007, Impact Assessment Research Center, Institute for Development Policy Management, University of Manchester.
30. Kim, S., H. Lee and I. Park (2004) “Measuring the Impact of APEC Trade Facilitation: A Gravity Analysis”, a paper presented in the Reunion of the Economic Committee of the APEC, 30 September 2004 in Santiago, Chili.
31. Limao, N. and A. Venables (2000) “Infrastructure, Geographical Disadvantage and Transport Costs”, World Bank, *Policy Research Working Paper* number 2257.
32. McCallum, John (1995) “National Borders Matter : Canada-U.S. Regional Trade Patterns”, *The American Economic Review*, Vol. 83, No.2, pp.615-62, June.
33. Messerlin, Patrick and Jamel Zarrouk (1999) “Trade Facilitation: Technical Regulations and Customs Procedures”, paper presented at the WTO/World Bank Conference on Developing Countries’ in a Millennium Round, WTO Secretariat, Center William Rappard, Geneva, September.
34. Nicita, Alessandro and Marcelo Olarreaga (2001) “Trade and production, 1976-99”, *Policy Research Working Paper Series* 2701, The World Bank, revised, November.
35. OECD (2002a), “La Relation entre les Accords Commerciaux Régionaux et le Système Commercial Multilatéral: Facilitation des Echanges”, prepared by Evokia Moïsé, Working Party of the Trade Committee, TD/TC/WP(2002)17/FINAL, June.
36. OECD (2002b) “Avantages pour les Entreprises de la Facilitation des Echanges”, prepared by T. Matsudaira and Evokia Moïsé, Working Party of the Trade Committee, TD/TC/WP(2001) 21/FINAL, August.
37. OECD (2002c) “Comment Aborder la Transparence et la Simplification des Formalités aux Frontières: Réflexions sur la Mise en Œuvre des Propositions Relatives à l’Article X du GATT dans certains pays”, prepared by Evokia Moïsé, Working Party of the Trade Committee, TD/TC/WP(2002)36/FINAL, November.

38. OECD (2002d) “Comment Aborder la Transparence et la Simplification des Formalités aux Frontières: Réflexions sur la Mise en Œuvre des Propositions Relatives à l’Article VIII du GATT dans certains pays”, prepared by Evokia Moïse, Working Party of the Trade Committee, TD/TC/WP(2002)50/FINAL, December.
39. OECD (2003a) “Comment Aborder la Transparence et la Simplification des Formalités aux Frontières: Réflexions sur la Mise en Œuvre des Propositions Relatives à l’Article V du GATT dans certains pays”, prepared by Evokia Moïse, Working Party of the Trade Committee, TD/TC/WP(2002)51/FINAL, September.
40. OCDE (2003b) “Réflexions sur les Méthodes Possibles pour mettre en Œuvre les Principes Relatifs à la Facilitation des Echanges Figurant dans les Articles V, VII et X du GATT”, prepared by Evokia Moïse, Working Party of the Trade Committee, TD/TC/WP(2003)12/FINAL, October.
41. OECD (2003c) “Evaluation Quantitative des Avantages de la Facilitation des Echanges”, prepared by par Walkenhorst, Peter and Tadashi Yasui, Working Party of the Trade Committee, TD/TC/WP(2003)31/FINAL, December.
42. OECD (2005) “L’Impact Economique de la Facilitation des Echanges”, prepared by Michael Engman, *OECD Working Paper on trade policy* no. 21, Working Party of the Trade Committee, TD/TC/WP(2005)12/FINAL, November.
43. Parayano, Guillermo (2004) “Trade Facilitation and Customs Modernization: The Philippine Experience”, paper presented at the Seminar on Trade facilitation and Customs Reform in South Asia organized by the International Trade Department of the World Bank, Bangladesh, June.
44. Prodyut, Dutt (2004) “Technical Assistance and Capacity Building Support for Trade Facilitation”, Seminar on Trade Facilitation in South Asia, Asia Development Bank, Dhaka, June.
45. Roy, Jayanta (2004) “Potential Consequences and Benefits of Implementing a Multilateral Approach to Trade Facilitation”, paper presented at the Seminar on Trade facilitation and Customs Reform in South Asia organized by the International Trade Department of the World Bank, Bangladesh, June.
46. Wilmott, Peter (2004) “Trade Facilitation in South Asia: Unilateral, Regional or Multilateral?”, World Bank Seminar, Dhaka, 8-10 June.
47. Wilson John S., Catherine Mann, Yuen Pau Woo, Nizar Assanie, and Inbom Choi (2002) “Trade Facilitation: A Development Perspective in the Asia-Pacific Region”, Asia Pacific Economic Cooperation: Singapore, October.
48. Wilson, John S., S. Bagat and C. Fink (2003a) “Reducing Trading Costs in a New Era of Security”, Chapter 5 in *Global Economic Prospects 2004 - Realizing*

the Development Promise of the Doha Agenda. Washington, D.C.: World Bank.

49. Wilson John S., Catherine Mann and Maros Ivanic (2006) “Aid for Trade Facilitation”, Draft copy, November.
50. Wilson John S., Catherine Mann and Tsunehiro Otsuki (2003b) “Trade Facilitation and Economic Development: Measuring the Impact”, *World Bank Policy Research Working Paper* 2988, Development Research Group, Trade, March.
51. Wilson John S., Catherine Mann and Tsunehiro Otsuki (2004) “Assessing the Potential Benefit of Trade Facilitation: A Global Perspective”, *World Bank Policy Research Working Paper* 3224, February.
52. Woo Yuen Pau and John S. WILSON (2000) “Cutting Through Red Tape: New Directions for APEC’s Trade Facilitation Agenda”, Asia Pacific Foundation of Canada: Vancouver.
53. WTO (2002) “Review, Clarification and Improvement of GATT Articles V, VIII and X Proposals Made by Delegations”, Council for Trade in Goods, G/C/W/434, November.

10 Appendixes

10.1 Appendix 1: Description of indicators

This appendix presents the definition as well as the source of each indicator used in our database:

- Transparency:
 1. Trans. Evo: Since 3 years, what is the evolution of the situation of the public action transparency in the economic activity from 0(deterioration) to 4(improvement) \Rightarrow MINEFI
 2. Trans.: transparency degree in the country \Rightarrow MINEFI.
 3. Adm. Reform :Reforms in the simplification of administrative procedures from 0 to 4 \Rightarrow MINEFI.

- Efficiency of customs:
 1. Cap. eng.: capacity of customs administration to implement its customs commitments (rules of origin, evaluation rules) 1 to 4 \Rightarrow MINEFI
 2. Cap. adv.: capacity customs administration to take advantages of specific trade arrangements (preferential and regional agreements) - 1 to 4 \Rightarrow MINEFI
 3. Cust. coll.: level of collaboration between local customs authorities and other countries ones (rules of origin, detection of fraud) 1 to 4 \Rightarrow MINEFI
 4. Imp. Lic.: automatic grant of import licences (=4), or grant subject to simple, restrictive and respected conditions (=3), restrictive conditions (=2), many restrictions (barrier to entry , huge corruption..=1) \Rightarrow MINEFI

- Harmonization:
 1. Norm. Bank: Normalized accounting system of banks - 0 to 4 \Rightarrow MINEFI
 2. Norm. SME: Normalized accounting system of small and medium enterprises - 0 to 4 \Rightarrow MINEFI
 3. Norm. LF: Normalized accounting system large firms - 0 to 4 \Rightarrow MINEFI
 4. Interv. Audit: intervention of international cabinets of audit (0=no intervention, if yes, from 1= rarely to 4=frequently) \Rightarrow MINEFI
 5. lang: Fraction of elites using an international language (English, German, French, Spanish) - from 1(small fraction) to 4(large fraction) \Rightarrow MINEFI

- Inefficiency of customs authority:
 1. Documents: All documents required to export and import the goods are recorded. 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 the concerned parties. Documents filed simultaneously are considered different documents but with the same time frame for completion \Rightarrow Doing Business.

2. Time: 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. 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. The waiting time between procedures, for example, during unloading of the cargo, is included in the measure \Rightarrow Doing Business.
 3. Fraud: importance of customs fraud (corruption, sub-declaration, etc.) 1 to 4 \Rightarrow MINEFI
- Technological environment: Internet users (per 1,000 people) \Rightarrow World Bank.
 - Other indicators:
 1. Infra.: Infrastructures synthetical indicator- 2000 \Rightarrow MINEFI
 2. Secu. Trans.: Since 3 years, evolution of the transaction security situation - from 0(deterioration) to 4(amelioration) \Rightarrow MINEFI
 3. Info: Information on the quality of exchanged goods and services - from 0 (no system for norms et standards) to 4(efficient system) \Rightarrow MINEFI

10.2 Appendix 2: List of countries in the sample

Table 9: List of countries by code iso-3

Pays	iso3	Pays	iso3
Argentine	ARG	Morocco	MAR
Bulgaria	BGR	Mexico	MEX
Brazil	BRA	Malaysia	MYS
Chili	CHL	Nigeria	NGA
Chine	CHN	Norway	NOR
Ivory Cost	CIV	Pakistan	PAK
Cameroon	CMR	Peru	PER
Colombia	COL	Philippines	PHL
Czech Republic	CZE	Poland	POL
Deutschland	DEU	Portugal	PRT
Egypt	EGY	Romania	ROM
France	FRA	Russia	RUS
Ghana	GHA	Saudi Arabia	SAU
Greece	GRC	Singapore	SGP
Hong Kong	HKG	Syria	SYR
Hungary	HUN	Thailand	THA
Indonesia	IDN	Tunisia	TUN
India	IND	Turkey	TUR
Ireland	IRL	Uganda	UGA
Iran	IRN	Ukraine	UKR
Israel	ISR	United States	USA
Japan	JPN	Venezuela	VEN
South of Korea	KOR	Vietnam	VNM
Lithuania	LTU	Zimbabwe	ZWE

Table 10: Distribution of countries used in the sample by income level

Income level	Frequency	Percent in the sample
High income: OECD	10	20.83
High income: non-OECD	4	8.33
Low income	8	16.67
Lower middle income	13	27.08
Upper middle income	13	27.08
Total of countries in the sample	48	100.00

Source: Constructed by the author from the World Bank database.

Note: In this table, the adopted classification is the World Bank's one

10.3 Appendix 3: Descriptive Statistics

Table 11: Descriptive Statistics of the used variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Ln (Rel. Imp.)	1671	-6.75123	2.874421	-20.8391	2.945185
Ln (Production)	1296	0	2.23405	-7.55678	7.556777
Ln (Distance)	2304	3.112883	1.257122	-0.71096	7.613622
ln (Tarif)	2304	2.341528	1.003151	0	4.531818
Contiguity	2304	0.036024	0.186391	0	1
Com. Lang.	2304	0.114149	0.318062	0	1
Colony	2304	0.015191	0.122339	0	1
PTA	2304	0.150608	0.357744	0	1
Landlock Imp.	2304	0.083333	0.276445	0	1
Landlock Exp.	2304	0.083333	0.276445	0	1
Secu. Trans.	2304	6.916667	1.153446	2	8
Harmoni.	2304	5.525	0.989585	2.8	7.6
Info.	2304	5.083333	1.499168	0	8
Infra.	2304	4.75	0.684802	4	8
Trans.	2304	4.971722	1.300517	1.553299	8
Evo. Trans.	2304	4.875	1.114777	0	8
Adm. Reform	2304	3.333333	1.667028	0	8
Customs eff.	2304	5.375	1.176186	2	8
Document	2304	15.83333	4.177146	4	31
Time	2304	49.0625	18.834	8	119
Internet	2304	236.0833	199.9342	2	1030
Fraud	2304	-2.10417	0.780655	-4	-1
Document for exports (exporter)	2304	6.458333	2	2	12
Document for imports (importer)	2304	9.375	3.667226	2	19
Time Exp.	2304	24.53125	9.416999	4	59.5
Time Imp.	2304	24.53125	9.416999	4	59.5
Cap. Eng.	2304	5.541667	1.45059	2	8
Cap. Adv.	2304	5.333333	1.394736	2	8
Cust. Coop.	2304	5.083333	1.52672	2	8
Imp. Lic.	2304	5.541667	1.298986	2	8

Table 12: Correlation matrix among the used variables

	Sec. Tran.	Harmoni.	Info.	Infra.	Evo. Tra.	Trans.	Adm. Ref.	Cust. Eff.	Document	Time	Internet	Fraud
Sec. Tran.	1											
Harmoni.	0.1835	1										
Info.	0.2913	0.6905	1									
Infra.	-0.4354	0.1338	0.1929	1								
Evo. Tra.	-0.1824	-0.1138	-0.0094	0.0887	1							
Trans.	0.0527	0.7186	0.645	0.4035	0.1399	1						
Adm. Ref.	-0.1012	0.3386	0.3114	0.1826	0.2692	0.5038	1					
Cust. Eff.	0.1344	0.6872	0.724	0.317	-0.0616	0.7613	0.3455	1				
Document	0.0981	-0.1518	-0.2718	-0.3133	-0.1007	-0.2104	-0.0469	-0.2959	1			
Time	0.0543	-0.22	-0.3673	-0.2426	-0.2247	-0.277	-0.2708	-0.4449	0.745	1		
Internet	-0.152	0.5093	0.4728	0.463	0.1706	0.6157	0.336	0.6609	-0.4176	-0.5044	1	
Fraud	-0.0395	-0.6418	-0.6107	-0.3947	0.0045	-0.6988	-0.379	-0.7789	0.3041	0.3093	-0.6729	1

10.4 Annexe 4: Summary of the predicted signs of the model

Table 13: Summary of the predicted signs of the model

Coefficient	Variables	Sign
1	Production	+
$\delta(\sigma - 1)$	Distance	-
$-(\sigma - 1)$	Tariff	-
$(\sigma - 1)\lambda$	Language	+
$(\sigma - 1)(\theta - \beta)$	PTA	+
$(\sigma - 1)\zeta$	Contiguity	+
$(\sigma - 1)\tau$	Colonial links	+
$(\sigma - 1)(\eta - \beta)$	Intercept	-
$(\sigma - 1)\mu_1$	Infrastructure	+
$(\sigma - 1)\mu_2$	Efficiency of customs	+
$(\sigma - 1)\mu_3$	Harmonization	+ -
$(\sigma - 1)\mu_4$	Security of transactions	+ -
$(\sigma - 1)\mu_5$	Internet users	+
$(\sigma - 1)\mu_6$	Availability of information	+
$(\sigma - 1)\mu_7$	Document for export and import	-
$(\sigma - 1)\mu_8$	Time for export and import	-
$(\sigma - 1)\mu_9$	Administrative reforms	+ -
$(\sigma - 1)\mu_{10}$	Transparency	+
$(\sigma - 1)\mu_{11}$	Customs Fraud	-
$(\sigma - 1)\mu_{12}$	Administrative reforms	+
$(\sigma - 1)\mu_{13}$	Landlockness of the importer	-
$(\sigma - 1)\mu_{14}$	Landlockness of the exporter	-

10.5 Annexe 5: Regressions Results

Table 14: Determinants of time of exports and imports

	COEFFICIENT	Time
Fraud	-1.765***	(-8.48)
Document for export (exporter)	1.736***	(31.0)
Document for import (importer)	0.986***	(30.3)
Landlock exp.	4.816***	(11.3)
Landlock imp.	3.838***	(8.59)
Infra.	0.552***	(3.29)
Info.	-1.173***	(-13.3)
Internet	-0.0272***	(-20.2)
Constant	6.192***	(6.35)
Observations		2304
R-squared		0.66

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

Table 15: Determinants of the customs efficiency

COEFFICIENT	Customs eff. (1)	Customs eff. (2)
ln(Tariff)	-0.00642 (-0.45)	-0.00463 (-0.35)
PTA	0.190*** (6.40)	0.180*** (6.21)
Landlock imp.	-0.132** (-2.42)	-0.0681 (-1.29)
Landlock exp.	-0.0595 (-1.05)	-0.0563 (-1.06)
Secu. Trans.	0.00655 (0.58)	0.00381 (0.34)
Harmoni.	-0.0263 (-1.50)	-0.0250 (-1.48)
Info.	0.159*** (15.0)	0.144*** (14.1)
Infra.	-0.0600*** (-2.64)	-0.0517** (-2.36)
Trans	0.331*** (20.1)	0.346*** (21.5)
Trans. Evo.	-0.168*** (-15.3)	-0.174*** (-16.1)
Adm. Reform	-0.0642*** (-7.95)	-0.0830*** (-10.3)
Internet	0.00145*** (9.16)	0.00117*** (7.58)
Fraud	-0.487*** (-23.1)	-0.521*** (-25.0)
Document for export (exporter)	0.0215*** (3.05)	
Document for import (importer)	0.0680*** (14.5)	
Time for export (exporter)	-0.0154*** (-9.85)	
Time for import (importer)	-0.0213*** (-17.9)	
Document		0.165*** (17.8)
Time		-0.0528*** (-23.2)
Constant	3.292*** (17.3)	3.152*** (16.7)
Observations	2304	2304
R-squared	0.82	0.82

Notes: (i.) Robust t statistics in parentheses.

(ii.) ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

Table 16: Impact of Trade Facilitation variables on Bilateral Trade

	Ln (Rel. Imp.)	Ln (Rel. Imp.)
Ln (Production)	0.639*** (31.4)	0.635*** (30.1)
Ln (Distance)	-0.250*** (-5.26)	-0.253*** (-5.14)
ln (Tarif)	-0.279*** (-4.78)	-0.269*** (-4.44)
Contiguity	1.559*** (8.99)	1.564*** (8.95)
Com. Lang.	1.445*** (8.55)	1.452*** (8.6)
Colony	0.763*** (3.62)	0.748*** (3.57)
PTA	0.905*** (6.86)	0.899*** (6.72)
Landlock Imp.	0.216 (1.16)	0.25 (1.35)
Landlock Exp.	0.471*** (3.38)	0.442*** (3.16)
Secu. Trans.	-0.203*** (-4.27)	-0.202*** (-4.21)
Harmoni.	-0.265*** (-3.38)	-0.258*** (-3.28)
Info.	0.372*** (7.35)	0.361*** (6.84)
Infra.	0.385*** (4.83)	0.379*** (4.73)
Trans.	-0.124 (-1.44)	-0.117 (-1.36)
Evo. Trans.	-0.0719 (-1.53)	-0.0712 (-1.52)
Adm. Reform	-0.177*** (-4.94)	-0.178*** (-4.96)
Customs eff.	-0.172* (-1.67)	-0.163 (-1.59)
Internet	0.00419*** (11)	0.00410*** (10.9)
Fraud	-0.0869 (-0.79)	-0.0897 (-0.81)
Time	-0.00819 (-1.56)	
Time Exp.		0.00123 (0.075)
Time Imp.		-0.0214 (-1.53)
Document	0.0237 (1.2)	
Document for exports (exporter)		0.0375 (1.06)
Document for imports (importer)		0.0149 (0.66)
Constant	-4.901*** (-6.15)	-4.865*** (-5.75)
Observations	1255	1255
R-squared	0.64	0.64

Notes: (i.) Robust t statistics in parentheses.

(ii.) ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

(iii.) Time for exportation is a simple average of time of exportation the importer and the exporter and time for importation is simple average of time of importation the importer and the exporter which is different of Time for exportation of the exporter or the same for the importer included in the second regression.

Table 17: Impact of Trade Facilitation variables on Bilateral Trade: Customs efficiency aspects

	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)
Ln (Production)	0.639*** (31.4)	0.642*** (31.9)	0.640*** (31.5)	0.639*** (31)	0.643*** (33.8)
Ln (Distance)	-0.250*** (-5.26)	-0.277*** (-5.79)	-0.269*** (-5.65)	-0.256*** (-5.48)	-0.229*** (-4.97)
ln (Tarif)	-0.279*** (-4.78)	-0.262*** (-4.58)	-0.261*** (-4.48)	-0.280*** (-4.91)	-0.285*** (-5.06)
Contiguity	1.559*** (8.99)	1.656*** (9.59)	1.609*** (9.28)	1.581*** (9.16)	1.387*** (8.01)
Com. Lang.	1.445*** (8.55)	1.471*** (8.6)	1.468*** (8.63)	1.435*** (8.38)	1.515*** (9.68)
Colony	0.763*** (3.62)	0.699*** (3.11)	0.707*** (3.31)	0.729*** (3.41)	1.046*** (4.55)
PTA	0.905*** (6.86)	0.767*** (5.99)	0.819*** (6.4)	0.879*** (6.83)	1.029*** (8.13)
Landlock Imp.	0.216 (1.16)	-0.00043 (-0.0023)	0.218 (1.19)	0.211 (1.16)	0.424** (2.36)
Landlock Exp.	0.471*** (3.38)	0.211 (1.52)	0.436*** (3.26)	0.466*** (3.35)	0.699*** (5.12)
Secu. Trans.	-0.203*** (-4.27)	-0.203*** (-4.47)	-0.190*** (-3.97)	-0.189*** (-3.73)	-0.168*** (-3.64)
Harmoni.	-0.265*** (-3.38)	-0.327*** (-4.10)	-0.254*** (-3.22)	-0.255*** (-3.20)	-0.365*** (-4.82)
Info.	0.372*** (7.35)	0.273*** (5.67)	0.316*** (6.26)	0.360*** (7.37)	0.317*** (6.88)
Infra.	0.385*** (4.83)	0.328*** (4.07)	0.381*** (4.75)	0.387*** (4.84)	0.235*** (3.04)
Trans.	-0.124 (-1.44)	-0.178** (-2.19)	-0.200** (-2.47)	-0.143 (-1.64)	0.159* (-1.82)
Evo. Trans.	-0.0719 (-1.53)	0.055 (1.18)	-0.0311 (-0.69)	-0.0515 (-1.13)	-0.158*** (-3.54)
Adm. Reform	-0.177*** (-4.94)	-0.152*** (-4.36)	-0.133*** (-3.45)	-0.170*** (-4.75)	-0.181*** (-5.41)
Document	0.0237 (1.2)	-0.00413 (-0.23)	0.0028 (0.15)	0.0235 (1.19)	0.0275 (1.53)
Time	-0.00819 (-1.56)	-0.00509 (-1.04)	-0.00407 (-0.80)	-0.00838 (-1.61)	-0.0105** (-2.16)
Internet	0.00419*** (11)	0.00335*** (8.93)	0.00387*** (10.5)	0.00403*** (11)	0.00428*** (12.7)
Fraud	-0.0869 (-0.79)	-0.0188 (-0.18)	0.0508 (0.42)	-0.0646 (-0.59)	-0.118 (-1.16)
Cust. Eff.	-0.172* (-1.67)				
Cap. Enga.		0.268*** (5.27)			
Cap. Adv.			0.105 (1.47)		
Cust. Coop.				-0.0906 (-1.33)	
Imp. Lic.					-0.468*** (-8.92)
Constant	-4.901*** (-6.15)	-5.993*** (-8.12)	-5.728*** (-7.04)	-5.369*** (-7.13)	-3.198*** (-4.15)
Observations	1255	1255	1255	1255	1255
R-squared	0.64	0.64	0.64	0.64	0.66

Notes: (i.) Robust t statistics in parentheses.

(ii.) ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

Table 18: Trade vs. Trade facilitation: controlling for endogeneity

	Ln (Rel. Imp.)	Ln (Rel. Imp.)
Custom Eff.	0.768*** (5.09)	0.793*** (5.17)
Ln (Production)	0.643*** (30.5)	0.636*** (29)
Ln (Distance)	-0.310*** (-6.08)	-0.323*** (-6.16)
ln (Tarif)	-0.219*** (-3.54)	-0.211*** (-3.33)
Contiguity	1.784*** (9.49)	1.786*** (9.42)
Com. Lang.	1.510*** (8.33)	1.522*** (8.42)
Colony	0.530** (2.32)	0.499** (2.17)
PTA	0.598*** (4.23)	0.573*** (3.96)
Landlock Imp.	-0.0605 (-0.29)	-0.0225 (-0.11)
Landlock Exp.	0.0625 (0.39)	0.0178 (0.11)
Secu. Trans.	-0.227*** (-4.79)	-0.227*** (-4.75)
Harmoni.	-0.271*** (-3.29)	-0.268*** (-3.24)
Info.	0.219*** (4.11)	0.206*** (3.7)
Infra.	0.397*** (4.71)	0.386*** (4.54)
Trans.	-0.433*** (-4.46)	-0.431*** (-4.40)
Evo. Trans.	0.120** (2.23)	0.123** (2.28)
Adm. Reform	-0.0738* (-1.90)	-0.0706* (-1.81)
Internet	0.00310*** (7.51)	0.00298*** (7.24)
Fraud	0.237** (2.02)	0.239** (2.04)
Document	-0.0487** (-2.30)	
Document for exports (exporter)		-0.0478 (-1.26)
Document for imports (importer)		-0.0574** (-2.40)
Time	0.00534 (0.98)	
Time Exp.		0.0332* (1.92)
Time Imp.		-0.0264* (-1.81)
Constant	-7.339*** (-8.76)	-7.187*** (-8.25)
Observations	1255	1255
R-squared	0.61	0.61

Notes: (i.) Robust t statistics in parentheses.

(ii.) ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

Table 19: Impact of Trade Facilitation variables on Bilateral Trade: controlling for income level and disaggregating time and document variables.

	Ln (Rel. Imp.)		
	Low+High	High+Low	Low+Low
Ln (Production)	0.790*** (13.9)	0.337*** (5.41)	0.556*** (14)
Ln (Distance)	-0.855*** (-5.53)	-0.275*** (-2.78)	-0.897*** (-9.66)
ln (Tarif)	-0.922*** (-5.98)	-0.435** (-2.30)	-0.143 (-1.34)
Contiguity	0.401 (1.14)	0.680* (1.88)	0.642*** (3.02)
Com. Lang.	1.380*** (4.35)	1.671*** (5.95)	1.107*** (4.28)
Colony	1.180** (1.98)	0.479 (0.88)	0.536 (1.43)
PTA	0.448* (1.88)	1.023*** (3.81)	0.435* (1.9)
Landlock Imp.	-0.0288 (-0.073)	0.449 (1.07)	1.080** (2.51)
Landlock Exp.	0.753** (1.98)	0.553 (1.47)	1.746*** (5.32)
Secu. Trans.	-0.659*** (-6.45)	-0.248** (-2.00)	-0.357*** (-5.47)
Harmoni.	-0.429** (-2.52)	-0.414*** (-2.60)	-0.467*** (-3.18)
Info.	0.294*** (2.7)	0.192** (2.12)	0.061 (0.78)
Infra.	-0.377** (-2.21)	0.124 (0.68)	0.569*** (4.76)
Trans.	0.129 (0.66)	-0.27 (-1.04)	-0.171 (-1.27)
Evo. Trans.	0.0628 (0.54)	0.176* (1.84)	0.220** (2.07)
Adm. Reform	-0.0937 (-1.33)	-0.101 (-1.39)	-0.249*** (-4.28)
Customs eff.	0.903*** (3.05)	0.35 (1.23)	0.539*** (3.32)
Internet	0.00747*** (8.17)	0.00745*** (9.03)	0.0113*** (10)
Fraud	0.655*** (2.67)	0.118 (0.5)	0.814*** (3.73)
Time Exp.	0.100** (2.17)	-0.0789** (-2.20)	-0.0379* (-1.76)
Time Imp.	-0.113*** (-2.80)	0.0568 (1.62)	-0.0146 (-0.78)
Document for exports (exporter)	0.046 (0.63)	-0.375** (-2.19)	0.132*** (2.87)
Document for imports (importer)	0.00693 (0.094)	0.0681** (2.03)	0.047 (1.57)
Constant	-2.154 (-1.38)	-3.407* (-1.71)	-4.435*** (-3.36)
Observations	275	275	595
R-squared	0.75	0.65	0.64

Notes: (i.) Robust t statistics in parentheses.

(ii.) ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

Table 20: Impact of Trade Facilitation variables on Bilateral Trade: controlling for income level and aggregating time and document variables.

	Ln (Rel. Imp.)	Ln (Rel. Imp.)	Ln (Rel. Imp.)
	Low+High	High+Low	Low+Low
Ln (Production)	0.789*** (14.6)	0.246*** (4.95)	0.551*** (13.7)
Ln (Distance)	-0.833*** (-5.12)	-0.232** (-2.32)	-0.924*** (-10.2)
ln (Tarif)	-0.825*** (-4.88)	-0.308 (-1.54)	-0.159 (-1.55)
Contiguity	0.419 (1.09)	0.750* (1.88)	0.610*** (2.92)
Com. Lang.	1.500*** (4.75)	1.618*** (5.73)	1.108*** (4.28)
Colony	1.315** (2.47)	0.801 (1.58)	0.498 (1.35)
PTA	0.581** (2.3)	1.115*** (4.19)	0.388* (1.74)
Landlock Imp.	-0.121 (-0.29)	0.920** (2.37)	1.011** (2.36)
Landlock Exp.	1.178*** (3.24)	0.167 (0.49)	1.736*** (5.39)
Secu. Trans.	-0.595*** (-5.95)	-0.322** (-2.52)	-0.367*** (-5.70)
Harmoni.	-0.611*** (-3.67)	-0.598*** (-3.70)	-0.518*** (-3.56)
Info.	0.400*** (3.89)	0.175* (1.91)	0.078 (1.03)
Infra.	-0.295* (-1.72)	-0.149 (-0.98)	0.561*** (4.72)
Trans.	0.297* (1.72)	0.196 (0.82)	-0.172 (-1.30)
Evo. Trans.	0.00474 (0.052)	-0.0041 (-0.056)	0.217** (2.09)
Adm. Reform	-0.110* (-1.66)	-0.173*** (-2.85)	-0.236*** (-3.97)
Customs eff.	0.581** (2.28)	0.121 (0.48)	0.552*** (3.37)
Internet	0.00672*** (7.83)	0.00657*** (8.46)	0.0115*** (10.1)
Fraud	0.574** (2.5)	0.101 (0.42)	0.805*** (3.69)
Time	-0.00131 (-0.11)	-0.0206*** (-2.61)	-0.0243*** (-3.21)
Document	0.0318 (0.65)	0.0512* (1.85)	0.0633** (2.33)
Constant	-1.8 (-1.16)	-2.023 (-1.08)	-3.951*** (-3.05)
Observations	275	275	595
R-squared	0.73	0.64	0.64

Notes: (i.) Robust t statistics in parentheses.

(ii.) ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.