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Trade Facilitation:  
How the burden of documentary and border  
procedures impact exports to the EU



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## Abstract

How to increase trade flows in today's globalized world is a relevant topic and the incentives to do so are exemplified by the WTO Trade Facilitation Agreement that came into force in 2017. Inefficient trade procedures have proven to aggravate and decrease trade. Inefficient trade procedures could be obtaining, preparing and submitting documents about the traded good to authorities, as well as customs clearance and inspections at the border. In this paper we investigate how the world's exports to the EU are affected by these procedures. We contribute to already existing literature by using recently released data from the World Bank on time for documentary and border compliance and investigate their impact on exports. The empirical analysis is conducted by using a gravity model with panel data and a fixed effects Poisson Pseudo-Maximum Likelihood (PPML). We find that a 1% decrease in time for documentary compliance would increase the world's exports to the EU by 0,164%, while no such relationship can be found between border compliance and exports. However, when estimating a model with four income per capita groups, we find these relationships not to be linear which implies that different areas of reform are suitable for different countries.

Keywords: *Trade Facilitation, Documentary Compliance, Border Compliance, Gravity Model*

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## 1. Introduction

In the globalized world of today, trade plays a substantial role in the economic system. The last decades the relief of tariff barriers have led to increased volumes of trade between countries. However, the political focus of reducing tariffs has moved towards dealing with the issue of non-tariff barriers, such as cutting red tape, harmonising and automatizing trade procedures in order to facilitate trade (Persson, 2012, 12). Obtaining, preparing and submitting documents about the traded goods to authorities, as well as customs clearance and inspections at the border, are both examples of trade procedures that can impact trade flows negatively. The relevance of trade facilitation is exemplified by WTO's trade facilitation agreement that came into force in February 2017. It contains provisions to facilitate trade procedures, including movement of goods, technical assistance and measures for effective cooperation between customs and authorities (WTO 2019).

In this paper we investigate the relationship between the time needed for complying with documentary procedures and border procedures in the exporting process and how these areas impact exports to the EU28. This will be investigated by using recently released data from the World Bank's Doing Business database who changed their methodology in 2016. The new data divides the hours it takes for companies to deal with documentary and border procedures. To our knowledge we are the first authors to use these indicators. The disaggregated data of trade facilitation allows us to study to what extent the indicators documentary compliance and border compliance impact exports. In turn, this provides more detailed information, which facilitates for policymakers when deciding in what area to put reforms.

In order to contribute to the research on trade facilitation and to provide resources for governments to boost trade, we set up a gravity model using panel data and a fixed effects Poisson Pseudo-Maximum Likelihood (PPML) estimator. The gravity model predicts bilateral trade flows being proportional to respective countries, economic size and the distance between them (Chaney 2011, 2). With data between 2016 and 2017, we study how the *time for documentary compliance* and *time for border compliance* for 155 exporting countries impact exports to the EU28. Our baseline result indicates that the export time for documentary compliance has a negative effect on exported volumes to the EU, while no significant impact is found for border compliance. Furthermore, we find that the relationships are not linear but vary depending on the income level of the exporting country.

Following this introduction, the background on trade facilitation is outlined in the second section. In the third section we present an overview of previous research on trade facilitation. The fourth section introduces our empirical strategy, including a presentation of the gravity model, our econometric

considerations and our data. In section five, we present and discuss our results. In section six we present a simulation study from our results. Finally, section seven is a summary and conclusion of our study.

## 2. Background

### 2.1 What is trade facilitation?

There is no universal definition of trade facilitation. Some definitions have a narrow approach while some are broader. The World Trade Organization (WTO) definition has a narrow focus and define trade facilitation as “*the simplification, modernization and harmonization of export and import processes*” (OECD 2005). Further, WTO define trade procedures as the “*activities, practices and formalities involved in collecting, presenting, communicating and processing data required for the movement of goods in international trade*” (OECD 2005).

At the Doha Ministerial Declaration (WTO 2001) trade facilitation was similarly defined as “*expediting the movement, release and clearance of goods, including goods in transit*”. The UN Center for trade facilitation and Electronic Business use a comparable definition for trade facilitation: “*the simplification, standardization and harmonization of procedures and associated information flows required to move goods from seller to buyer and to make payment*” (UNECE 2012). In contrast to the narrow definition, only including the procedural issues, Wilson, Mann and Otsuki (2003; 2005) use a broader perspective on the definition of trade facilitation that involves border elements such as port efficiency and customs administration, as well as behind the border elements as domestic environment and infrastructure.

Various authors, e.g. Bourdet and Persson (2014), Djankov, Freund and Pham (2010), Felipe and Kumar (2010), have used the narrow WTO definition, while Hoekman and Shepherd (2015) have used both the narrow and the broad perspective when studying the impact of trade facilitation. In this study we adapt the WTO definition with a narrow focus on trade facilitation. Using the same definition that has been used in the past simplifies the comparison of the results. It also enables policymakers to estimate the effects and identify what areas to improve.

### 2.2 How should trade facilitation be measured?

As previously mentioned, there is no universal definition of trade facilitation. Depending on if you use a broad or narrow definition different areas can be of interest. This means that measuring trade facilitation can be done differently and involve more or less direct indicators affecting trade procedures. Some frequently used tools are World Bank’s Doing Business’ *trading across borders* and Logistics

Performance Index (LPI), World Economic Forum’s Enabling Trade Index and OECD’s Trade Facilitation Indicators. They have many similarities but also differences. This could, for example, be how the data is gathered as well as what areas connected to trade procedures they cover (Bilotserkivska 2015). This shows the depth and richness of trade facilitation as well as the complexity of the matter. Some common sources for data on trade facilitation are presented in the table below:

Table 1. Tools for measuring trade facilitation.

Database	Sample	Method	Covered areas	Source
The Logistics Performance Index (LPI)	160 countries	Ask Freight Forwarders & Express Carriers perception-based & quantitative questions on logistical conditions and infrastructural environment for trade	Customs, Infrastructure, International shipments, Logistics competence, Tracking & tracing and Timeliness. The weighted average of these gives a country’s rank and score	Connecting to Compete 2018
The Enabling Trade Index	136 countries	Built on 56 indicators from 7 pillars covering different aspects of a country's trade environment	Transport services; ICT infrastructure; Domestic market access; Foreign market access; Border administration; Transport infrastructure; and Operating environment	World Economic Forum 2016
OECD's Trade Facilitation Indicators	152 countries	11 indicators, providing information on countries performance in trade procedures	Areas such as cooperation, documentary and border procedures, as well as regulations and the availability to find information for traders	OECD 2015

In this thesis we will measure trade facilitation by using indicators from the World Bank’s Doing Business database and their section *trading across borders*. It is one of 11 sections covering business regulations in the Doing Business database and the section with a direct focus on the efficiency of trade procedures. The indicator can be summarized as estimating “time and cost to export the product of comparative advantage and import auto parts” (Doing Business 2016).

The *trading across borders* data is gathered from questionnaires where local freight forwarders, customs brokers, port authorities and traders are asked about the efficiency of trade procedures. This makes the data largely built on perceptions, rather than empirical findings. One could argue this to be negative for the credibility of the indicators due to an increased risk of errors. However, we claim the information provided by freight forwarders and other relevant agencies to be valid as they have specific knowledge of the subject. E.g. in 2010, freight forwarders handled about 85% of foreign trade which implies good insights on these matters (Djankov, Freund and Pham 2010).

The *trading across borders* case study consists of various assumptions about the traded goods and the trade procedure. The reason for this is to make it possible to compare the data for the 190 included economies. The assumptions are presented in the table below.

Table 2. Assumptions about the trade procedure and the good.

The Trade procedure	The Good
The good is exported from the largest business city in the exporting economy to the importing country's largest business city	Product exported is the good with the largest export value and is exported to the biggest importer of this product
Insurance cost and informal payments are excluded from the costs recorded	Imports for each economy assumed to be of a standardized shipment of 15 metric tons of containerized auto parts
The exporting/importing firm hires a freight forwarder and/or customs broker and pays for all costs associated with the trade procedure	Exports not necessarily containerized auto parts
All electronic submissions requested by any government agency are considered documents obtained, prepared and submitted during the export or import process	Some goods, e.g oil, are excluded from possible exports
A port or border is defined as a place where merchandise can enter or leave an economy	If fees are determined by the value of the shipment, the value is assumed to be \$50,000
Relevant agencies are such as customs, port authorities, road police, border guards, standardization agencies, ministries or departments of agriculture or industry, national security agencies and central banks	The product is new, not secondhand or used merchandise

Note: For 11 economies the data is also collected for the second largest business city.

(Doing Business 2015)

Previously, the *trading across borders* database consisted of four indicators recording the total time and cost for a good in different stages of the trading process. These were documentation, customs clearance and inspections, inland transport and handling as well as port and terminal handling. However, there were no published data on the specific time and cost for each area, only for the aggregated time and cost (Doing Business 2016).

However, the *trading across borders* methodology was changed in 2016. Today, it consists of more detailed data, where they record three sets of procedures involved in trade. Trade procedures are divided into time and cost for documentary compliance and border compliance in import and export procedures.



The third recorded procedure is domestic transport, which does not affect the score or rank of a country in neither the *trading across borders* section or the *ease of doing business* index. This is mainly due to the many external factors other than trade policy and reforms affecting the indicator (Doing Business 2015). We have therefore decided to ignore this indicator.

The new methodology is of importance for us in our aim to examine what role documentary and border procedures have in determining trade flows. It gives us a unique opportunity to go into more detail in how these specific areas impact trade, which we have not found in previous works. As the new data was first released in 2016, we will use panel data between 2016 and 2017, with documentary and border compliance in the exporting process being our indicators of interest.<sup>1</sup>

Our decision to study exports, rather than overall trade or imports, is primarily a matter of narrowing our study. Reports have implied a causal positive relationship between both exports and imports and economic growth (Shirazi and Abdul Manap 2005). However, policymakers are often more interested in boosting exports than imports in order to increase a country’s competitiveness (Ketels 2010).

Table 3. Definitions for the documentary and border compliance indicators.

<b>Documentary compliance indicator</b>	<b>Border compliance indicator</b>
Captures the time and cost for obtaining, preparing, and submitting documents during transport, clearance, inspections and port or border handling in origin economy, destination and any transit economies	Captures the time and cost for customs clearance and inspections by customs and inspection by other agencies (if applied to more than 20% of shipments)
Covers all documents required by law and in practice, including electronic submissions of information as well as non-shipment-specific documents necessary to complete the trade	Port or border handling at most widely used port or border of economy

(Doing Business 2015)

The indicators time and cost for documentary and border compliance cover, as seen in the table above, different sets of procedures in the exporting process. The more complicated these procedures are, the higher the time and cost indicators are likely to be.

The time and cost indicators are closely related, but have different characteristics. The cost for documentary compliance captures the actual payments for companies in the process of obtaining, preparing and submitting documents. The cost for border compliance captures the direct costs related to the inspections and port or border handling (Okazaki 2018).

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<sup>1</sup> For information about the included importer and exporter countries in the sample - see appendix.

The characteristics of the time indicators are different from the cost indicators, as they cover *indirect* rather than *direct* costs. The time indicators better capture the efficiency of the exporting process as it indicates how time-consuming it is to move goods from a country to another. I.e. obtaining, preparing and submitting documents as well as customs clearance and inspections at the border would not necessarily result in any direct costs but could be unnecessarily complex and involve hours or days of delays (Doing Business 2015). Therefore, we find the time indicators more suitable for our baseline study as we claim them to be more relevant indicators on the efficiency of trade procedures, which go well together with the WTO definition of trade facilitation that we have adapted (OECD 2005).

As the documentary burden can be assumed to be less sensitive for the actual volume of the exported goods, and rather constant in terms of paperwork, it makes sense to view this as a fixed cost in the trade procedure. Border compliance and the time and cost for this procedure, can be expected to be more affected by the traded volumes. Therefore we will view this as a variable cost to trade, which varies depending on the size of the export. For our thesis, this distinct difference between our indicators, will be beneficial for our ability to draw conclusions from our study and in terms of policy implications.

Furthermore, we motivate our decision to only include *exporters'* time for documentary and border compliance with the big variation of the 155 exporting countries in our sample. In the EU the differences in time in their *import* procedures are relatively small (Doing Business 2019).

### 2.3 Descriptive statistics

The time and costs associated with the trade procedures vary depending on i.e .what region or level of income a country belongs to. Table 4 consists of information on the aggregated mean of 2016 and 2017 in our dataset as well as the interval of the time and cost of documentary and border compliance.

Table 4. Time and cost for documentary and border compliance.

Trade procedure	Mean	Minimum	Maximum
Time for documentary compliance	59	1 (Canada)	504 (Iraq)
Time for border compliance	67	0 (San Marino)	515 (Congo, Dem. Rep.)
Cost for documentary compliance (USD)	142	0 (Norway)	1800 (Iraq)
Cost for border compliance (USD)	445	0 (Hong Kong)	2223 (Congo, Dem. Rep.)

There is a substantial difference in the time and cost associated with the procedures of trade. For instance, the general time for obtaining, preparing and submitting documents when exporting a good from Canada takes 1 hour while it takes 21 days in Iraq.

Table 5 shows disaggregated data of four income levels and *time* taken for the procedures of trade. We see patterns of the correlation between income per capita and the efficiency in the exporting process.

Table 5. Time for documentary and border compliance in different income-level groups.

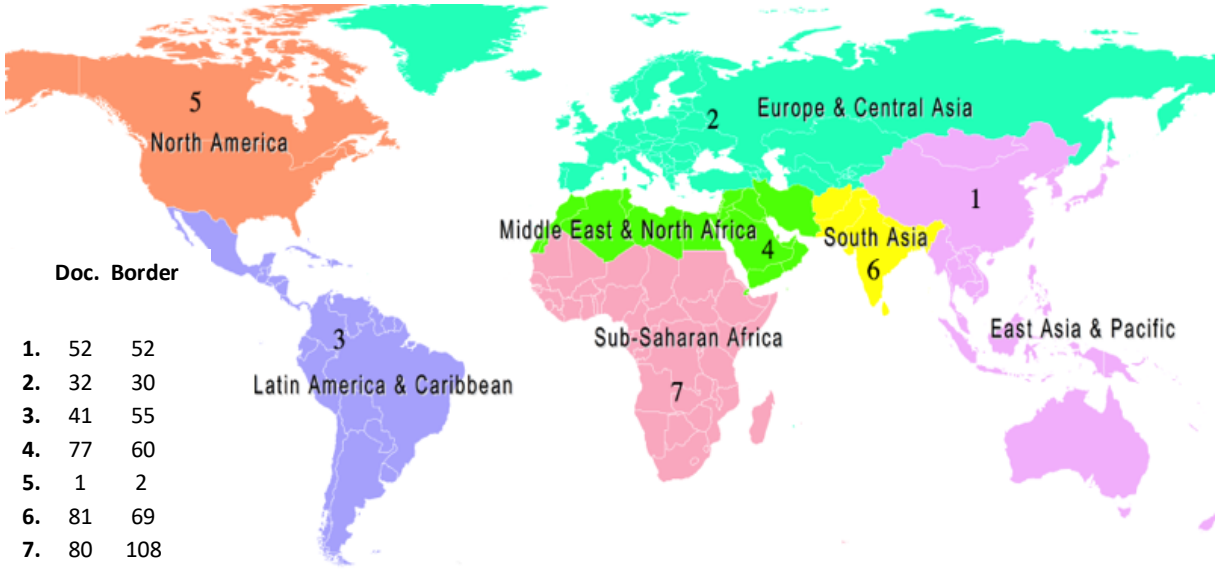
Indicator (Hours) \ Income level	High-income	Upper-middle income	Lower-middle income	Low-income
Documentary compliance	26	53	72	84
Border compliance	40	58	79	93

The correlation in our data between income level and time taken for the studied export procedures is negative<sup>2</sup>. The time for documentary compliance and border compliance is more than 3 and 2,3 times higher, respectively, in a general low-income country compared to a high-income country.

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<sup>2</sup> When doing a correlation matrix (pwcorr command) in Stata we find this correlation – Documentary compliance (-0,31) and border compliance (-0,29)

Table 6. Mean time for documentary and border procedures in different regions.



Note that the EU28 is excluded from the mean of region 2.

The map indicates a difference in the efficiency of the export procedures, depending on region. We see that the region having by far the shortest mean time for both procedures is North America, while Sub-Saharan Africa and South Asia are the least efficient. In comparison to table 5, showing the correlation between income level and time for documentary and border procedures, the distribution of the numbers connected to the map makes sense as it to a large extent correlates with the level of income of the regions (World Bank 2019).

What could be expected, and what is also indicated in the diagrams, is a correlation between documentary and border compliance. I.e. a country with relatively efficient border procedures probably have relatively efficient procedures for obtaining, preparing and submitting documents concerning trade as well. The correlation coefficient is 0,55 which indicates a moderate positive correlation between the trade procedures<sup>3</sup> (Buxton 2008).

The correlation between cost and time for documentary compliance and cost and time for border compliance is 0,67 and 0,65, respectively, which indicates a strong correlation between the time and cost indicators (Buxton 2008).

<sup>3</sup> The result comes from a correlation matrix (pwcorr command) in Stata.

## 2.4 Theoretical considerations: Are documentary requirements or delays at the border most important?

This section will first demonstrate how trade facilitation reduce trade costs and increase volumes of trade on the world market. This is followed by a description of why time for documentary and border compliance should be viewed as trade costs and how they could affect trade.

Hoekman and Shepherd (2013, 5-6) explain trade costs as a wedge between export and import prices. Inefficient trade procedures are an expense for companies. In order for companies to be able to overcome the cost of inefficient trading procedures, they have to set higher market prices. As a result, production and consumption decreases. By facilitating trade, trade costs are reduced and will therefore decrease the size of the wedge. This will increase the producers' surplus in the exporting country while the consumers' surplus increase in the importing country (Hoekman and Shepherd 2013, 5-6).

When trading, the import and export country wants to receive information about the concerned product. The information includes how the product has been produced, what characteristics it has, the value of the good and if it follows technical regulations. This information is important for several reasons. Primarily, for knowing which export tax rate or import tariff the product should have. Secondly, it is important to know if the product follows environmental and security standards and thirdly to prevent illegal products to cross the border (Person 2017, 297). Documentary compliance is the time and cost associated with preparing, obtaining and submitting documents demanded by authorities. The more complicated these procedures are, the harder for companies to follow the requirements. This is a indirect cost for companies as the employees need to spend time on working with the required documents instead of focusing on other duties. In some cases, even direct costs emerge from these procedures, as a company might need to hire a specialist for the administrative work or pay another company to do it for them (Doing Business 2015).

By facilitating documentary procedures, the burden of this procedure could decrease. E.g. it is not unusual that companies have to send in similar forms to different authorities and the information requested could be difficult to find. E.g. by implementing e-documents these procedures could become more efficient. (Persson 2017, 297-299).

Extensive border procedures lead to unnecessary delays at the border which bring indirect trade costs. When goods are stuck at the border, their value can decrease. Perishables, such as fruit could deteriorate, and other goods can either decrease in price or not be sold due to the delays. Furthermore, companies could need more space for stockholding. By streamlining the border procedures, e.g. by implementing IT-systems or by using risk management, trade can be boosted. Risk management is the concept of when

reliable companies can go through a fast track where only a random sample of the product is checked (Persson 2017, 297-299).

Examining to what extent documentary and border compliance impact trade is an empirical question. This is the reason why we investigate the relationship in our paper.

### 3. Previous research

Felipe and Kumar (2010) use a sample of 140 countries. They use data on bilateral trade flows from Gaulier et. al (2008) for the year 2005 on approximately 5000 products. Trade facilitation is measured with the World Bank's Logistics Performance Index (LPI). By analysing import and export procedures they find the relationship between trade facilitation and trade flows in Central Asia. The LPI is used as an index and also divided into seven separate indicators. Felipe and Kumar use a gravity model and run a sample selection estimation procedure to overcome the issue of trade flows taking the value zero. The results conclude that there is a significant increase in trade flows when improving trade facilitation in this area. They find that a 1% improvement in the exporting country's LPI is associated with a 5,5% increase in exports and a 1% improvement in the importing country's LPI increase imports by 2.8%. Further, the research demonstrates that the greatest increase in total trade come from improvements in infrastructure, followed by logistics and efficiency of border agencies.

Wilson, Mann and Otsuki (2003) investigate the relationship between trade facilitation and trade flows in the Asia-Pacific area. For their analysis they use data on trade flows among APEC member nations from 1989 to 2000 and trade facilitation data for a single year. These indicators are country-specific data for port efficiency, customs environment, regulatory environment and e-business usage. The data for these indicators is found in the Global Competitiveness Report, World Competitiveness Yearbook, Global Corruption Report and Clark et al (2002). When investigating the relationship between trade facilitation and trade flows a gravity model is used. Their results indicate that port efficiency, customs environment and e-business have a significant positive impact on trade flows. Port efficiency has the largest impact, where a 1% increase leads to a 4.2% increase in trade flows while regulatory barriers are found to hinder trade.

Iwanow and Kirkpatrick (2007) analyse the effect trade facilitation reforms can have on trade flows, using a 5-year panel data running from 2000 to 2004 for 78 countries. They operationalize trade facilitation as a weighted average of two perception-based indicators from the Global Competitiveness Report - hidden export barriers and irregular payments in exports and imports. They also create a trade facilitation index using the section *trading across borders* from World Bank's Doing Business database.

The database contains information on time and cost for importing and exporting goods as well as the amount of documents needed. The Heckman two-step procedure is used to deal with the sample selection bias that can occur due to observations taking the value zero in the gravity model. When estimating a gravity model they find that a 5 % improvement in trade facilitation is associated with a 5 % increase in exports.

The data from Doing Business database that Iwanow and Kirkpatrick (2007) use for their study is established in trade facilitation research and various reports have integrated these indicators in their work, some of which are presented below.

Martínez-Zarzoso and Márquez-Ramos (2007) evaluate the effect of trade facilitation on sectoral trade. They use a sample of 13 exporters and 167 importers. They use data on the time, costs and documents requested for the import and export procedures. They run these in the new and traditional gravity model using OLS and PPML. They find an increase of trade flows by 0,22% from a one-day reduction of time to export, while a one-day reduction of importing a good increases export by 0,83%.

Bourdet and Persson (2014) study how the export and import procedures on bilateral trade to EU from non-EU Mediterranean countries affect volumes of trade, as well as the diversification of traded products. They integrate the time to export and import indicators between 2006 and 2009 in a gravity model and use a fixed effects Poisson Pseudo-Maximum Likelihood estimator. Their results imply that a 1% increase in the efficiency of export procedures lead to a 0,56% increase in exports. An increase in the efficiency of import procedures lead to a 0,33% increase in exports. Furthermore, their results show an increase in export diversification by improving the efficiency of export or import procedures. In a previous study from 2013, where Persson studies trade facilitation in 130 developing countries, she concludes that a reduction of the export time has a positive impact on both homogeneous and differentiated goods.

Hoekman and Shepherd (2015) use a sample of 39 African countries, where they use firm-level data from World Bank's Enterprise Survey to investigate how the indicators time to export and import, impact the exports of differently sized firms. To do this, they use a computable general equilibrium model and estimate it with a PPML estimator. They find a positive relationship, no matter the size of firm, where a 10% decrease in the export time in average increase the export gain by 1,1%.

In a paper from 2010, Djankov, Freund and Pham, study trade facilitation with a sample of 146 countries. They use data on time to export in each country (2005), as well as signatures required to export and import, in order to control for endogeneity. They use a gravity model for their estimations. By adding a modified gravity model where country-specific characteristics are taken into consideration,

they control the robustness of their estimations. The results imply that every extra day needed to export lowers bilateral trade by at least 1% in average.

Fontagné, Orefice and Piermartini (2015) analyse the heterogeneous effect of facilitating trade on French exports. By computing the OECD trade facilitation indicators and Doing Business data into indexes, they study how import procedures affect French firms of different sizes. They conclude that facilitating trade have a positive effect on export values, as well as the intensive and extensive margin of trade.

Various authors have estimated and found the positive effect trade facilitation has on trade flows. The studies vary in their methods of measuring this relationship. The most commonly used model is the gravity model but it differs in its specification and estimation of the model. Previous studies have used World Bank's database on Doing Business and their section *trading across borders*. However, the current data from *trading across borders* is updated and have added indicators for the specific time and cost it takes for documentary compliance and border compliance. To our knowledge, none of the previous studies have used this data. Therefore, our study contributes to specify how the time and cost for documentary and border compliance impact trade flows. By doing this we investigate within which of these areas trade facilitation would be most useful.

## 4. Empirical strategy

### 4.1 The Gravity Model

The gravity model of trade, which is the basis of our thesis, was introduced In 1962 by a professor in economics named Jan Tinbergen. The model predicts bilateral trade flows to be proportional to the respective countries economic size and the distance between them, where economic mass is a positive determinant and distance a negative determinant (Chaney 2011, 2). In its original and multiplicative form the gravity model is as presented below:

$$X_{ij} = GS_i M_j \varphi_{ij}$$

$X_{ij}$  represents exports from Country  $i$  to Country  $j$ ,  $M_j$  the importer's demand.  $S_i$  represents the supply of the exporter.  $G$  is a general variable independent from  $i$  and  $j$  and  $\varphi_{ij}$  is the inverse of bilateral trade costs. The initial proxy used for representing the demand/supply of  $M_j/S_i$  are the respective countries GDP.  $G$  could for example be the level of world liberalization and a proxy used for  $\varphi_{ij}$  is bilateral distance between the respective countries (Bacchetta et al 2012, 104).



However, the traditional way of estimating bilateral trade flows with the gravity model is to take the natural logarithm of all variables of interest:

$$\ln X_{ij} = \ln G + \ln S_i + \ln M_j + \ln \varphi_{ij}$$

The advantage of using of the logarithmic model is the simplicity of estimating and interpreting the model that comes from it. In this shape, the model is possible to estimate with an Ordinary Least Squares (OLS) regression, which historically has been the most frequently used method for estimating the gravity model. Furthermore, the coefficients of the logged variables can be viewed as elasticities, which simplifies interpretation (Bacchetta et al 2012, 105).

The gravity model has proven to have big explanatory power in analysing international trade flows. However, since its introduction it has been criticized of being based on economic empiricism while lacking theoretical foundation (Disdier and Head 2008, 2). Originally, the criticism was motivated due to the lack of connection to established theories of reasons behind emergence of trade. However, various authors, beginning with Anderson (1979) and continuing with e.g. Bergstrand (1985) and Deardoff (1998) have established a theoretical framework for the model and incorporated it into already existing economic theory. This, together with its empirical success has increased the legitimacy of the gravity model and today it is often referred to as the workhorse for studying trade patterns (Yotov et al 2016, 5).

#### 4.2 Specification of The Gravity Model

In our attempt to analyse whether time for documentary and border compliance have a significant impact on exports from 155 countries to EU28, we define a gravity model. Imports to the EU28 is the dependent variable containing 6860 observations over a time interval of two years.

Our specification of the gravity model is as follows:

$$\begin{aligned} Imports_{ijt} = & \beta_1 + \beta_2 \ln DocComp_{jt} + \beta_3 \ln BordComp_{jt} + \beta_4 \ln GDP_{it} + \beta_5 \ln GDPpc_{it} + \beta_6 \ln GDP_{jt} + \\ & \beta_7 \ln GDPpc_{jt} + \beta_8 \ln Dist_{ij} + \beta_9 PTA_{ij} + \beta_{10} Border_{ij} + \beta_{11} Language_{ij} + \beta_{12} Colony_{ij} + \beta_{13} Landlocked_j + \\ & \beta_{14} \ln Remoteness_j + \beta_{15} \ln VoiAcc_{jt} + \beta_{16} Region_j + \tau_t + \lambda_j + \varepsilon_{ijt} \end{aligned}$$

In our study,  $Imports_{ijt}$  is the dependent variable. It covers imports to EU28 from 155 exporting countries between the years 2016 and 2017.

Our two main explanatory variables of interest are  $DocComp_{jt}$  (time for documentary compliance) and  $BordComp_{jt}$  (time for border compliance) for the exporting countries. Documentary compliance is the time needed to obtain, prepare and submit documents in the exporting process and border compliance is the time taken for customs clearance, inspections and port or border handling. We use the variables as proxies for trade facilitation and our expectation is that both have a negative impact on exports to the EU.

As proxies used to control for the importing and exporting countries demand and supply, our model consists of their respective GDP in US Dollars for both years ( $GDP_{it}$  and  $GDP_{jt}$ ). The logic behind this is that a larger economic mass of the importing country implies an increasing demand. In terms of the exporter a larger economic mass implies a bigger supply capacity. In regards to this our assumption is that both will have a positive effect on imports to the EU.

In addition, we integrate the importing and exporting countries GDP per capita ( $GDPpc_{it}$  and  $GDPpc_{jt}$ ). The GDP per capita variable for the importer and exporter country is supposed to represent economic development and the standard of essential infrastructure for trade which has proven to have an impact on supply and demand structures. According to Linder (1961, 94), similar countries in terms of GDP per capita tend to trade more as it implies similarities in consumers' taste. However, it is difficult to predict whether GDP per capita will have a positive or negative impact in our study.

To account for bilateral trade costs, we use data on distance between each country's largest business cities in our sample, which is the variable  $Dist_{ij}$ . It can be viewed as a variable cost of entering a market and has empirically, as Tinbergen stated in 1962, a negative relationship to trade. Hence, we expect the coefficient to be negative (Chaney 2011, 2).

Furthermore, we have included a dummy variable,  $PTA_{ijt}$ , taking the value 1 if the exporting country has a Preferential Trade Agreement (PTA) with the EU. In our model we bring different types of trade agreements together. This means that whatever the characteristics of the PTA, and no matter how far-reaching it is, the variable takes the value 1. This could be viewed as negative to the accuracy of the dummy variable. However, as we use the PTA dummy as a control variable rather than a variable of specific interest, we claim this not to be negative for the legitimacy of our study. As a PTA reduces the tariffs of exporting to the EU we expect the coefficient to take a positive value.

To capture similar geographical and cultural characteristics we use the dummy variable  $Border_{ij}$ ,  $Language_{ij}$  and  $Colony_{ij}$ . The first takes the value 1 if an exporting and importing country have a common border, the second if they have a same official language and the third if they have a common colonial history. The reason behind the use of a dummy for having a common border is that neighboring

countries probably have a greater understanding of each other's market and business environment as well easing temporary visits in the other country (Helliwell 1997, 175). Sharing an official language has a similar impact and also indicates cultural links implying similar consumption patterns in the countries. Using a dummy for a common colonial history is to capture the information costs of trade, which are expected to be lower due to the familiarity between the countries (Bacchetta et al. 2012, 106). All three dummies, capturing geographic and cultural similarities, are expected to have a positive impact on bilateral exports to the EU.

Furthermore, we use the dummy *Landlocked<sub>j</sub>*, which takes the value 1 if a country is entirely surrounded by land or only connected to a closed sea. Due to the need of exporting through transit economies and the higher costs of transport on land compared to the sea, exports to the EU are expected to be negatively affected if a country is landlocked (Warr 2019, 3).

The variable *VoiAcc<sub>it</sub>* stands for voice and accountability and is used as a proxy for how democratic a country is. The indicator captures the quality of democratic institutions, such as media independence, freedom of expression and association as well as the ability for citizens to participate in selecting the government. We expect the coefficient to be positive.

The standard gravity model has been criticized for solely capturing bilateral conditions between a country pair and can be argued to miss a lot of relevant information on each country's multilateral trade resistance which could lead to biased estimations. When estimating our model we take the exporters' multilateral trade resistance into consideration by creating a remoteness variable which takes a higher value the more remote a country is.

$$Remoteness_{it} = \sum_j Distance_{ij} / (GDP_{jt}/GDP_{wt})$$

The remoteness of country *i* is the sum of the bilateral distance to country *j* divided by country *j*'s share of world GDP. Constructing a remoteness index is not as accurate or theoretically robust as other methods of measuring multilateral trade resistance, e.g. the approach introduced by Anderson and Wincoop (2003). However, we claim that the complexity of using other methods and the fact that remoteness indexes have been used by various established authors such as Helliwell (1997) and Wolf (2000) justifies our decision to use it rather than the alternatives.

We also create 16 regional dummy variables taking the value 1 if an exporting country belongs to the specific region. These dummy variables are supposed to capture regional fixed effects of the exporters' that are not captured by the other variables included in the model.  $\tau_t$  is a year fixed effect and is included to account for specific characteristics of each year and  $\lambda_i$  is an importer fixed effect to capture the

unobserved heterogeneity between the importing EU-countries. The error term,  $\varepsilon_{ijt}$ , represents the sum of the deviations within the regression line.

### 4.3 Econometric strategy

Silva and Tenreyro (2006) conclude from a simulation study, comparing different estimators, the Poisson Pseudo-Maximum Likelihood Model (PPML) to be the most consistent and efficient estimator for studying trade flows due to its ability to handle common econometric problems. They argue the PPML has two main advantages compared to other estimators. First and foremost, the PPML can estimate the gravity model in its original multiplicative form, instead of in its log-linearized form. In our case this means that the observations with zero trade flows, which makes 14% of our observations, are not omitted. If these observations were omitted it could violate the results and lead to biased and inefficient estimates of the elasticities. Secondly, PPML has proven to be consistent in the presence of heteroskedasticity, i.e. when the error term is correlated with one or more of the independent variables. When doing a White's test we find our data to be heteroskedastic<sup>4</sup>. Using a PPML estimator on the gravity model in its multiplicative form therefore reduces the issue of bias and inconsistency when estimating the elasticities (Silva and Tenreyro 2006, 653).

However, we claim that the estimator proposed by Silva and Tenreyro is not ideal as they use cross-sectional data which aggravates controlling for heterogeneity in the data. This in turn can lead to biased estimates of the independent variables (Baier and Bergstrand 2007, 74). Instead we primarily use a panel based model, estimated with a fixed effects PPML, as advised by Wilhelmsson and Westerlund (2011). Using a PPML with fixed effects not only deals with the problem of heteroskedasticity, but also controls for heterogeneity between countries. Furthermore, we use robust standard errors. In presence of heteroskedasticity, they increase the accuracy of the standard errors as well as leading to a more accurate p-value of the independent variables (Williams 2015, 6-7).

To examine the suitability of using a fixed effects model, we run a Hausman test, which indicates that we should use fixed effects<sup>5</sup>. Hence, we use a time-invariant regional dummy variable to pick up unobserved heterogeneity between different regions (Wooldridge 2002, 328-329). We also use country-specific fixed effects for the importers as well as time fixed effects capturing unexplained differences in time. Finally, we create a remoteness index to control for multilateral resistance (Anderson 2011, 3). The fixed effects pick up the heterogeneity of the population in the sample. In our case the various

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<sup>4</sup> When doing a White's test in Stata we get the following results. P-value: 0,000, Chi2: 1267,30 → Reject the null hypothesis that the data is homoskedastic.

<sup>5</sup>When doing a Hausman test in Stata (command: hausman fe re) we get the following result: Chi2 = -35,62 → Reject the null hypothesis, use a fixed effects model.

exporting and importing countries have individual characteristics not picked up by the explanatory variables that impact the dependent variable. If not controlled for unobserved heterogeneity, it can lead to biased estimates of the parameters of the independent variables (Baier and Bergstrand 2007, 74).

An issue difficult to control for is endogeneity. It refers to when an independent variable correlates with the error term. This can cause endogeneity bias leading to inconsistent estimates of the parameters. The biggest problem of endogeneity is how to interpret the causal link between the explanatory and the dependent variable. This aggravates interpretation of the coefficients as it could be the case that larger exports to the EU has a negative impact on our main variables of interest, time for documentary and border compliance (Ullah et al 2018, 69). This is not an impossible link as countries involved in trade probably have incentives to facilitate trade procedures. To tackle the issue of endogeneity bias, various authors, e.g. Baier and Bergstrand (2007) and Egger et al. (2011) have integrated instrumental variables in their models. However, this strategy has proven to not be entirely convincing. Furthermore, identifying instrumental variables that are not correlated with the error term can be hard, especially when studying trade flows on an aggregate level as we do (Standaert & Rayp 2015, 2-4). Controlling for endogeneity in the data has proven to be difficult and the potential issue of it is something to have in mind when interpreting the coefficients of the independent variables.

In order to check for the robustness of our results we run the fixed effects PPML, first without export time for border compliance and then without documentary compliance. This controls for the correlation between these specific variables. Furthermore, we use an OLS estimator, both with and without fixed effects, on the gravity model in its log-linearized form. This facilitates the comparison to previous literature, as the OLS estimator traditionally has been the workhorse in research on international trade. We also use the fixed effects PPML estimator with cost for documentary and border compliance. Finally, we use the aggregated export time for documentary and border compliance.

#### 4.5 Data

The data on imports to the EU28 in 2016 and 2017 was gathered from World Integrated Trade Solution (WITS 2019). The GDP and GDP per capita data comes from World Bank, an established source for data and statistics on economic matters. The indicators for trade facilitation, documentary and border compliance are from the World Bank's Doing Business database and the section *trading across borders*, covering procedures of trade (World Bank 2019). The variable voice and accountability was also taken from the World Bank and is part of their World Governance Index containing six dimensions of governance (Worldwide Governance Indicators 2019).

The variables for distance, common language, common border, common colonial history and landlocked was found at Cepii (2019), a website providing data for the gravity model. The PTA dummy variable was manually created by information from the European Commission on EU's free trade agreements in practice as well as countries under the Generalized Scheme of Preferences (European Commission 2019). The Remoteness index was computed with the GDP data from World Bank and the data on bilateral distance from Cepii.<sup>6</sup>

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<sup>6</sup> For further information about the data - see appendix.

## 5. Empirical results

### 5.1 Baseline results – importer, region and year fixed effect PPML

Table 7. Regression Result: The impact of time for documentary and border compliance on the world's exports to the EU

Imports (Nominal USD)	Poisson (1)	Poisson (2)	Poisson (3)	OLS (4)	OLS (5)	OLS (6)
Doc. comp. hours (exporter)	-0.164*** (0.006)	-0.160** (0.010)		-0.302*** (0.000)	-0.274*** (0.000)	
Border comp. hours (exporter)	0.011 (0.782)		-0.072 (0.153)	0.075** (0.036)		-0.111** (0.038)
GDP (exporter)	0.847*** (0.000)	0.848*** (0.000)	0.836*** (0.000)	1.277*** (0.000)	1.279*** (0.000)	1.275*** (0.000)
GDP per capita (exporter)	-0.121* (0.060)	-0.120* (0.059)	-0.007 (0.902)	-0.232*** (0.002)	-0.228*** (0.003)	-0.157** (0.024)
GDP (importer)	-1.032 (0.452)	-1.032 (0.452)	-1.029 (0.456)	-3.030** (0.040)	-3.030** (0.040)	-3.313** (0.022)
GDP per capita (importer)	2.778** (0.035)	2.778** (0.035)	2.763** (0.037)	4.109*** (0.002)	4.120*** (0.002)	4.400*** (0.001)
Distance	-0.265* (0.062)	-0.263* (0.061)	-0.308** (0.025)	0.152 (0.563)	0.169 (0.513)	0.143 (0.586)
PTA with the EU	0.176** (0.038)	0.174** (0.049)	0.212** (0.021)	-0.089 (0.568)	-0.088 (0.573)	-0.129 (0.402)
Common border	1.254*** (0.000)	1.253*** (0.000)	1.243*** (0.000)	2.369*** (0.000)	2.353*** (0.000)	2.320*** (0.000)
Common official language	0.322* (0.100)	0.321 (0.100)	0.312 (0.115)	1.154*** (0.000)	1.149*** (0.000)	1.165*** (0.000)
Common colonial history	0.425** (0.015)	0.425** (0.015)	0.424** (0.018)	0.830*** (0.001)	0.840*** (0.001)	0.839*** (0.001)
Landlocked (exporter)	-0.691*** (0.004)	-0.698*** (0.004)	-0.731*** (0.003)	-0.985*** (0.000)	-1.000*** (0.000)	-0.961*** (0.000)
Voice and accountability	-1.658*** (0.000)	-1.654*** (0.000)	-1.344*** (0.000)	1.715*** (0.000)	1.723*** (0.000)	2.262*** (0.000)
Observations	8680	8680	8680	7524	7524	7524
Importer fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Remoteness (exporter)	Yes	Yes	Yes	Yes	Yes	Yes

*P-value in parenthesis. \*\*\* Symbolize 1% significance level,  
\*\* 5% significance level and \* 10% significance level.*

The baseline model found under (1) in table 7 is an importer, region and year fixed effects PPML. The results will be used to analyse how the time for documentary and border compliance affect the world's export to the EU. The estimated coefficient of time for documentary compliance is negative at a 1% significance level. This confirms our theoretical prediction that the procedure has a negative effect on exported volumes. The value of the coefficient is -0.164, meaning that a 1% decrease in time for documentary compliance would lead to a 0.164% increase in the world's export to the EU. The variable time for border compliance is insignificant.

The exporters' GDP has a 1% significance level and a positive coefficient, which is in line with our theoretical predictions. Furthermore, the variable for sharing a border has a 1% significance level and a positive coefficient, which is also in line with our expectations. The coefficient for having a common colonial history is positive at a 5% significance level, which confirms our predictions. The coefficient for sharing an official language is positive at a 10% significance level, which is also in line with our theoretical predictions. The estimated coefficient for having a PTA with EU is positive at a 5% significance level, which we expected. The coefficient for bilateral distance is negative at a 10% significance level. This confirms our predictions that the further apart two countries are the less they trade on average. The coefficient for a country being landlocked is negative at a 1% level of significance, which confirms our expectations.

The importers' GDP has no significance. Furthermore, the coefficient for the importers' GDP per capita is positive with a significance level of 5%, which confirms our predictions. The coefficient for the exporters' GDP per capita is negative at a 10% significance level. This is not in line with our theoretical predictions. The negative coefficient could e.g. be due to changes in productions patterns. However, the weak significance level makes the relationship difficult to analyse.

The estimated coefficient for voice and accountability is negative at a 1% significance level. The negative sign is not expected, as it implies that countries with more powerful democratic institutions trade less. When running the same regression but with samples for only 2016 or 2017, the results are similar which strengthens our results in regression (1)<sup>7</sup>.

Regression (2) and (3), found in table 7 are estimated using the same regression model as in (1). However, (2) includes the variable for documentary compliance but not border compliance while the opposite applies for (3). Regression (2) and (3) are included to investigate if the correlation between our main variables of interest could impact the estimates. The estimated coefficients in (2) and (3) are similar to (1) which strengthen our results. Furthermore, it indicates that the correlation between documentary and border compliance does not violate regression (1).

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<sup>7</sup> See appendix for the regressions with one year samples.



## 5.2 Robustness analysis

### 5.2.1 Robustness test 1: Importer, region and year fixed effects OLS

In table 7, under column (4), (5) and (6) we have importer, region and year fixed effects OLS regressions. Regression (4) includes both the variable of time for documentary and border compliance while regression (5) has dropped border compliance and (6) documentary compliance. The estimated effect of the time for documentary compliance in (4) and (5) are in line with the results in (1),<sup>8</sup> which strengthens our baseline result. Time for border compliance has a positive coefficient and is significant at a 5% level in (4). This is not in line with theoretical predictions as it implies that the longer border procedures, the higher trade flows. However, in column (6) the estimated coefficient for border compliance is negative at a 5% significance level. This indicates that the correlation between the variables documentary and border compliance affect the results in equation (4).

Most of the coefficients in (4), (5) and (6) are in line with our baseline result. However, the coefficients for distance and sharing a border are insignificant. The coefficient for the importers' GDP is negative at a 5% level, which is not in line with our predictions. The importer fixed effects could be an explanation to the negative coefficient. The coefficient for voice and accountability is positive and significant at a 1% level. This differs from our result in (1). We have no explanation for the switching signs other than it has to do with the method of estimation.

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<sup>8</sup> In the robustness test section we compare the coefficients in each robustness test with the baseline result. We mention if they become significant, insignificant or if they are significant and switch sign. We do not mention if a variable increase or decrease in significance level. If the reader wants to see that we refer to the table with the regression of interest.

## 5.2.2 Robustness test 2: Year fixed effects OLS.

Table 8. Regression Results: Continued

Imports (Nominal USD)	OLS	OLS
	(7)	(8)
Doc. comp. hours (exporter)	-0.329*** (0.000)	
Border comp. hours (exporter)	-0.016 (0.687)	
Doc+bord comp. hours (exporter)		-0.334*** (0.000)
GDP (exporter)	1.281*** (0.000)	1.285*** (0.000)
GDP pc (exporter)	-0.139*** (0.000)	-0.088** (0.012)
GDP (importer)	1.353*** (0.000)	1.352*** (0.000)
GDP pc (importer)	-0.526*** (0.000)	-0.527*** (0.000)
Distance	-0.730*** (0.000)	-0.713*** (0.000)
PTA with the EU	-0.106 (0.246)	-0.056 (0.541)
Common border	2.762*** (0.000)	2.705*** (0.000)
Common official language	0.908*** (0.000)	0.916*** (0.000)
Common colonial history	0.978*** (0.000)	0.977*** (0.000)
Landlocked (exporter)	-0.913*** (0.000)	-0.931*** (0.000)
Observations	7524	7524
Importer fixed effects	No	No
Regional fixed effects	No	No
Year fixed effects	Yes	Yes
Remoteness (exporter)	No	No

*P-value in parenthesis. \*\*\* Symbolize 1% significance level, \*\* 5% significance level and \* 10% significance level.*

Estimation (7), found in table 8, is estimated using a year fixed effects OLS. The results are in line with equation (1), which strengthens our baseline result. However, the importers' GDP is different from (1) as it has a positive coefficient at a 1% level of significance. Furthermore, having a PTA with the EU is

insignificant and the coefficient for the importers' GDP per capita has a negative coefficient at a 1% significance level.

### 5.2.3 Robustness test 3: The total export hours for documentary and border compliance – year fixed effect OLS

Estimation (8), found in table 8, is estimated using a year fixed effects OLS. Here we use the combined hours for documentary and border compliance. The variable is significant at a 1% level, with a negative coefficient of -0.334. This implies that a 1% decrease in time for documentary and border compliance would lead to a 0.334% increase in exports. The estimations are similar to regression (1). Exceptions are the importers' GDP, the importers' GDP per capita and having a PTA with EU. They differ from (1) in a similar way as they do in regression (7). This is explained in robustness test 2.

## 5.2.4 Robustness test 4: Documentary and border costs to export – importer, region and year fixed effect PPML

Table 9. Regression Results: Continued

Imports (Nominal USD)	Poisson (9)	Poisson (10)	Poisson (11)
Doc. comp. cost (exporter)	-0.136** (0.024)	-0.109** (0.037)	
Border comp. cost (exporter)	0.094 (0.114)		0.044 (0.329)
GDP (exporter)	0.813*** (0.000)	0.839*** (0.000)	0.810*** (0.000)
GDP pc (exporter)	-0.058 (0.371)	-0.056 (0.392)	0.010 (0.865)
GDP (importer)	-1.035 (0.452)	-1.033 (0.453)	-1.030 (0.455)
GDP pc (importer)	2.771** (0.036)	2.769** (0.036)	2.764** (0.037)
Distance	-0.322** (0.014)	-0.320** (0.015)	-0.338** (0.011)
PTA with the EU	0.127 (0.169)	0.137 (0.141)	0.243** (0.010)
Common border	1.302*** (0.000)	1.292*** (0.000)	1.250*** (0.000)
Common official language	0.361* (0.071)	0.353* (0.080)	0.312 (0.107)
Common colonial history	0.410** (0.021)	0.406** (0.024)	0.432** (0.016)
Landlocked (exporter)	-0.327 (0.150)	-0.387 (0.102)	-0.686*** (0.007)
Voice and accountability	-1.173*** (0.000)	-1.257*** (0.000)	-1.277*** (0.000)
Observations	8680	8680	8680
Importer fixed effects	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Remoteness (exporter)	Yes	Yes	Yes

*P-value in parenthesis. \*\*\* Symbolize 1% significance level, \*\* 5% significance level and \* 10% significance level.*

This test is estimated using an importer, region and year fixed effect PPML (9) (same as estimation (1)) and is found in table 9. We use the cost, instead of time, for documentary and border compliance. The cost for documentary compliance is significant at a 5% level and the cost for border compliance is insignificant, which strengthens our baseline result. Most of the coefficients are also in line with regression (1). However, exporters' GDP per capita, having a PTA with EU and being landlocked are all insignificant.

Regression (10) and (11) are estimated the same way as (9), but without cost for border compliance in (10) and documentary compliance in (11). The results are similar. However, (11) has a positive coefficient for having a PTA with the EU at a 5% significance level. Furthermore, the coefficient for being landlocked is negative at a 1% significance level while the coefficient for having a common official language is insignificant.

### 5.3 The baseline result tested on countries different income levels.

Table 10. Regression Results: Disaggregated

Imports (Nominal USD)	Poisson (12)	Poisson (13)	Poisson (14)
Doc. comp. high income	-0.175** (0.012)	-0.153** (0.025)	
Doc. comp. upper-middle income	-0.001 (0.986)	-0.083 (0.138)	
Doc. comp. lower-middle income	-0.295*** (0.000)	-0.234*** (0.000)	
Doc. comp. low income	-0.106 (0.282)	-0.360*** (0.000)	
Border comp. high income	-0.033 (0.612)		-0.107* (0.070)
Border comp. upper-middle income	-0.129* (0.094)		-0.023 (0.603)
Border comp. lower-middle income	0.004 (0.960)		-0.164*** (0.000)
Border comp. low income	-0.301*** (0.004)		-0.253*** (0.000)
GDP (exporter)	0.854*** (0.000)	0.839*** (0.000)	0.827*** (0.000)
GDP pc (exporter)	-0.209** (0.028)	-0.189** (0.018)	-0.057 (0.540)
GDP (importer)	-1.046 (0.444)	-1.044 (0.445)	-1.036 (0.451)
GDP pc (importer)	2.787** (0.033)	2.784** (0.033)	2.760** (0.036)
Distance	-0.153 (0.250)	-0.164 (0.208)	-0.180 (0.177)
PTA with the EU	0.295*** (0.000)	0.299*** (0.000)	0.321*** (0.001)
Common border	1.261*** (0.000)	1.255*** (0.000)	1.237*** (0.000)
Common official language	0.285 (0.161)	0.295 (0.132)	0.302 (0.127)
Common colonial history	0.448** (0.016)	0.445** (0.016)	0.436** (0.018)
Landlocked (exporter)	-0.636** (0.011)	-0.602** (0.018)	-0.669*** (0.009)
Voice and accountability	-1.301*** (0.000)	-1.243*** (0.000)	-0.927*** (0.000)
Observations	8680	8680	8680
Importer fixed effects	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Remoteness (exporter)	Yes	Yes	Yes

*P-value in parenthesis. \*\*\* Symbolize 1% significance level, \*\* 5% significance level and \* 10% significance level.*

Estimation (12), which is found in table 10, is estimated using an importer, region and year fixed effects PPML (same as estimation (1)). Here the export countries are divided into four groups – *high, upper-middle, lower-middle and low-income countries*.

The time for documentary compliance for high-income countries has a coefficient of -0.175 at a 5% significance level, implying that a 1% decrease is associated with a 0,175% increase in exports. The coefficient of time for documentary compliance in lower middle-income countries is significant on a 1% level and has the coefficient -0.295. This means that a 1% reduction in time for documentary compliance would increase lower middle-income countries exports to the EU with 0.295%.

The time for border compliance in upper middle-income countries has the coefficient -0,129 at a 10% level of significance. This implies that a 1% reduction in hours for border compliance would increase exports with 0.129%. The coefficient time for border compliance in low-income countries is -0,301 at a 1% level of significance. This means that a 1% reduction in export hours for border compliance is associated with a 0,301% increase in exports.

Regression (13) is estimated without the variable time for border compliance. Here, the income-groups being significant negatively affected by time for documentary compliance are high, lower middle and low-income countries. The time for documentary compliance for low-income countries is significant at a 1% level, compared to insignificant in (12). Regression (14) has instead omitted the variable time for documentary compliance. The income groups being significant negatively affected by time for border compliance are high, lower-middle and low-income groups. What differs from estimation (12) is 1) The time for border compliance is negatively significant for high-income and lower-middle income countries in (14). 2) The time for border compliance is negatively significant for the upper-middle income group in (12), but not in (14). The different results, depending on if both or only one variable is included in the regression, could be due to the correlation between them. Regression (13) and (14) are found in table 10.

## 6. Simulation

In order to get an idea of the potential gains from facilitating trade we use the estimated coefficients in regression (1) and (12). These are our baseline regressions and the estimations we find most convincing. The numbers in table 11 are the estimated percentage increase in exports to the EU. They represent the average increase in exports for a country in an income group if it would adapt to best practice, i.e. reduce the time for trade procedures to the level of the best performing country, in the specific income group.

Table 11. Potential increase in exports from adapting to best practice.

Indicator \ Income level	All (1)	High (12)	Upper-mid (12)	Lower-mid (12)	Low (12)
Time for documentary compliance (Mean)	59	26	53	72	84
Time for doc. compliance (Best practice)	1	1	2	2	11
Time for border compliance (Mean)	67	40	58	79	93
Time for border compliance (Best practice)	0	0	4	3	28
Time for documentary compliance	16,12%	16,8%	Insignificant	28,7%	Insignificant
Time for border compliance	Insignificant	Insignificant	12%	Insignificant	21,1%

These numbers should be carefully interpreted and cannot be viewed as the actual effects of trade facilitation and cannot be viewed as general equilibrium results (Bourdet and Persson 2014). However, they give an idea of the potential benefits from facilitating documentary and border procedures. The numbers imply that if a country would decrease time for documentary compliance from the mean to best practice of the world, it would boost exports to the EU by 16,12%. Furthermore, e.g. if a lower-middle income country would decrease the time for border compliance from the mean to best practice in the income group, the average increase in exports would be 28,7%.

## 7. Summary and conclusion

In this study we look at the effects of trade facilitation on exports to the EU28 for 155 exporting countries. We examine how the variables time for documentary compliance and time for border compliance impact exports to the EU. Furthermore, we look at if the relationship is linear, no matter how economically developed a country is, by ordering the sample into four income groups.

Our study contributes to the field of trade facilitation as we proceed from previous research but also examine new indicators of relevance. By following previous works as Hoekman and Shepherd (2015) and Bourdet and Persson (2014), using data from Doing Business, we investigate the potential impact of trade facilitation. However, we go further by using the new disaggregated data on time to export and by including two separate variables, *time for documentary compliance* and *time for border compliance*.



Hence, we are able to present more detailed information on how different areas of trade facilitation could affect trade flows.

We answer our question on how the efficiency of documentary and border procedures impact exports by using a fixed effects PPML (1) estimator on a gravity model. Our baseline result find that a 1% decrease in time for documentary compliance would increase exports by 0,164%, while no such relationship could be found between border compliance and exports. This indicates that documentary procedures has a more robust relationship to levels of exports. However, when estimating with four income per capita groups, we find the relationship between the trade facilitation variables and volume of exports not to be linear. This implies that the suitable area of reform depends on how economically developed a country is. For instance, low and upper-middle income countries seem to have more to gain by improving border procedures while high and lower-middle income economies would benefit more from streamlining documentary procedures.

The results provided in our report could be of great benefit for policymakers when determining what areas to reform. Due to the fact that facilitating trade also comes with costs, there is of substantial importance to carry out the right reforms. We claim this thesis to be of help in the decision-making process. However, it is important to be aware that the results, although passing our robustness tests, can have errors violating the estimated elasticities. For instance, using a remoteness index as a way of measuring multilateral resistance is not ideal (Anderson and Wincoop 2003). Furthermore, the lack of data on our variables of trade facilitation limits the amount of observations in our study. Therefore, we hope that other authors proceed from here and continue the research on the specific impact of documentary and border procedures that we have initiated. As more data will be published on these disaggregated trade procedures, the opportunity to measure the impact of these trade procedures will increase. The fact that most WTO countries have ratified the trade facilitation agreement that came into force in 2017 is a proof of the worldwide will to improve. However, this must be accompanied with knowledge on what areas to put specific focus on. We believe our study will be of help in doing that, and we hope others will follow.

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## 9. Appendix

### A1. Variables and data sources

Variable	Definition and Data Source
Imports	Imports in nominal USD. Data source: World Integrated Trade Solution (2019)
Documentary compliance (hours)	Hours for a firm to cope with all the paperwork associated with the product being exported. Data source: World Bank's Doing Business database (2019)
Border compliance (hours)	Hours for a firm to cope with all the border procedures for the product being exported. Data source: World Bank's Doing Business database (2019)
Documentary compliance (cost)	Cost for a firm to cope with all the paperwork associated with the exported good. Data source: World Bank's Doing Business database (2019)
Border compliance (cost)	Cost for a firm to cope with all the border procedures for the exported good. World Bank's Doing Business database (2019)
GDP importer/exporter	Data source: World Bank (2019)
GDP per capita importer/exporter	Data source: World Bank (2019)
Distance	Bilateral distance in km between the two largest business cities of the respective countries. Data source: CEPII (2019)
PTA with the EU	Dummy variable taking the value 1 if a country has a PTA with the EU. Computed by the authors by using information from European Commission (2019)
Common Border	Dummy variable taking the value 1 if countries have a common border. Data source: CEPII (2019)
Common official language	Dummy variable taking the value 1 if two countries have a common official language. Data source: CEPII (2019)
Common colonial history	Dummy variable taking the value 1 if countries have a common colonial history. Data source: CEPII (2019)
Landlocked	Dummy variable taking the value 1 if a country is landlocked. Data source: CEPII (2019)
Voice and Accountability	An index on the quality of a country's democratic institutions, such as independence of the media and freedom of expression. Data Source: World Bank(2019)
Remoteness	Calculated using GDP data from World Bank (2019) and distance data from CEPII (2019)

## A2. Exporting and importing countries

Exporting countries		Importing countries	
Afghanistan	Grenada	Norway	Austria
Albania	Guatemala	Oman	Belgium
Algeria	Guinea	Pakistan	Bulgaria
Angola	Guinea-Bissau	Palau	Croatia
Antigua and Barbuda	Guyana	Panama	Cyprus
Argentina	Haiti	Papua New Guinea	Czech Republic
Armenia	Honduras	Paraguay	Denmark
Australia	Hong Kong SAR, China	Peru	Estonia
Azerbaijan	Iceland	Philippines	Finland
Bahamas, The	India	Qatar	France
Bahrain	Indonesia	Russia	Germany
Bangladesh	Iran, Islamic Rep.	Rwanda	Greece
Barbados	Iraq	Samoa	Hungary
Belarus	Israel	San Marino	Ireland
Belize	Jamaica	Sao Tome and Principe	Italy
Benin	Japan	Saudi Arabia	Latvia
Bhutan	Jordan	Senegal	Lithuania
Bolivia	Kazakhstan	Serbia	Luxembourg
Bosnia and Herzegovina	Kenya	Seychelles	Malta
Botswana	Kiribati	Sierra Leone	Netherlands
Brazil	Korea, Rep.	Singapore	Poland
Brunei Darussalam	Kosovo	Solomon Islands	Portugal
Burkina Faso	Kuwait	Somalia	Romania
Burundi	Kyrgyz Republic	South Africa	Slovakia
Cabo Verde	Lao PDR	Sri Lanka	Slovenia
Cambodia	Lebanon	St. Kitts and Nevis	Spain
Cameroon	Lesotho	St. Lucia	Sweden
Canada	Liberia	St. Vincent and the Grenadines	United Kingdom
Central African Rep.	Libya	Sudan	
Chad	Macedonia, FYR	Suriname	
Chile	Madagascar	Switzerland	
China	Malawi	Tajikistan	
Colombia	Malaysia	Tanzania	
Comoros	Maldives	Thailand	
Congo, Dem. Rep.	Mali	Timor-Leste	
Congo, Rep.	Marshall Islands	Togo	
Costa Rica	Mauritania	Tonga	
Cote d'Ivoire	Mauritius	Trinidad and Tobago	
Djibouti	Mexico	Tunisia	
Dominica	Micronesia, Fed. Sts.	Turkey	
Dominican Republic	Moldova	Uganda	
Ecuador	Mongolia	Ukraine	
Egypt, Arab Rep.	Montenegro	United Arab Emirates	
El Salvador	Morocco	United States	
Equatorial Guinea	Mozambique	Uruguay	
Eswatini	Myanmar	Uzbekistan	
Ethiopia	Namibia	Vanuatu	
Fiji	Nepal	Vietnam	
Gabon	New Zealand	West Bank and Gaza	
Gambia, The	Nicaragua	Zambia	
Georgia	Niger	Zimbabwe	
Ghana	Nigeria		

### A3. Regression results for 2016 and 2017 separately

<b>Imports (Nominal USD)</b>	<b>2016</b>	<b>2017</b>
Doc. comp. hours (exporter)	-0.166*** (0.001)	-0.143*** (0.007)
Border comp. hours (exporter)	-0.020 (0.769)	0.027 (0.665)
GDP (exporter)	0.867*** (0.000)	0.842*** (0.000)
GDP pc (exporter)	-0.165* (0.066)	-0.054 (0.553)
GDP (importer)	0.809*** (0.000)	0.806*** (0.000)
GDP pc (importer)	0.191 (0.110)	0.140 (0.271)
Distance	-0.237 (0.124)	-0.369*** (0.009)
PTA with the EU	0.156 (0.257)	0.223 (0.133)
Common border	0.807*** (0.004)	0.970*** (0.000)
Common official language	0.346** (0.027)	0.404*** (0.003)
Common colonial history	0.340** (0.029)	0.281** (0.042)
Landlocked (exporter)	-0.483 (0.147)	-0.726*** (0.009)
Voice and accountability	-1.552*** (0.000)	-1.707*** (0.000)
Observations	4340	4340
Importer fixed effects	No	No
Regional fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Remoteness (exporter)	Yes	Yes

*P-value in parenthesis. \*\*\* Symbolize 1% significance level,  
\*\* 5% significance level and \* 10% significance level.*



