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Integrating the African market without trade facilitation – Tariffying?

by

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Abstract

A new trade agreement, the African Continental Free Trade Area, was signed in 2018 and will unite the African nations into one trade union. The agreement seeks to integrate the African markets in several ways, with two objectives being to reduce tariffs with 90 percent and improve the level of trade facilitation within the continent. This paper investigates whether tariffs or trade procedures represent the highest barriers to trade in the context of intra-African trade. This is achieved by using a model based on a gravity framework which allows for the estimation of Ad Valorem equivalents of trade facilitation, comparable to tariffs. The results of the study indicate that the effect of a change in time to import on average will have a significant effect on the unit value of intra-African traded goods. Further, the results suggest that there is no significant difference in the effect between different product categories. When comparing trade facilitation Ad Valorem tariff equivalents calculated from the model to applied tariff levels it was found that the reduction of tariffs would remove a greater barrier than improvements in trade facilitation.

Keywords: *Ad valorem equivalent, AfCFTA, Intra-African Trade, Trade Facilitation*

Abbreviations and Acronyms

AfCFTA = African Continental Free Trade Area

AVE = Ad Valorem tariff Equivalent

DB = Doing Business Indicators

CEPII = Centre d'Études Prospectives et d'Informations Internationales

CGE = Computable General Equilibrium

ETI = Enabling trade index

GATF = Global Alliance for Trade Facilitation

GDP = Gross domestic product

HS = Harmonized Systems

IMF = International Monetary Fund

LDC = Least Developed Countries

LPI = Logistics Performance Index

NTM = Non-tariff measures

OECD = Organization for Economic Cooperation and Development

OLS = Ordinary Least Square

RTA = Regional Trade Agreement

TFI = OECDs Trade Facilitation Indicators

UN = United Nations

UNCTAD = United Nations Conference on Trade and Development

UNECE = United Nations Economic Commission for Europe

UNECA = United Nations Economic Commission for Africa

WEF = World Economic Forum

WTO = World Trade Organization

Table of contents

List of Figures

List of Tables

1. Introduction

Through technological advancements and increased international cooperation, trade costs have decreased in the last few years (WTO, 2015). The WTO named trade costs one of the primary factors to shape the future evolution of trade and since then, policymakers and researchers have searched for different ways to reduce it (WTO, 2015). One example is the concept of trade facilitation, which has become somewhat of a buzzword within trade organizations such as the WTO. Trade facilitation is discussed as the next concept to stimulate trade when further lowering tariffs is not an option, especially in multilateral agreements (WTO, 2015). Trade facilitation is a concept defined by many, but in its essence, it refers to the simplification, modernization and harmonization of trade procedures (WTO, 2015). One of the main advantages of trade facilitation is that it not only benefits the country that implements it, but also its trading partners and potential future trading partners (WTO, 2015). The implementing country can expect a lower price on the goods they import, while its partners receive a higher price on their export goods as well as creating possibilities for new trading routes, to name some benefits (WTO, 2015). This is especially beneficial for the least developed countries in the world, where the trade costs are the highest and therefore stands to gain the most if they were to be lowered (WTO, 2015).

Africa is a continent that has been largely overlooked in international trade since most African countries are small developing economies which mainly exports raw materials or intermediate merchandise (Verter, 2017). However, after the WTO's Doha development agenda, the focus rapidly shifted towards how developing countries could be included and engaged in international trade (WTO, 2015). The WTO ratified the Trade Facilitation Agreement, which covers several trade facilitation measures that should be implemented by all WTO members (WTO, 2015). However, developing countries have flexibility in the implementation where they can demand technical support or other aid if they are unable to implement the measures themselves (WTO, 2015). African countries are seeking even deeper integration to boost economic growth and a new trade agreement has been ratified, namely the African Continental Free Trade Agreement (AfCFTA) (Abrego, et al, 2019). This seeks to improve economic cooperation in several ways, and regarding intra-African trade, it aims to eliminate both tariffs and non-tariff barriers (Abrego, et al, 2019). Nevertheless, with limited time and resources, every policy option cannot

be done immediately which raises questions of what effect these improvements will have on intra-African trade, what policy change that are most effective and which one that should be the highest priority to implement. The research question this paper seeks to address is therefore the following:

> "Do tariffs or trade procedures represent the highest barriers to trade in the context of intra-African trade?"

Poor trade facilitation constitutes a trade cost, which may have a similar effect on the economy as a tariff (Cadot, Gourdon & van Tongeren, 2018). To quantify the effect that these trade costs have, it is therefore useful to transform it into Ad valorem tariff equivalents (AVEs). This allows for a comparison of policy changes against applied tariffs and a comparison between policy decisions.

The methodology used in this paper is based on a model presented by Cadot, Gourdon and van Tongeren (2018). The model is based on a gravity framework, explaining the effect non-tariff barriers have on the unit value of traded goods by estimating a log-linear model with additional variables. These effects can then be translated into AVEs and compared to applied tariffs. The model is adapted to fit the question posed in this paper, hence instead of focusing on all non-tariff barriers, the original model is narrowed down to concentrate on the effect trade facilitation has on the unit value of traded goods. To the authors' knowledge, no previous study has estimated AVEs of trade facilitation and compared them to applied tariffs.

The contribution of this paper is to investigate the barriers to trade that poor trade facilitation constitutes on the unit value of intra-African traded goods and compare this to applied tariffs. An earlier study by Cadot, Gourdon and van Tongeren (2018) has calculated AVEs of non-tariff measures (NTMs) using a global sample, which indicated that NTMs constitute significant barriers to trade. However, since the AfCFTA aims to eliminate 90 percent of the tariffs within the free trade area (FTA) and improve trade facilitation, it is interesting to investigate whether trade facilitation solely has greater effects on trade in terms of goods prices (IMF, 2019). If so, that would be an implication for policymakers that implementing trade facilitation measures

should be of a higher priority, even though tariff reductions are beneficial for the trading environment as well. The results in this paper indicate that trade facilitation has a significant effect on the unit value of imported goods in Africa, but that the reduction of tariffs removes a larger barrier than improvements in trade facilitation.

The paper is structured in the following way. In chapter 2, a brief background on Intra-African trade, trade facilitation in Africa and the AfCFTA is provided for context. Chapter 3 explains the concept of trade facilitation in depth and introduces descriptive statistics to give an understanding of the current situation of trade facilitation in Africa. Chapter 4 reviews previous research, focusing on research that has concluded results that are comparable to this study, as well as studies that come up with interesting results regarding trade facilitation in Africa. In chapter 5 the original modeling framework of estimating AVEs of non-tariff barriers is presented as well as the authors´ adapted model which is used to reach the results in this paper. The results are then presented in chapter 6. The final chapter provides the reader with a summary of the paper.

2. Background

2.1 Introduction to Intra-African trade[1]

Gardiner and Busufami Dickson (2019) describe that most of the Intra-African trade today consists of consumables such as tobacco, sugar, meat, food and drinks, however, the authors also mention that industrialization in many African countries has led to an increase in trade with manufactures. Songwe (2019) states that the most advanced and complex exports are usually performed by southern African economies. The United Nations Economic Commission for Africa (UNECA) has shown that when African countries trade intra-continental with each other, they can exchange more manufactured goods and are able to create more value while at the same time being able to transfer knowledge between the countries (Songwe, 2019).

The Intra-African trade is not problem-free, Gardiner and Busufami Dickson (2019) state that a lack of relevant statistics and data, high levels of smuggling and corruption and unrecorded border activity lead to an underestimation of the amount of Intra-African trade. Another challenge with Intra-African trade has been that trade has remained concentrated to areas with shared currencies and trade areas originating from colonial history, leading to an inefficient and handicapped trade between African countries (Gardiner & Busufami Dickson, 2019). These trade patterns originating from colonial history is further supported by Abrego et al. (2019).

The intra-African export levels as a percentage of the total exports from African countries has increased from 10 to 17 percent between 1995 and 2017 (Songwe, 2019). Although the positive development, the share of intra-continental trade in Africa remains small in relation to levels in other parts of the world (Songwe, 2019). According to Songwe (2019), these stipulate important factors and reasons to believe that increased trade will be a key factor of growth and development in Africa.

[1] 27 out of 54 countries, representing 44,6 percent of the African population are low-income countries (World Bank, 2019b). Furthermore, the African continent inhabits 16 percent of the world population but only 5 percent of the world income (Abrego et al., 2019).

2.2 African Continental Free Trade Area (AfCFTA)

In 2018, after many years of discussion, the nations of the African continent signed a deal that will create the biggest trade bloc since the WTO was created in 1994 (Balima, 2019). The deal is called the *"African Continental Free Trade Area (AfCFTA)"* and the free-trade zone will unite 1.3 billion people into the same market worth about 3.4 trillion USD (Balima, 2019). The expected value of the new single market varies and while Balima (2019) suggests a worth of 3.4 trillion USD, Mukeredzi (2019) states that the new bloc can have an expected united value of over 4 trillion USD. Even though the expected value and output of the new deal varies, there is no doubt or ambiguity around the huge potential of a successful implementation of the AfCFTA.

The President of Egypt and chairman of the African Union, Abdel Fattah al-Sisi, said the following after a ceremony under 2019:

> "The eyes of the world are turned towards Africa…The success of the AfCFTA will be the real test to achieve the economic growth that will turn our people's dream of welfare and quality of life into a reality" (Balima, n.p., 2019).

Abrego et al. (2019) describe that there are still many things within and around the AfCFTA to be negotiated but it is possible to distinguish seven specific objectives with the agreement. The objectives are the following: eliminate tariffs and non-tariff barriers to trade in goods; liberalize trade in services; cooperate on investment, intellectual property rights and competition policy; cooperate on all trade-related areas; cooperate on customs matters and the implementation of trade facilitation measures; establish a mechanism for the settlement of disputes concerning members' rights and obligations; and establish and maintain an institutional framework for the implementation and administration of the AfCFTA (Abrego et al., 2019).

IMF (2019) states that the AfCFTA can be a game changer for the whole African continent if it is implemented successfully. The integration is believed to contribute to increased trade flows, productivity, growth and help to spread knowledge, technology and development of new products. Creating a large free trade area such as the AfCFTA will give the African continent and its nations a significant potential and opportunity for an economic transformation that will help boost the intra-African trade, increase the interest for FDI in the continent while also facilitating the development of regional and continental supply chains (IMF, 2019).

The importance of trade facilitation in general, and especially in combination with tariff reduction is discussed by WTO (2015). WTO (2015) states that complicated, slow and inefficient trade procedures are huge barriers to trade and development for all countries, but especially for middle- and low-income countries; hence, most of the countries on the African continent. This further establishes the importance of working to improve non-tariff measures, such as trade facilitation, to fully enjoy the benefits and potential of the AfCFTA.

3. Trade Facilitation

3.1 What is Trade Facilitation?

Trade facilitation is a concept that is brought up in most trade agreements nowadays, however there is no formal definition of it, since each trade agreement or study may define the concept in its own way. How the concept is defined depends on the scope of the agreement or study (WTO, 2015). For example, the WTO Trade Facilitation Agreement has eleven different definitions of the concept (Magwape, 2018). A definition that captures the concept in its essence is the definition of trade facilitation coined by UNCTAD:

> "Trade facilitation measures seek to establish a transparent, consistent and predictable environment for border transactions based on simple and standardized customs procedures and practices, documentation requirements, cargo and transit operations and trade and transport conventions and arrangements" (UNCTAD, p.6, 2006).

The concept has evolved over time, as the usage of it has increased. In the World Trade Report, it is explained that the concept can be differentiated in two different dimensions; broad or narrow and hard or soft infrastructure (WTO, 2015). A narrow definition focuses on the administrative procedures at the border, while a broad definition also considers behind-the-border measures as for example technical barriers to trade (WTO, 2015). Defining the concept with soft infrastructure focuses on improvements in procedures that do not require investments in physical infrastructure while in a hard infrastructure definition, physical infrastructure investments are included (WTO, 2015). A definition that is narrower and has a soft infrastructure focus is the trade facilitation definition made by UNECE:

> "Simplification, standardization and harmonization of procedures and associated information flows required to move goods from seller to buyer and to make payment" (UNECE, n.p, 2012).

As can be understood from the citations above trade facilitation is a very comprehensive concept, covering a lot of different policy measures depending on its definition. It can include everything from improving border controls, harmonizing documental requirements to improving port

infrastructure and making payments between enterprises smoother if the concept is applied with a broad perspective and includes hard infrastructure. Persson (2012) mentions several concrete examples of how to simplify the movement of goods across borders. The measures include documental requirements, which should be simple and as few as possible, as well as making actual information about the requirements for traders accessible and understandable (Persson, 2012). Getting goods through customs at a faster pace can be achieved by implementing risk-assessment techniques together with audit-based control, which removes the need to control every goods transport (Persson, 2012). One could say that trade facilitation measures are any measures that seek to ease trade transactions and leads to a reduction of cost or time (UNCTAD, 2006). Trade facilitation is complex not only due to its broad application possibilities, but also since it involves and affects government authorities, private entities and involves legal aspects. It requires cooperation from involved parties to be effective. UNCTAD (2017) states having a private-public dialogue is fundamental to reach a successful implementation of trade facilitation measures. It also requires international cooperation between countries, since to make documentation as simple as possible for traders, all countries should have the same requirements.

The definition of trade facilitation adopted in this paper has a narrow perspective and focuses on soft infrastructure. The goal of this study is to compare the barrier inefficient trade procedures at the border constitute and compare them with a tariff, whereas the authors will adopt the following definition "*Trade facilitation is defined as measures which goal is to simplify and harmonize administrative border procedures* ".

3.2 What economic and welfare effects can trade facilitation generate?

3.2.1 Transaction Costs

By making trade transactions easier and simplifying the trading processes, the goal of trade facilitation is to reduce transaction costs for traders (Persson, 2012). These transaction costs can take different forms but are comprised of direct and indirect elements (Milner, et al., 2008). Briefly explained, direct costs consist of compliance costs, such as providing documents and information that are required to move the goods across the border (Milner, et al., 2008). Indirect costs are costs that are caused by procedural delays (Milner, et al., 2008)

More specifically, direct costs can be categorized into sunk-, fixed- and variable costs to better understand their implications (Persson, 2012). Gathering information about a foreign market and the trade regulations that must be complied with is the first step a company must take to engage in international trade (Persson, 2012). The cost to retrieve this information and learn how to comply with the regulations is a one-time entry cost and can therefore be categorized as a sunk cost (Persson, 2012). The size of this sunk cost depends on how complex the compliance requirements are in a specific country (Persson, 2012). Furthermore, Persson (2012) concludes that each time a company then moves goods across the border, it will have to make the effort to complete these compliance procedures, resulting in a cost. In general, the process to comply with trade regulations is not affected by the volume of goods traded, which would fit the cost to comply for each shipment of goods into the fixed cost category (Persson, 2012). Persson (2012) continues to explain that there are variable costs, that will vary in size depending on the volume of goods traded, for example, charges for certain trade-related services.

The indirect costs caused by procedural delays can, for example, occur due to inefficient customs clearance and cargo handling (Milner, et al., 2008). These time delays can cause depreciation costs, for example by agricultural products being spoiled or causing time sensitive products like technology or fashion to lose their market value (Persson, 2012). It can also lead to increased storage costs since goods cannot be traded immediately, and this is particularly costly if the goods need to be stored in refrigerators to avoid getting spoiled (Persson, 2012). Time delays are also associated with increased uncertainty, which means that companies will have to waste resources on wider safety margins or hinder companies from engaging in international trade at all (Persson, 2012).

3.2.2 Theoretical implications of trade facilitation

How removing these transaction costs affects the economy can be analyzed with economic theories, both in a partial equilibrium analysis and a general equilibrium analysis. The trade facilitation analysis can also be compared to a tariff analysis, to understand the similarities and differences between these two trade policies.

In a partial equilibrium analysis, both tariffs and inefficient trade procedures constitute trade costs (Marrewijk, 2012). This raises the domestic price of the good from the world price P_w to $P_w + T$, where T represents the trade cost. It is assumed that the entire trade cost T can be removed by implementing trade facilitation measures, and T is also removed when the tariff is withdrawn. When the trade cost is removed, less goods will be produced domestically, which is indicated in Figure 1 by the shift from S_1 to S_2. Since the price decreases, more goods will be consumed as indicated by the shift from D_1 to D_2. The amount of goods imported into the economy is illustrated by the difference in supply and demand, whereas the increased difference implies that a larger volume of goods is being imported. Hence, the economic effects are the same when removing a tariff as implementing trade facilitation measures. However, it should be noted that a tariff generates government revenue, while inefficient trade procedures do not. This becomes clear when comparing the welfare effects of removing a tariff and implementing trade facilitation measures. When withdrawing a tariff, the government revenue from the imported goods $(D_1 – S_1) * T$ will disappear, which is represented by area C in Figure 1. The producer surplus will decrease with area A. Lastly, the consumer surplus will increase with area A, B, C and D. The net welfare effect for the economy is therefore area B and D.

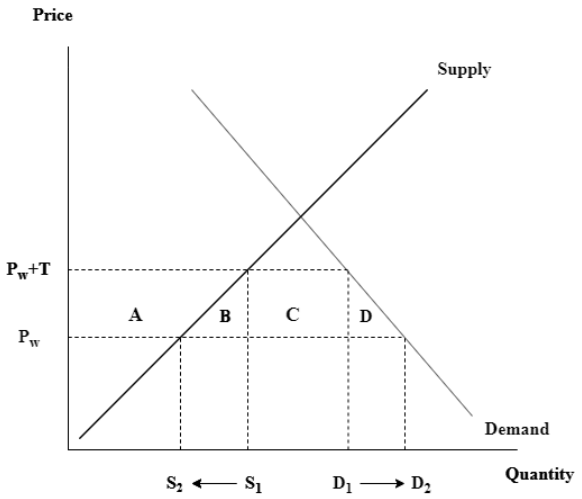

Figure 1 **Analysis of tariff & trade cost** *source:* Authors´ illustration

When implementing trade facilitation measures the government revenue is unchanged. The producer surplus will still decrease with area A, and the consumer surplus increase with area A, B, C and D. This implies that the net welfare effect for the economy is area B, C and D, which must be greater than area B and D alone. The gains from implementing trade facilitation are particularly beneficial for small developing countries where tariff revenues might be the government's main source of income (Persson, 2012). This is the case due to two effects; the increased trade volume which expands the tax base and that customs modernization might lead to a more efficient and reliable collection of trade taxes (Persson, 2012).

The World Trade Report (2015) further explains the general equilibrium analysis, utilizing both the Ricardian model (1817) and the Heckscher (1949) - Ohlin (1934) model. While the partial equilibrium focuses on a single market, these two theories analyze the world market as a whole (WTO, 2015). Both these theories assume constant returns to scale and perfect competition, and that factors of production are mobile between sectors in a country, but immobile in between countries (WTO, 2015). The Ricardian model predicts that trade will arise due to differences in labor productivity, as it is the only factor of production in the model. In contrast, the Heckscher-Ohlin model predicts that trade will arise due to differences in factor endowments. When trade is initiated, relative prices in the countries will converge from the autarky (no trade) situation until they are equal in the free trade situation (WTO, 2015). In both these theories, trade costs will create an obstruction so that if compared to a free trade situation, relative prices will be closer to the autarky situation (WTO, 2015). Countries will still gain from trade, but the gains will be smaller than what they would have been without the obstruction. By removing the trade cost by implementing trade facilitation measures, the trade flows will increase, and the countries will be able to specialize more in the goods they are relatively more efficient at producing.

Trade theories have developed since the classical models to explain trade phenomena the old theories could not explain, which led to the development of Krugman's "New Trade Theory" (Krugman, 1979; 1980). This theory seeks to explain why intra-industry trade is occurring, by changing some of the classical assumptions, allowing for increasing returns to scale, introducing a utility function where consumers prefer variety and that firms are selling different varieties of a product which is also called imperfect competition (WTO, 2015). This theory provides a more complex consequence of trade costs for small developing economies since it does not only affect the volume of trade but also causes a reallocation of manufacturing to larger economies (WTO, 2015). The diversity of goods produced in the small developing economy therefore suffers in addition to the decreases trade volume if there is a trade cost. By implementing trade facilitation measures, the trade volume will increase as in the Heckscher-Ohlin model, but with the additional benefit that smaller economies will increase the diversification of goods they produce.

Then there is the "New New Trade Theory" (Melitz, 2003), which has shifted the classical theories focus on countries to instead study trade from the firm's perspective. The theory seeks to

explain why there is only a small number of firms that engage in exporting activities by showing that firms have different levels of productivity and that they are heterogeneous (WTO, 2015). By inserting two productivity thresholds, the model shows that the least productive firms will not survive the competition from other, more productive firms, while the most productive firms will sell both at the domestic market and engage in export activities (WTO, 2015). The firms in between these thresholds will only serve the domestic market (WTO, 2015). In the World Trade Report (WTO, 2015), it is stated that the main results from the literature using this model is that a reduction in trade costs, which could be achieved by implementing trade facilitation measures, will bring the two thresholds closer to each other. This indicates that firms that could not engage in trade before now have that possibility and that firms who already trade will trade larger volumes (WTO, 2015). The benefits for the economy are that resources are being reallocated from less productive firms to more productive firms, resulting in higher efficiency (WTO, 2015). The welfare gains are that consumers will face a greater variety of goods, at a lower import price.

To summarize, in a partial equilibrium the economic effect of removing a tariff is the same as implementing trade facilitation measures, as both will increase the trade volume and decrease the domestic price. The welfare effects differ however, due to trade facilitation generating larger benefits to the economy, which is particularly evident for developing countries. The classical trade theories predict that removing a trade cost will lead to larger volumes of trade, benefiting the global economy. The newer trade theories introduce more complex consequences of removing trade costs by increasing the diversification of goods produced and the number of firms that export.

3.3 How is Trade Facilitation measured?

Since trade facilitation can be defined in different ways, depending on the scope of the agreement or study, the ways to measure trade facilitation also differ. The most common way to measure trade facilitation is with indicators. The definition of trade facilitation used in the study will decide what indicator that is most appropriate to use (WTO, 2015). In the World Trade Report published by the WTO (2015), there is said to be more than twelve different indicators used to measure trade facilitation, but the following four indicators are the ones primarily used to measure the economic effects of trade facilitation by researchers: the World Bank's Doing

Business indicators (DB), the World Bank's Logistics Performance Index (LPI), the OECD's Trade Facilitation Indicators (TFI) and World Economic Forum's Enabling Trade Index (ETI) (WTO, 2015). These are presented below in Table 1.

Table 1, Trade facilitation measurements

	Doing Business indicators (DB)	**Logistics Performance Index (LPI)**	**Trade Facilitation Indicators (TFI)**	**Enabling Trade Index (ETI)**
Publisher & Report	The World Bank, (2019a) "Trading across Borders"	The World Bank, (2018) "Connecting to Compete"	OECD, (2018) "Trade Facilitation and the Global Economy"	WEF & GATF, (2016) "The Global Enabling Trade Report"
Methodology	The data is collected through a questionnaire and then analyzed by experts. The questionnaire uses a simple business case to ensure comparability across economies and over time.	The data is collected through an online survey where logistics professionals participate who work at the firms which moves goods internationally.	The indicators are based on a questionnaire and the data is gathered from three sources; publicly available information, direct submissions from countries and factual information from the private sector.	The data is acquired from various organizations like UNCTAD, The World Bank, WTO, International Trade Centre as well as the World Economic Forum's Executive Opinions Survey.
Data results	Provides data about average time and cost to import auto parts and export comparative advantage good and how much documentation is needed.	Inputs cover the areas where policy regulations are applicable which is; customs, infrastructure and service quality Outputs category is; the performance of logistics services, and includes timeliness, international shipments and tracking and tracing.	Data covering; information availability, involvement of the trade community, advance rulings, appeal procedures, fees and charges, formalities - documents, formalities - automation, formalities - procedures, internal cooperation, external cooperation and governance and impartiality.	Provides data about; market Access, border administration, infrastructure and operating environment.
Indicators and economies covered	DB consists of 12 indicators covering 190 economies.	LPI consists of six core performance measures covering 160 economies.	TFI consists of 11 indicators and covering 163 economies.	ETI consists of 57 indicators covering 136 economies.

Table 1, (World Bank, 2019a; World Bank, 2018; OECD, 2018; WEF & GATF, 2016)

As understood by the information above each of the indicators offer data points that are comparable over time and between countries, which allow researchers to measure the impact of different trade facilitation reforms. There are however pros and cons with each of the indicators. In the World Trade Report 2015, a distinction is made between indicators that measure policy inputs and those that track the outcomes of a policy (WTO, 2015). The DB measure policy outcomes, TFI primarily focuses on policy inputs while LPI and ETI take both perspectives into account (WTO, 2015). WTO (2015) further suggests that the main difference between the trade facilitation measurements is the scope of trade facilitation that is considered. The LPI and ETI both have broad scopes, measuring the overall logistics environment and the general competitiveness performance of a country respectively (WEF, 2016). The DB indicators are more concentrated on border activities, while the TFI is designed to follow developments in line with the WTO´s Trade Facilitation Agreement (WTO, 2015) The LPI and DB indicators detect some of the less observed trade costs (Go, 2018). Go (2018) further describes the LPI and DB indicators as beneficial to use due to their broad coverage and possibilities to compare the data across many different countries. Go (2018) suggests that these indicators have limitations such as cultural biases from individuals compared to information from statistical and administrative sources. Persson (2012) argues that there are some challenges with the data available today in the datasets, such as DB. The most important challenge is, according to Persson (2012), that there is almost no time series variation in the data and most variation is between countries and not over time, which can lead to econometrical difficulties when analyzing the data. Finally, Persson (2012) points to the challenges of having data that does not differentiate between products, destinations or origins, or take into consideration different firm sizes.

When using these indicators to perform empirical research, researchers often apply the gravity model or computable general equilibrium (CGE) models on the data (WTO, 2015). The gravity model utilizes historical data of outcomes from trade policies, which can then be used to estimate future policies, while the CGE model uses data from a reference year and then allow researchers to change policy variables to estimate outcomes (WTO, 2015).

In this paper, the DB indicators will be used in all empirical sections. The DB indicators are aligned with the scope of the paper since they focus on the administrative border procedures. The

DB indicators provide import and export data regarding the time and cost associated with three sets of procedures: Domestic transport, Border compliance and Documentary compliance (World Bank, 2019a). In the case study used by the World Bank to gather the data for the DB database, the good that is imported is assumed to be a standardized shipment of 15 metric tons of containerized auto-parts (World Bank, 2019a).

3.4 Descriptive statistics

The earlier mentioned benefits of trade facilitation are agreed upon by economists, but the development and implementation process has been slow, as can be seen in the Doing Business dataset (World Bank, 2019a). The data shows that there are still a lot of countries that have a long way to go before reaching the "best practice" level of trade facilitation.

Presented in two world maps, the DB 2020 dataset has been compiled to show the number of days it takes to complete the border and documentary compliance procedures to import and export goods in each of the countries in the DB database. Since the data shows the time in hours, the authors divided it with 24 to transform it from hours to days to make it more apprehensible. The greyed-out countries are countries that the database does not cover or did not have any data values for. As can be seen in Figures 2 and 3, the countries with the most efficient trade facilitation can import and export goods in less than one day, while the most inefficient countries take up to 25 days for export goods and 27 days for import goods to complete the procedures. In Denmark for example, which is one of the most efficient countries, it takes one hour to export and one hour to import (World Bank, 2019a). In the Democratic Republic of the Congo however, the situation is the opposite, where it takes 20.3 days to export and 21.3 days to import (World Bank, 2019).

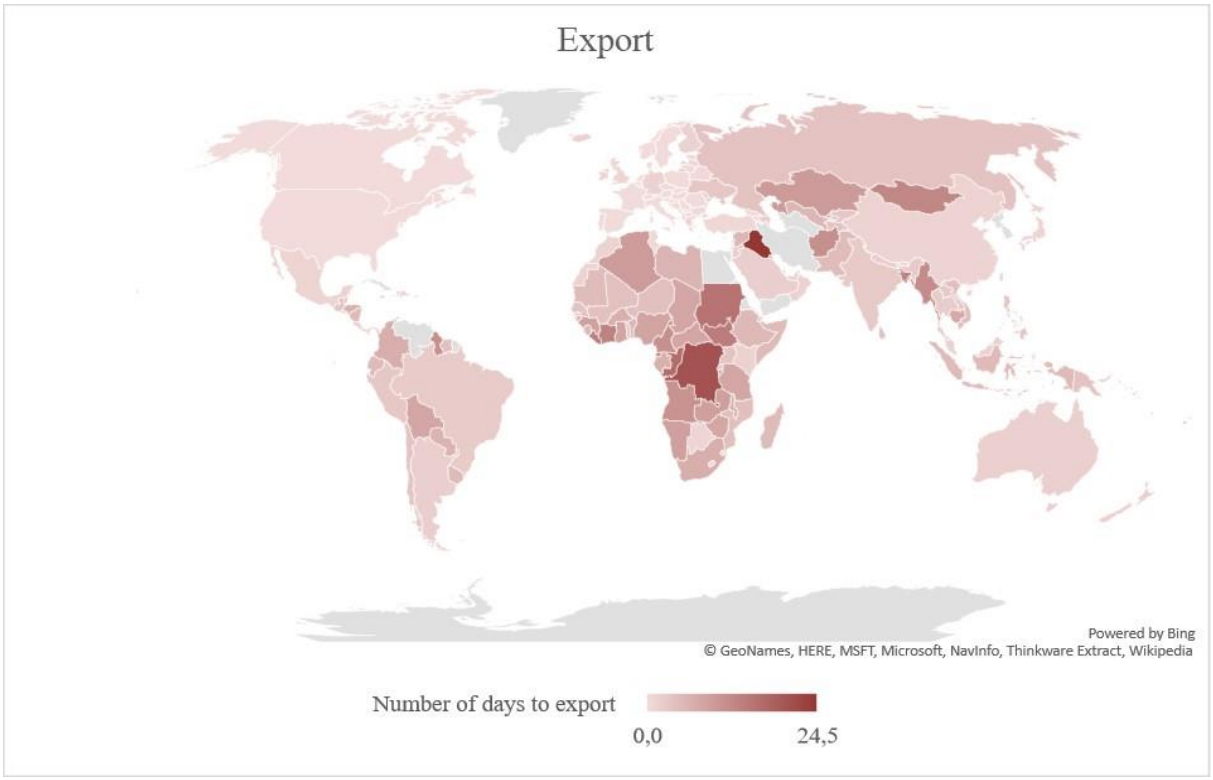

Figure 2, **World export procedures: Time** *Source*: (World Bank, 2019a)

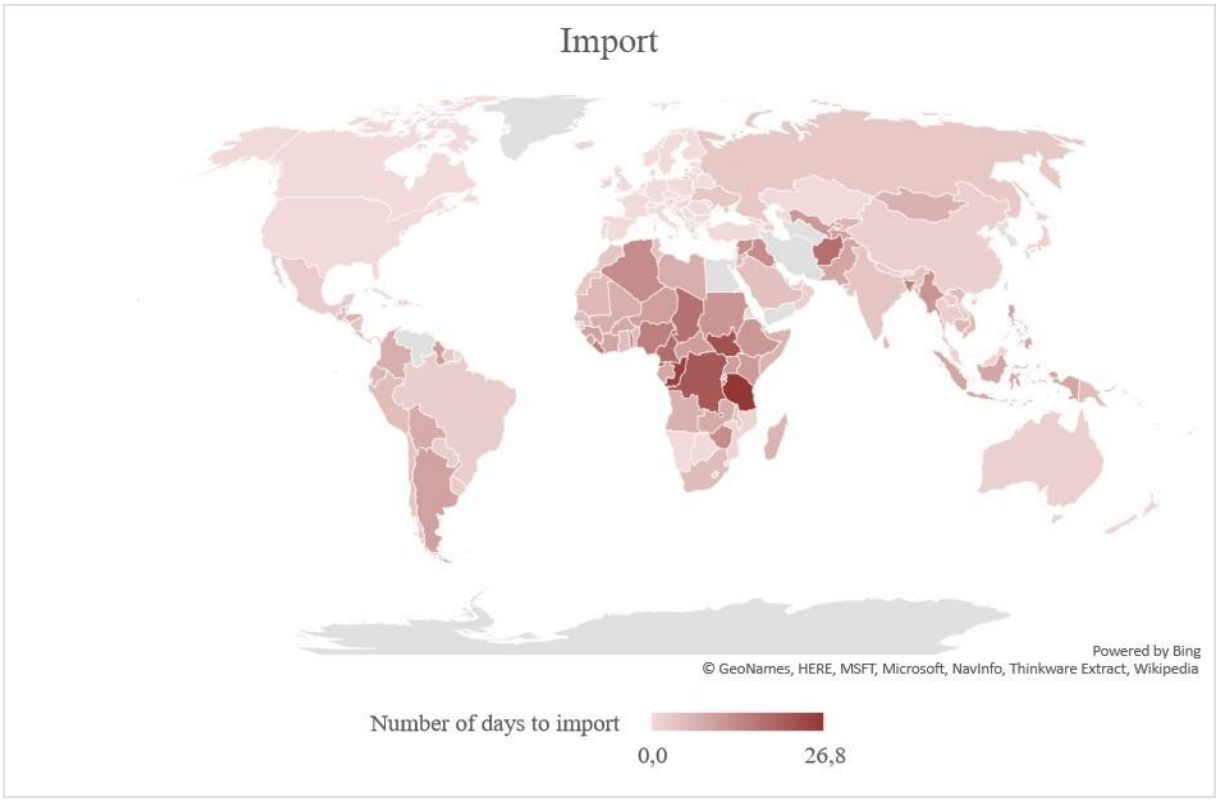

Figure 3, **World import procedures: Time** *Source*: (World Bank, 2019a)

In general, it can be seen that the region that needs improvement in trade facilitation the most is the countries in Sub-Saharan Africa (World Bank, 2019a). The reasons why Sub-Saharan Africa is less efficient at processing goods are multiple. In the Regional Economic Outlook report published by IMF (2019), poor logistics, transportation infrastructure, border processes and custom practices are listed as key impediments to trade for African countries. In Table 2 below, the DB 2020 dataset regarding both the time to import and the cost to import for all African countries is presented. These two measures of trade facilitation are both relevant to review and despite the authors' decision the focus on time to import as the trade facilitation measure in this paper, both measures are presented in this section to give a broader overview over the trade facilitation situation in Africa today.

The cost to import varies significantly between African countries, where in the cheapest country, Botswana, it is reported to cost 165 USD to import goods while in the most expensive country, Democratic Republic of the Congo, it is reported to cost 3804 USD to import (World Bank, 2019a). The potential benefits to be reaped are significant for the whole continent if the countries in Africa with the highest trade costs manage to lower these. Table 3 illustrates the development of the time it takes to import goods in the African countries from the year 2016 to 2020. In general, the development has been slow, which can be seen by all the countries that have not improved at all. However, there is evidence proving that significant improvements are possible, such as Ghana, Rwanda and Angola, which has managed to decrease the time it takes to import drastically. As mentioned previously, the large differences in time to import might also hinder trade in goods that are time sensitive or add unnecessary storage costs (Persson, 2012). The high trade cost and slow trade procedures are two factors which are brought up by WTO (2015) as reasons why Sub-Saharan countries stand to gain the most from implementing trade facilitation measures. It also stresses the importance of including and following through on any trade facilitation agreements in the AfCFTA, since the gains from implementing trade facilitation measures could potentially be larger than those from removing tariffs.

Table 2, Import procedures in Africa: Time & Cost

Country	Time to import (Days)	Cost to import (USD)	Country	Time to import (Days)	Cost to import (USD)
Algeria	12.8	809	Liberia	15.0	1418
Angola	7.0	1490	Libya	7.3	697
Benin	5.9	709	Madagascar	6.5	745
Botswana	0.3	165	Malawi	4.6	306
Burkina Faso	8.3	462	Mali	7.3	635
Burundi	13.9	1469	Mauritania	5.5	980
Cabo Verde	3.5	713	Mauritius	2.1	538
Cameroon	18.1	2256	Morocco	3.5	344
Central African Rep.	10.1	1209	Mozambique	1.0	459
Chad	17.3	1465	Namibia	0.4	208
Comoros	4.0	858	Niger	9.8	744
Congo, Dem. Rep.	21.3	3804	Nigeria	15.1	1641
Congo, Rep.	25.2	1891	Rwanda	5.1	403
Côte d'Ivoire	8.9	723	São Tomé & Príncipe	7.0	481
Djibouti	7.0	1155	Senegal	5.2	1247
Egypt, Arab Rep.	21.0	1554	Seychelles	5.4	434
Equatorial Guinea	20.0	1055	Sierra Leone	8.4	1208
Eritrea	N/A[2]	N/A	Somalia	6.7	1252
Eswatini	0.3	210	South Africa	5.1	749
Ethiopia	11.1	870	South Sudan	22.5	1131
Gabon	8.5	1490	Sudan	11.5	1513
Gambia, The	5.0	478	Tanzania	26.8	1725
Ghana	4.8	1027	Togo	14.5	864
Guinea	9.8	989	Tunisia	4.5	740
Guinea-Bissau	5.0	755	Uganda	10.0	743
Kenya	10.6	948	Zambia	8.0	555
Lesotho	0.3	240	Zimbabwe	12.9	712

Source: (World Bank, 2019a)

[2] The Doing Business database does not report any data about cost to comply or the amount of time it takes to import goods to Eritrea in the 2016-2020 datasets (World Bank, 2019a)

Table 3, Development of trade facilitation between 2016-2020: Time

Country	Percentual change in time to import (Days)	Country	Percentual change in time to import (Days)
Ghana	-69%	Botswana	-0%
Rwanda	-64%	Burkina Faso	-0%
Angola	-63%	Burundi	-0%
Morocco	-47%	Cameroon	-0%
Algeria	-47%	Central African Rep.	-0%
Congo, Dem. Rep.	-37%	Chad	-0%
Zambia	-35%	Congo, Rep	-0%
Mozambique	-34%	Côte d'Ivoire	-0%
Sierra Leone	-25%	Djibouti	-0%
Lesotho	-25%	Equatorial Guinea	-0%
Cabo Verde	-22%	Gabon	-0%
Eswatini	-22%	Gambia, The	-0%
Nigeria	-21%	Guinea-Bissau	-0%
Uganda	-17%	Liberia	-0%
Mauritius	-17%	Libya	-0%
Ethiopia	-16%	Mali	-0%
Mauritania	-15%	Namibia	-0%
Malawi	-14%	Senegal	-0%
Niger	-13%	Somalia	-0%
Togo	-13%	South Africa	-0%
Madagascar	-9%	South Sudan	-0%
Guinea	-5%	Sudan	-0%
Kenya	-4%	Tanzania	-0%
São Tomé & Príncipe	-3%	Tunisia	-0%
Comoros	-3%	Egypt	+62%
Seychelles	-2%	Zimbabwe	+119%
Benin	-0%	Eritrea	N/A

Source: (World Bank, 2019a)

4. Previous Research

The main scope of this literature review is to present a summary of relevant research made on the main topics covered in this paper; trade facilitation and tariff equivalents. Since this paper will use methodology based on price estimation models, the most important reference points will be previous research that has used a similar methodology. As mentioned previously, the gravity model is one of the most common tools used to estimate the trade volume effects of trade facilitation measures, while this study will estimate the barrier of trade facilitation measures. To the authors' knowledge, no previous study has measured the barrier of trade facilitation measures, but several have been conducted measuring the barrier of NTMs in general. The studies also tend to not compare the yielded AVEs to applied tariffs, which this study will attempt. When reviewing previous research in journals and online sources, the authors also chose to include research that have provided impactful results and important insights about trade facilitation using different methodologies.

Kee, et al. (2009) seek to establish a measurement of trade restrictiveness that clearly defines what it measures and is grounded in trade theory. To succeed in this task, the authors estimate a model with price-based estimates to estimate ad valorem tariff equivalents of non-tariff barriers (Kee, et al., 2009). It was found that non-tariff barriers constitute an additional 87 percent to the restrictiveness imposed by tariffs (Kee, et al., 2009). Further, it was also concluded that in 34 out of the 78 countries in the sample, non-tariff barriers were more restrictive than tariffs (Kee, et al., 2009).

A study by Hummels and Schaur (2013) uses US import data to calculate consumers' valuation of time. The authors construct a model with two firms; one that import by shipping and one that import by air cargo (Hummels & Schaur, 2013). Since importing by air is faster but more expensive, introducing a consumer and analyzing at what cost the consumer would choose the faster option, a valuation of time can be achieved (Hummels & Schaur, 2013). An ad valorem equivalent of time is then estimated with this valuation and the authors conclude that each day in transit is equivalent to an ad valorem tariff of 0,6 to 2,3 percent (Hummels & Schaur, 2013).

Fernandes, Hillberry and Mendoza Alcantara (2015), investigate the effects of reductions in inspection-related delays on values of imported goods. The paper finds evidence that when the probability of imported goods being inspected falls to under 50 percent, the median number of days goods spend in customs, falls by 7 percent. This reduction in time contributes to a 7 percent growth in import flows (Fernandes, Hillberry, & Mendoza Alcantara, 2015). The authors further calculate that this result is roughly consistent with a 0,36 percentage point reduction in AVE trade costs.

The paper by Zaki (2010), which builds on the methodology of Kee, et al. (2009), seeks to address the question of whether several trade facilitation aspects have an effect on bilateral trade. The author estimates an augmented gravity model and adopts it to estimate ad valorem tariff equivalents of administrative barriers to trade for different sectors (Zaki, 2010). The data used for the regression was mainly the DB database (Zaki, 2010). The author's estimation of time to imports effect on trade is that a one-day increase in time to import causes a decrease in trade volume by 1,24 percent (Zaki, 2010). It is also stated that improvements in trade facilitation will have a different impact depending on the characteristics of the good, which can be seen in the tariff equivalents (Zaki, 2010). For example, the ad valorem equivalent of time for importing wearing apparel (seasonal good) is 49,32 percent while it is 0,01 percent for importing tobacco goods (Zaki, 2010). This implies that time sensitive goods stand to benefit the most from trade facilitation measures (Zaki, 2010).

In an article by Moïsé and Sorescu (2013), the OECD indicators of trade facilitation (TFI) are discussed. The authors suggest that the indicators that seem to have the greatest impact on trade and trade-related costs are; Information availability, governance and impartiality, formalities – documents, automation and procedures. Furthermore, when studying the importance of different dimensions of trade facilitation in the manufacturing sector, Moïsé and Sorescu (2013) got significant results for the following indicators; Involvement of the trade community, Advanced rulings and Appeal procedures. If all these trade facilitation indicators are added up in the same regression, Moïsé and Sorescu (2013) describe that the potential of reducing trade costs would be 13,2 percent for upper-middle income countries, 15,5 percent for middle income countries and 14,5 percent for low income countries. The effect of combining the indicators is greater than the individual effects of the indicators when measured alone. This further points to the importance of

trade facilitation and that it should be viewed in a holistic manner, instead of focusing on the individual measures separately (Moïsé & Sorescu 2013).

Nordås, Pinali and Geloso Grosso (2006) explain the effect time can have on trade volume in three different types of goods; fashion, electronics and intermediates. They argue that time can act both as an entry barrier and a trade cost. To further analyze the effect time has on trade, the authors estimate two gravity models; one focusing on how time affects trade volumes and one for how time affects the probability of entering an export market (Nordås, Pinali & Geloso Grosso, 2006). The result concluded that time has a negative impact on trade volume, especially for electronic products, as well as showing that time is negatively correlated with the probability to enter the export market (Nordås, Pinali & Geloso Grosso, 2006).

Research by Iwanow and Kirkpatrick (2008) attempts to answer how the three factors; trade facilitation, regulatory environment and infrastructure, impact the trade volume of manufactured goods in Africa. By using a gravity model and incorporating an "Africa" dummy, Iwanow and Kirkpatrick (2008) show that the infrastructure variable became insignificant, which can be interpreted as that improvement in infrastructure will have the same effect on export for African countries as for the rest of the world (Iwanow & Kirkpatrick, 2008). Furthermore, the authors show that the regulatory environments are estimated to have a larger effect on manufactured exports than improved trade facilitation (Iwanow & Kirkpatrick, 2008). A 10 percent increase in trade facilitation is estimated to increase exports with 6 percent for African countries, while a 10 percent increase in regulatory environments is estimated to increase exports with 12 percent (Iwanow & Kirkpatrick, 2008).

Another study conducted by Djankov, Freund and Pham (2010) uses data from 98 countries in a gravity equation to estimate how much time delays affect trade volume. In the study, the researchers find results showing that for every day the shipment of a product is delayed, the traded volume of the product reduces with more than 1 percent (Djankov, Freund & Pham, 2010). When the authors transform the time delay into distance, the result suggests that every day's delay is equivalent to two trading partners distancing themselves from each other with, on average, 70 km (Djankov, Freund & Pham, 2010). Additionally, Djankov, Freund and Pham (2010), in accordance with findings from other authors mentioned earlier, find that time delays

have a relatively greater impact on goods that are more time-sensitive, such as food and agricultural products.

Buigut (2016) estimates the effect that the East African Community (EAC) customs union has had on trade since 2005. By using a gravity model and fixed effects, controlling for endogeneity and performing robustness tests, Buigut (2016) concludes that the EAC customs union and increased trade facilitation have had a positive effect on traded volumes within EAC with about an increase of 22 percent.

Research by the IMF (2019) shows that if AfCFTA successfully leads to the implementation of both tariff *and* non-tariff policies, it could be a significant boost for the trade flows in Africa. AfCFTA's goal of a tariff-reduction of 90 percent would lead to an increase in intra-regional trade by 16 percent worth 16 billion USD, in only the region of sub-Saharan Africa (IMF, 2019). But IMF also states that merely the reduction of tariffs is not enough but should be implemented in combination with reducing and improving non-tariff barriers such as trade logistics, customs procedures and infrastructure (IMF, 2019). Reducing non-tariff barriers and improving trade facilitation could be up to four times more effective in increasing trade flows compared to solely reducing tariffs, which highlights the importance of implementing policies improving trade facilitation and other non-tariffs measures to reach the full potential of the AfCFTA (IMF, 2019). Furthermore, Mukeredzi (2019) presents data from the UNECA showing that a removal of all trade barriers potentially could increase intra-African trade with up to 50 percent while improved trade facilitation could double the amount of intra-African trade flows.

The future impacts of a successful implemented AfCFTA are discussed in an empirical assessment conducted by UNECA (2018). In this paper, it is projected that a tariff removal in the AfCFTA agreement could increase the intra-African trade value by 15 to 25 percent, worth between 50 to 70 billion USD. It is also mentioned that, based on the efforts and ambitions of liberalization, the share of intra-African trade could rise by 40 to 50 percent between the start of the implementation period 2020 until the expected time for the agreement to be fully implemented, 2040 (UNECA, 2018). The analysis from UNECA also mentions the expected impact of AfCFTA on agricultural products. More specifically, UNECA's modeling predicts that by the time the agreement will be fully implemented in the continent, the intra-African trade with

products related to agriculture will have increased by 20 to 30 percent (UNECA, 2018). Finally, UNECA (2018), in accordance with previously cited authors, mentions AfCFTA's potential to help African countries to develop and increase their diversification, industrialization and the development of value chains while also discussing the importance of working with and improving non-tariff barriers and increase trade facilitation.

5. Empirical Strategy

5.1 Outline of strategy

The structure of this empirical strategy will be as follows: first, the original methodology of Cadot, Gourdon and van Tongeren (2018) will be introduced and all the variables in the model will be explained. The calculations of how trade facilitation is transformed to an ad-valorem tariff equivalent (AVE) is then explained, which then leads to the introduction of the model used in this paper. Challenges related to the estimations and reliability of the model will be discussed after the model has been introduced. The final part of the empirical strategy will present the data that is used in the model and calculations.

5.2 Model

The model used in this paper to estimate ad-valorem tariff equivalents of trade facilitation builds upon the methodology of Cadot, Gourdon and van Tongeren (2018), where the estimation is approached with price-based and quantity-based equations. A cross-sectional dataset is used, which implies that data is collected from one year. However, the scope of the report is broader than the scope of this paper, as it includes all non-tariff measures. Sanitary and phytosanitary measures, technical barriers to trade and quantitative restrictions are not covered in the scope of this paper, which focuses on trade facilitation. The models follow a traditional trade modelling framework, but instead of estimating a standard gravity model it is divided into two models; one which estimates price and one which estimates quantity effects (Cadot, Gourdon, & van Tongeren, 2018). The model which estimates price effects is the one used to estimate AVEs and is thus the model which this paper will build upon. The original price equation presented by Cadot, Gourdon and van Tongeren (2018) is specified below:

$$ln\, p_{ijk} = G_{ij} * \beta_1 + \sum_m \beta_{2m}\, n_{jkm} + \sum_m \beta_{3jm}\left(n_{jkm} s_{jk}\right) + \sum_m \beta_{4m}\left(n_{jkm} s_{ik}\right) + \sum_i \delta_i + \sum_j \delta_j + \sum_k \delta_k + u_{ijk} \quad (1)$$

The subscript *i* denotes the country of origin, *j* denotes the country of destination for the good which is denoted by *k*. The product data is from Harmonized System level 6 of disaggregation.

Harmonized systems is a system used internationally to classify products by assigning them numbers, where HS6 is the most detailed classification used by all countries (WCO, 2012). *m* is the non-tariff measures index. p_{ijk} is the Cost, Insurance, Freight (CIF) unit value of product *k* exported by country *i* to country *j*. G_{ij} represents all the traditional gravity variables which are distance, shared border, common language and RTA. n_{jkm} is the amount of non-tariff measures applied to product *k* by country *j*. s_{jk} and s_{ik} are the importing countries share in world trade of product k and the exporting countries share in world trade of product *k* respectively. δ_i and δ_j are country specific characteristics, and the ones used in the model is GDP and GDP per capita. The beta coefficients are estimated using an OLS regression. Every observation will contain a unit value above zero, hence the regression does not face the challenge of zero trade flows. u_{ijk} is the error term of the regression. When the model has been estimated and the coefficients collected, they are then inserted into another equation to estimate the price-based AVE. The equation is specified as follows:

$$AVE_{ijm}^{C(k)} = exp\left(\beta_{2m} + \bar{s}_{jk}\beta_{3m} + \bar{s}_{ik}\beta_{4m}\right) - 1 \tag{2}$$

$\bar{s}_{jk}$ and $\bar{s}_{\text{ik}}$ are the importers and exporters share of world trade respectively. However, the goal of this thesis is to estimate AVE of the chosen measure of trade facilitation, so the model will have to be adapted to this purpose. The model used in this paper is specified as follows:

$$ln\, p_{ijk} = \beta_1 * G_{ij} + \beta_2\, ln(\delta_i) + \beta_3\, ln\left(\delta_j\right) + \beta_4 lnTM_j + u_{ijk} \tag{3}$$

As in the equation proposed by Cadot, Gourdon and van Tongeren (2018), the subscript *i* is the country of origin, *j* the country of destination, *k* is the product at HS6 level and p_{ijk} is the CIF unit value. G_{ij} represents the gravity variables used in this model, which are the logarithm of distance, shared border dummy, shared currency dummy, shared language dummy, shared earlier colonizer dummy and finally a shared RTA dummy. The dummy variables take the value one if the country pair share the object of the dummy e.g. share currency and zero if they do not. δ_i and δ_j represent country-specific characteristics which in this model are the country's GDP, GDP per capita and the landlocked dummy, pointing out if the country is landlocked or not. TM is the measurement of trade facilitation chosen in this model which is represented by the time it takes

to import goods in country *j*. This regression will capture the effect improvements in trade facilitation will have across all product types. The beta coefficient β_4 can be interpreted as the effect that a 100 percent increase in trade facilitation will have on the unit value of intra-African traded goods. u_{ijk} is the error term of the regression.

Based on previous research and economic theories the expected signs of each variable are the following: RTA, shared currency, shared border, common language, common colonizer, importer GDP and exporter GDP are expected to yield negative signs. The negative signs indicate that the variables are stimulants, which decrease the price. Distance, landlocked, time to import are expected to yield positive signs. The positive signs indicate that the variables constitute barriers, which increase the price. The effect of GDP per capita for both importer and exporter is ambiguous and might yield positive or negative signs. A change in GDP per capita constitutes a population change and might affect the economy in several ways.

However, since tariffs can differ across different products, the estimated effect of trade facilitation on different products is preferred. The effect of trade facilitation is then used to distinguish the barrier on a more disaggregated product level to make the results comparable to product level applied tariffs. To achieve this the variables PCD is added to the regression, which is a dummy variable for each chapter of the 97 products at a HS2 level. The dummy variable takes the value one if the product is a part of the chapter in question, e.g. “Cashew nuts, in shell, fresh or dried” (080131) will take the value 1 when the chapter dummy is for chapter “Fruit and nuts, edible; peel of citrus fruit or melon” (08). If the product does not belong to the chapter, the dummy variable will instead take the value zero. The dummy variables are then interacted with the trade facilitation variable to estimate the disaggregated effects. The coefficient β_4 for the trade facilitation variable will then represent the effect of the reference group which is the chapter that will not receive a dummy variable to avoid the “dummy trap”. The coefficients for each product chapter is the different effect of trade facilitation on the product compared to the reference group. With these estimations, it is then possible to distinguish the percentual price effect of improvements in trade facilitation for each of the HS2 chapters which are then comparable to an AVE. The equation used to estimate AVEs in this paper is therefore:

$$AVE_{ijTF}^{C(k)} = (\beta_4 + \beta_{PCD}) * percentual\ change\ in\ time\ to\ import \quad (4)$$

The AVE will be estimated at the HS2 level, for all chapters. Change in time to import is the percentual change needed to improve the level of trade facilitation, in this paper the change in time it takes to import a good, to reach a certain level. The authors have calculated four case scenarios to which trade facilitation can be improved and one case in which trade facilitation is deteriorated. These case scenarios will be further explained and presented in chapter 6.

5.2.1 Estimation questions

The choice of model used to estimate the variable of interest can have a significant impact on the generated results. Most models have advantages and disadvantages, which must be considered. The most common challenge when using the gravity model, which is also applicable to this paper's model, is unobserved heterogeneity, endogeneity and heteroskedasticity (Bacchetta, et al., 2012). These estimation challenges will be discussed below.

Due to the scope and comparability of this study, the authors opted for a cross-sectional dataset. The original equation by Cadot, Gourdon and van Tongeren (2018) was constructed for a cross-sectional dataset, which also implies that the authors' adaptation of the model is designed for a cross-sectional dataset. The cross-sectional dataset is suitable for this paper since price data for all trade between African countries for more than one year shows a small variation in the data from year to year for the average country.

Using cross-sectional data can be problematic in econometrical analyses as it makes it harder to control for unobserved heterogeneity (Persson, 2012). Unobserved heterogeneity occurs when you have differences between your observations which is not captured by your included variables which makes the estimators biased and inconsistent. In this study, such unobserved heterogeneity could arise due to product differences as well as differences between country pairs. To tackle this challenge a fixed effect model can be adopted, but a choice between capturing the product differences or country pair differences must be made (Bachetta, et al., 2012). The authors of this paper argue that the dependent variable is more likely to be biased due to product differences and therefore a product fixed effect model is incorporated for all regressions. To

account for the country pair differences bilateral gravity variables are included. This is however not a guaranteed solution to capture all unobserved heterogeneity.

If the estimations have issues with endogeneity, it is due to one of the variables in the equation being correlated with the error term. This can occur for different reasons, for example unobserved heterogeneity, omitted variable bias, measurement errors or simultaneity. There is no easy fix to deal with endogeneity, but including fixed effects will decrease the severity of the effect that omitted variables can have on the estimations (Bacchetta, et al., 2012). As mentioned earlier, to handle this challenge a fixed effect for products will be used in all regressions.

The problem with heteroskedasticity arises when the standard errors of the included variables are non-constant. This leads to complications because if the coefficients of a log-linear model are interpreted as elasticities, which is common practice, the results can be severely misleading (Santos Silva & Tenreyro, 2006). In the gravity literature there are several proposed solutions, for example using a Pseudo Poison Maximum Likelyhood (PPML) estimations, a Helpman, Melitz and Rubenstein (HMR) model or to use robust standard errors (Bacchetta, et al., 2012). To control for heteroskedasticity the authors ran the data through a Breusch-Pagan / Cook-Weisberg test[3], where the null-hypothesis of constant variance was rejected. The authors will therefore run all regressions with robust standard errors.

Since the model in this paper is estimating the barrier trade facilitation constitutes on the price and not the trade flow, a trade flow of zero simply means that no observations are captured. Cadot, Gourdon and van Tongeren (2018) explain that no observations will take the unit value zero, and as mentioned earlier zero trade flows will not be a problem in this model.

5.3 Data

In this section, the data sources are presented along with in which parts of the model the data has been used. All data included in models and calculations covers the nations of the African Continent since the scope is to cover intra-African trade. A bias that may occur in the sample is

[3] The test yielded a chi-square value of 1221.1 and p-value of 0.000

that more data are available and used from countries that trade more with each other compared to countries that trade less and the data may therefore be more weighted towards larger economies. This may lead to a bias when the data is used in models and regressions. All countries which offered unit value data on imports are presented in Table A.1 in the appendix. Since the model is based on a cross-sectional dataset, all data is collected from one specific year. The authors chose 2016, as the DB indicators changed its methodology that year and from some databases, 2016 offered the most recent data. The data-sample used in this study is therefore all nations of the African continent focusing on the year of 2016. Stata was the program used to handle the data, perform the regressions and run tests.

The data containing CIF import unit values for the products in USD was collected from the Trade Unit Value (TUV) database, developed by The Centre d'Études Prospectives et d'Informations Internationales (CEPII). In the model, the unit values act as a proxy for the price of the good and do not include trade costs (Berthou & Emlinger, 2011). Unit value and price will be used interchangeably. The database provides data on a HS6-level with unit values for over 6000 products from 182 reporters and 253 partners (Berthou & Emlinger, 2011). Descriptions for the HS codes regarding product chapters and sections are presented in Table A.4 and A.5 respectively in the appendix. Tariffs are applied to imported goods and therefore data for imports are required in this study.

Distances between the African countries were collected from CEPII's *GeoDist*, which contains data for geographical variables for 225 countries in the world (Mayer & Zignago, 2011). The data for the gravity dummies being landlocked, having a common border and having a shared earlier colonizer is also derived from CEPII's *GeoDist.* The linguistic part, the dummy for common language spoken, was collected from CEPII's *Language* which contains linguistic data for most countries in the world (Melitz & Toubal, 2012).

The data for the dummy for common currency was collected from International Organization for Standardization (ISO) and its database containing ISO Currency codes, in which it can be seen what currencies are used in a country (ISO, 2015). Based on this data, the authors transformed the data into bilateral dummies showing whether a country has a shared currency with another

country. No changes in the database affecting any African nations have been made since 2015 and the data are therefore still relevant. The data for the dummy variable for shared RTA was collected from WTO's Regional Trade Agreements Database containing all RTAs actively in force in the world today.

The data containing GDP and GDP per capita was collected from the World Bank's World Development Indicators databank which reports data and statistics related to e.g. economics, health, development, equality and environment from the world's countries (World Bank, 2020).

The measurements for trade facilitation and for Time to Import were collected from the World Bank's Doing Business Database, which is presented in detail in chapter 3. The trade facilitation measurement included in the model is the amount of time (in hours) it takes to import goods in each country. The time to import measurement was preferred to cost to import since time to import constitutes an indirect cost. Moïsé and Le Bris (2013) explain that improvements that remove indirect costs constitute pure efficiency gains which leads to greater welfare gains than decreasing direct costs would. They also mention that in CGE simulations with iceberg trade costs, the results indicated that decreasing indirect cost can capture up to 80 percent of the welfare gains (Moïsé and Le Bris, 2013) Further, the authors of this paper argue that since time can constitute a major hindrance for certain goods, it is a more interesting variable to study.

Data about the African countries tariff profiles were gathered from UNCTAD's Trade Analysis Information System (TRAINS). The database contains information about the tariff levels applied to products at a disaggregated HS6-level (UNCTAD, 2016). Data for applied tariffs between bilateral pairs from the year 2016 was not possible to retrieve, due to the most recent data being from 2014. UNCTAD's TRAINS database is recommended by Bachetta, et al. (2012) to retrieve tariff data for models estimating the effects of trade policies.

6. Empirical Results

6.1 Estimating the effect on unit values

To analyze and control that time to import has a significant effect on the unit value of imported goods, the first regression is performed without the interaction variables between trade facilitation and product level dummies. The results from the first regression are presented below in Table 4.

The importer GDP variable yielded a significant estimation but did not yield the expected sign. The reported effect was positive, indicating that as a country's economy grows, the effect on imported unit value rises. This is not in line with economic theory since if a country's economy grows, the country should become a more attractive trading partner with increased trade flows, which should lower the unit value of traded goods. The exporter GDP variable yielded a significant estimation as well and contrary to the importer GDP variable it yielded the expected sign. The importer GDP per capita variable as well as the exporter GDP per capita yielded significant estimations, and both proved to have positive estimations. This would indicate that a population decrease would increase the unit value of imported goods in the case of intra-African trade. The GDP per capita variables seem to capture a larger effect than expected which could indicate a problem with unobserved heterogeneity, where it might capture the effect of another variable.

Common currency and shared border both yielded significant estimations with the expected sign. This is in line with previous research and economic theory as the variables are seen as stimulants to trade and should therefore have a negative effect on the unit value. Contrary to their effect, the landlocked and distance variable also yielded significant estimations with the expected sign. Since these variables are considered barriers to trade, they should have a positive effect on the unit value of goods, which they were found to have.

The RTA variable and common colonizer coefficients did not yield expected signs as they were positive, implying that sharing an RTA or a common colonizer raises the unit value of imports. This result contradicts previous research as sharing an RTA and colonizer usually is proven to

increase trade, which should have a negative effect on the unit value of the traded goods. The reason for this deviation is not determined; it could be that the variables capture bilateral effects that are not covered by the variables included in the regression or that increased trade flows do not result in lower unit values in the authors' sample.

Common language was the only variable that did not yield a significant estimation. The reason for the insignificance is ambiguous but could be explained by the previously mentioned bias in the data towards larger economies. This could offset the stimulating effect common language is found to have in other studies, since the larger economies could be more attractive to trade with despite not sharing a language.

The most interesting result of the regression was the estimation of the chosen trade facilitation variable. Time to import yielded a significant estimation as well as the expected sign. The result indicated that a 1 percent improvement in trade facilitation would result in a 0,027 percent decrease in the unit value of imported goods. This indeed indicates that time to import constitutes a significant price barrier to intra-African traded goods and that improvements in trade facilitation could be instrumental in reducing this barrier.

To test the robustness of the data, the authors ran a regression with cost to import as the trade facilitation variable. The test estimates were in line with the time to import regression, where the estimations yielded the same signs and still maintained their significance. The size of the effects of the variables were also found to be similar. The cost to import variable was found to be insignificant. The result would indicate that cost to import does not have a significant effect on the unit value of imported goods, which is a confounding result. Since cost to import is a direct trade cost, it is not estimated to yield as significant welfare effects as reductions in time to import would have, which could explain this result.

This is an interesting result indicating that time to import as a trade facilitation measure constitute significant trade costs. This also implies that reductions in time to import could remove a significant trade barrier, while reducing the cost to import will not.

Table 4, Regression results from trade facilitations effect on the unit value of imported goods[4]

Variable	Beta coefficient	Beta coefficient	Dependent variable: Unit value of imported good
	Time to import regression	Cost to import regression	
GDP (Importer)	0.055***	0.061***	
	(0.000)	(0.000)	
GDP (Exporter)	-0.040***	-0.041***	
	(0.000)	(0.000)	
GDP per capita (Importer)	0.220***	0.205***	
	(0.000)	(0.000)	
GDP per capita (Exporter)	0.145***	0.144***	
	(0.000)	(0.000)	
RTA Dummy	0.108***	0.121***	
	(0.000)	(0.000)	
Common currency	-0.337***	-0.348***	
	(0.000)	(0.000)	
Common border	-0.120***	-0.133***	
	(0.000)	(0.000)	
Common Language	0.001	0.000	
	(0.963)	(0.982)	
Common Colonizer	0.072***	0.085***	
	(0.000)	(0.000)	
Landlocked Importer	0.177***	0.164***	
	(0.000)	(0.000)	
Landlocked Exporter	0.124***	0.120***	
	(0.000)	(0.000)	
Bilateral Distance	0.252***	0.255***	
	(0.000)	(0.000)	
Time to import	0.027***	N/A	
	(0.000)		
Cost to import	N/A	0.007	
		(0.591)	
Observations	70 516	70 516	
Adjusted R-squared	0.1089	0.1092	
Product fixed effects	YES	YES	
Robust standard errors	YES	YES	

Source: Authors' model

[4] *** = indicates that the variable is significance at a 1% level, ** = significance at a 5% level, * = significance at a 10% level and no star indicates that variable is insignificant. P-values are reported in parentheses under each variable.
All the continuous variables such as distance, time to import, cost to import, GDP and GDP per capita have been log-transformed, whereas the dummy variables have not.

To fully reach results and analyzes which can help policy makers in decision making, it can be valuable to analyze how much of a barrier to trade that trade facilitation constitutes on a more disaggregated product level. This can be valuable partly because of the large variation in tariff levels across different products and product categories, but also because of the differences in how much time to import can be a trade barrier between different types of products. When reaching more disaggregated product level results, policy makers can, based on these results, control for what barriers are the largest for their country and their imports and make decisions based on this information.

To reach these more detailed results, estimating the barrier to trade time to import can constitute on a specific type of goods, requires adding dummies for different types of products. When traded goods were divided into product chapters on the HS2-level, 96 dummies were created, one for each product chapter and then interacted with the trade facilitation variable. The regression results when adding these interaction variables to the model are presented in Table 5 below. The results for all variables are presented in Table A.2 in the appendix. The regression shows that merely two of the interaction variables give a significant result. The first variable that showed a significant result was product dummy 41, containing products within the category “Raw hides and skins (other than furskins) and leather”, significant on a 10 percent level with a p-value of 0,089. The other variable that showed a significant result was product dummy 43, consisting of products within the category “Furskins and artificial fur; manufactures thereof”, significant on a 5 percent level with a p-value of 0,002. Even though two interaction variables showed significant results, the time to import variable, representing the reference group, was not significant. This is an interesting result indicating that decreased time to import does not have significantly different impacts on the unit value of different imported goods.

Table 5, Regression results from the authors' model, on disaggregated product levels[5]

Variable	Beta coefficient	Beta coefficient	Dependent variable: Unit value of imported good
	Product chapter regression	Product section regression	
GDP (Importer)	0.056***	0.055***	
	(0.000)	(0.000)	
GDP (Exporter)	-0.041***	-0.041***	
	(0.000)	(0.000)	
GDP per capita (Importer)	0.222***	0.222***	
	(0.000)	(0.000)	
GDP per capita (Exporter)	0.144***	0.146***	
	(0.000)	(0.000)	
RTA Dummy	0.109***	0.110***	
	(0.000)	(0.000)	
Common currency	-0.334***	-0.337***	
	(0.000)	(0.000)	
Common border	-0.120***	-0.119***	
	(0.000)	(0.000)	
Common Language	-0.002	-0.002	
	(0.896)	(0.919)	
Common Colonizer	0.072***	0.074***	
	(0.000)	(0.000)	
Landlocked Imp	0.177***	0.179***	
	(0.000)	(0.000)	
Landlocked Exp	0.121***	0.124***	
	(0.000)	(0.000)	
Bilateral Distance	0.252***	0.253***	
	(0.000)	(0.000)	
Time to import	0.110	0.021	
	(0.501)	(0.378)	
Observations	70 516	70 516	
Adjusted R-squared	0.1472	0.1434	
Product fixed effects	YES	YES	
Robust standard errors	YES	YES	

Source: Authors' model

[5] *** = indicates that the variable is significance at a 1% level, ** = significance at a 5% level, * = significance at a 10% level and no star indicates that variable is insignificant. P-values are reported in parentheses under each variable.
All the continuous variables such as distance, time to import, GDP and GDP per capita have been log-transformed, whereas the dummy variables have not. The product dummies are our trade facilitation measure (time to import) times each dummy.

As a robustness test to see if it was possible to generate more significant results for different types of products, a regression was run on a more aggregated level in which products were grouped and organized in the 21 sections defined by HS 2002, replacing the 96 chapter dummies with 20 new, more aggregated product dummies (UN, 2016). The regression and results for relevant variables are presented in Table 5 while the results for all variables are presented in Table A.3 in the appendix. When running this regression, seven interaction variables proved to be significant, more specifically sections 1, 2, 8, 12, 18, 19 and 20. All section descriptions can be found in Table A.5 in the appendix. This could indicate that there would be differences in the effect of improved trade facilitation between different products. Nonetheless, since the variable for trade facilitation is insignificant in the regression, it is not possible to determine that time to import would have different effects on different types of products. Therefore, the result is still interpreted as that there are no product differences, as indicated in earlier regressions.

6.2 Calculating AVEs of import procedures

Earlier regressions did not yield significant estimations of trade facilitation's effect on a product chapter level or a sectoral level, indicating that trade facilitation does not constitute different barriers to different types of products. This implies that the barrier that was calculated on the aggregated level, covering all product types, is the applicable barrier. When calculating AVEs of trade facilitation, the authors therefore used the aggregated barrier effect of trade facilitation from the first regression, which was 0,027 percent across all goods.

Using equation (4) to calculate AVEs of trade facilitation, without the product specific β_{PCD}, requires two variables, the coefficient of trade facilitation and the percentual change in trade facilitation. As previously mentioned, the aggregated trade facilitation coefficient from the first regression was used, and to capture the percentual change in trade facilitation the authors have constructed four case scenarios. To provide an example, if a country would improve its trade facilitation with 100 percent which is multiplied with the effect of trade facilitation, 0,027, it would result in an AVE of trade facilitation of 2,7 percent. This implies that improving a country's trade facilitation with 100 percent is equal to decreasing an applied tariff rate with 2,7 percentage.

Based on the data collected regarding time to import as a trade facilitation measure from DB 2016, it was calculated that to improve from being the worst African performer to reach the average African level, a country must improve its level of trade facilitation with 69 percent. If an African country wants to go from the African average to reach the level of best practice in Africa, it must improve its level of trade facilitation with 97 percent. If a country instead were to improve from being worst to reach best practice it would have to improve its trade facilitation with 99 percent. The fourth case scenario represents if a country would deteriorate its situation and go from average to worst, which implies an increase in time to import with 223 percent. "Worst" in these cases is the worst performer regarding trade facilitation, which in the authors' sample is the Democratic Republic of Congo. "African average" is the simple average level of trade facilitation of all countries in the sample. "Best practice" is the best performer regarding trade facilitation in the authors' sample, which is Botswana.

Table 6, Case scenarios and respective AVEs of trade facilitation

Case scenario	Percentage change	AVE of change in trade facilitation
1. Improving trade facilitation worst to average	-69%	-1.86%
2. Improving trade facilitation from average to best	-97%	-2.61%
3. Improving trade facilitation from worst to best	-99%	-2.67%
4. Deteriorating trade facilitation from average to worst	+223%	+6.02%

Source: Authors' calculations

Scenario 1, which implies a 69 percent decrease in time to import, is a plausible improvement if resources are focused on improving trade facilitation. Ghana managed to achieve this in 4 years, which could be seen previously in this paper, which is a relatively short time span. It is an interesting case to simulate since if trade facilitation would be the policy focus, the African countries could probably replicate this improvement. Scenario 2 and Scenario 3, which implies a 97 and 99 percent decrease in time to import respectively, are unlikely to be achieved in a short time span. To achieve these kinds of improvements major investments must be made into both soft and hard infrastructure, educating border personnel and implementing effective border

procedures, which requires time and aid in form of technical assistance and financing. Nevertheless, it is interesting to simulate how long-term effects of trade facilitation improvements will affect the intra-African trading environment. Scenario 4, which implies a 223 percent increase in time to import, is interesting since it illustrates the size of the trade cost trade facilitation constitutes. Although unlikely, it is not an impossible scenario. Time to import could increase due to threatened national security, where imported goods could suffer increased scrutiny, or due to other policy concerns.

The authors ran a regression of the model from Cadot, Gourdon and van Tongeren (2018), as a robustness test to see if this model could give significant results to calculate AVEs of trade facilitation measures based on shares of world trade, as previously described. The trade facilitation variable gave a significant result. The regression however did not give significant results for the exporter share and importer share variables needed to calculate the AVEs of trade facilitation measures. It would be misleading to use insignificant coefficients in further calculations, which explains why such calculations were not performed in this paper. The result of the regression is presented in Table A.6 in the appendix.

6.3 Comparing import procedures and applied tariffs

To reach useful policy recommendations, the calculated AVE's should be compared to applied tariff rates. This comparison will help to obtain an understanding of what policy option removes the greatest trade barrier. Since no product level differences were found, the most aggregated level of applied tariffs is used in the comparison. The most aggregated level is the average of all applied tariffs covering all products. This tariff data is obtained for all bilateral pairs according to the authors' sample, therefore covering data for intra-African trade. Data for the applied tariffs did not provide full coverage of all observations but was applicable to 11 164 out of 70 516 observations in the sample. This can be considered a significant amount and the authors argue that this data is sufficient to capture the average applied tariff on intra-African trade. The simple average of the applied tariff rate in the authors' sample was 6,42 percent. The case used to calculate how tariff reductions would affect the unit value is the agreed upon 90 percent reduction proposed in the AfCFTA. The comparison is presented below in Table 7.

Table 7, Comparison of AVEs of trade facilitation to applied tariff rate

Case scenario	Barrier effect
1. Improving trade facilitation worst to average	-1.86%
2. Improving trade facilitation from average to best	-2.61%
3. Improving trade facilitation from worst to best	-2.67%
4. Deteriorating trade facilitation from average to worst	+6.02%
Tariff reduction of 90%	-5.76%

Source: Authors' calculations

The comparison should be viewed with a conservative approach since the estimated effects of trade facilitation are not the exact quantitative effects. As can be seen by the comparison, tariff reduction has the greatest decreasing effect on unit values of intra-African traded goods. The reduction of applied tariffs is substantial in the AfCFTA promising significant welfare effects, but the result also indicates that trade facilitation constitutes a significant trade cost. Scenario 1 which was the most feasible improvement, is estimated to remove a relatively small barrier compared to the other scenarios. Scenario 2 implied that a country had to improve its trade facilitation with 97 percent which has roughly half the effect of the 90 percent tariff reduction. Even if the scenario is unlikely to be achieved in a short time span, it still indicates that long-term improvements in trade facilitation promise a significant decrease in the unit value of intra-African traded goods. Scenario 3 resulted in similar effects as scenario 2. Nevertheless, the result indicates that the tariff reduction constitutes a larger removal of trade barriers, given the comparison to the AVEs of trade facilitation. The result of the deteriorating trade facilitation case indicated that if a country's trade facilitation was to decrease with 223 percent, it would be roughly equal to applying an average 6,02 percent tariff across all products. This highlights the importance of maintaining good trade facilitation as increases in time to import raises trade costs significantly, and it also effectively illustrates the size of the trade cost poor trade facilitation can constitute.

7. Conclusion

This thesis sought to address the question if tariffs or trade procedures represented the highest barriers to trade in the context of intra-African trade. With limited time, resources and many policy options available, this can help policymakers decide which policy option to prioritize. In the regression without product specific dummies performed in this paper the trade facilitation variable, time to import, was found to have a significant effect on the unit values of imports. This result is comparable with previous research which has found that time to import has a significant positive effect on the price of imported goods (Hummels & Schaur, 2013). In this study, the effect of trade facilitation improvements was estimated to that a 1 percent decrease in time to import leads to a 0,027 percent decrease in the average unit value of imports across all product categories. The effect is equal to a reduction of average applied tariffs of 0,027 percent. When running regressions to estimate trade facilitation effects on specific chapters and sectors of goods, no significant trade facilitation effect was captured. This indicates that decreasing the time to import does not have different effects on the unit values of different types of products.

Based on the calculations of AVEs of trade facilitation and the comparison to applied tariffs, the authors can conclude that AfCFTA will bring benefits to the intra-African trading environment, promising both substantial tariff reductions and improvements in trade facilitation. The interpretation should be carefully approached however and not compared to tariffs applied to specific products since it could be misleading. It is important to consider that not all products have tariffs and an overall tariff reduction will therefore only affect products that currently have tariffs. Improvements in trade facilitation on the other hand affects all products, regardless of whether there is a tariff on the specific product.

In a policy decision applying to all products, the result concludes that reducing tariffs should be the main focus for policymakers. However, the result also indicates that poor trade facilitation constitutes trade costs which should be addressed when resources to implement trade facilitation measures are available. The cost to implement trade facilitation measures is important to take into consideration, as well as the additional benefits trade facilitation improvements can generate. There is not a significant amount of research estimating AVEs of trade facilitation, and especially not comparing them to applied tariff levels, implying that there is still a lot of research

to be done within the area. Since this paper is one of the first contributors within the area, the result is relevant and indicates that improvements in trade facilitation have significant welfare effects by lowering prices on imported goods.

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Appendix

A.1, Importers and exporters covered in data

Importer		Exporter	
Algeria	Zimbabwe	Algeria	Lesotho
Benin		Angola	Liberia
Botswana		Benin	Madagascar
Burkina Faso		Botswana	Malawi
Cape Verde		Burkina Faso	Mali
Central African Rep.		Burundi	Mauritania
Ethiopia		Cameroon	Mauritius
Gambia		Cape Verde	Morocco
Ghana		Central African Rep.	Mozambique
Madagascar		Chad	Namibia
Mali		Comoros	Niger
Mauritania		Congo	Nigeria
Mauritius		Cote d´Ivoire	Rwanda
Morocco		Djibouti	Sao Tome and Principe
Namibia		Egypt	Senegal
Niger		Equatorial Guinea	Seychelles
Sao Tome and Principe		Eritrea	Sierra Leone
Senegal		Eswatini	Somalia
Seychelles		Ethiopia	South Africa
Sierra Leone		Gabon	Tanzania
South Africa		Gambia	Togo
Tanzania		Ghana	Tunisia
Togo		Guinea	Uganda
Tunisia		Guinea-Bissau	Zambia
Uganda		Kenya	Zimbabwe

Source: Authors´ data

A.2, Result from authors' model, for all product chapters

Variable	Beta coefficient	P values	Variable	Beta coefficient	P values
GDP (Importer)	0.056***	0.000	Chapter 44	-0.028	0.866
GDP (Exporter)	-0.041***	0.000	Chapter 45	0.208	0.290
GDP per capita (Importer)	0.221***	0.000	Chapter 46	-0.249	0.153
GDP per capita (Exporter)	0.144***	0.000	Chapter 47	-0.078	0.817
RTA	0.110***	0.000	Chapter 48	-0.102	0.537
Common currency	-0.334***	0.000	Chapter 49	-0.032	0.851
Common border	-0.121***	0.000	Chapter 50	0.224	0.188
Common language	-0.002	0.896	Chapter 51	0.051	0.798
Common colonizer	0.072***	0.000	Chapter 52	-0.198	0.235
Landlocked Imp	0.177***	0.000	Chapter 53	-0.220	0.218
Landlocked Exp	0.121***	0.000	Chapter 54	-0.275	0.106
Distance	0.252***	0.000	Chapter 55	-0.211	0.207
Time to import	0.110	0.501	Chapter 56	-0.266	0.122
Chapter 01	0.034	0.845	Chapter 57	-0.243	0.154
Chapter 02	-0.122	0.460	Chapter 58	-0.101	0.548
Chapter 03	-0.268	0.111	Chapter 59	-0.049	0.780
Chapter 04	-0.124	0.458	Chapter 60	-0.059	0.732
Chapter 05	-0.103	0.668	Chapter 61	-0.070	0.671
Chapter 06	0.126	0.522	Chapter 62	-0.081	0.621
Chapter 07	-0.203	0.221	Chapter 63	-0.093	0.573
Chapter 08	-0.155	0.348	Chapter 64	-0.192	0.244
Chapter 09	-0.237	0.156	Chapter 65	-0.160	0.347
Chapter 10	-0.150	0.404	Chapter 66	-0.088	0.598
Chapter 11	-0.101	0.549	Chapter 67	-0.038	0.822
Chapter 12	-0.040	0.814	Chapter 68	-0.025	0.882
Chapter 13	-0.098	0.572	Chapter 69	-0.068	0.682
Chapter 14	0.040	0.835	Chapter 70	-0.081	0.629
Chapter 15	-0.143	0.394	Chapter 71	-0.119	0.497
Chapter 16	-0.113	0.499	Chapter 72	-0.067	0.685
Chapter 17	-0.181	0.287	Chapter 73	-0.020	0.906

A.2 Continued

Variable	Beta coefficient	P-value	Variable	Beta coefficient	P-value
Chapter 18	-0.191	0.276	Chapter 74	-0.064	0.699
Chapter 19	-0.099	0.552	Chapter 75	0.234	0.456
Chapter 20	-0.124	0.453	Chapter 76	-0.070	0.676
Chapter 21	-0.095	0.577	Chapter 77	N/A	N/A
Chapter 22	-0.141	0.404	Chapter 78	0.045	0.826
Chapter 23	-0.101	0.553	Chapter 79	0.031	0.862
Chapter 24	-0.095	0.598	Chapter 80	-0.007	0.967
Chapter 25	-0.102	0.549	Chapter 81	-0.196	0.317
Chapter 26	-0.024	0.904	Chapter 82	-0.135	0.418
Chapter 27	-0.058	0.727	Chapter 83	-0.047	0.778
Chapter 28	-0.004	0.979	Chapter 84	-0.043	0.795
Chapter 29	-0.075	0.651	Chapter 85	-0.061	0.711
Chapter 30	-0.028	0.870	Chapter 86	-0.024	0.898
Chapter 31	-0.033	0.845	Chapter 87	-0.060	0.716
Chapter 32	-0.096	0.566	Chapter 88	-0.101	0.616
Chapter 33	-0.115	0.490	Chapter 89	-0.056	0.749
Chapter 34	-0.136	0.416	Chapter 90	-0.006	0.973
Chapter 35	-0.057	0.759	Chapter 91	0.147	0.398
Chapter 36	-0.082	0.653	Chapter 92	-0.275	0.111
Chapter 37	-0.223	0.232	Chapter 93	0.056	0.775
Chapter 38	-0.078	0.642	Chapter 94	-0.143	0.389
Chapter 39	-0.089	0.591	Chapter 95	-0.173	0.293
Chapter 40	-0.091	0.582	Chapter 96	-0.123	0.464
Chapter 41	-0.329*	0.089	Chapter 97	N/A	N/A
Chapter 42	-0.120	0.467			
Chapter 43	-0.570**	0.002			

Source: Authors´ model

A.3, Results from robustness test, product sections

Variable	Beta coefficient	P values	Variable	Beta coefficient	P values
GDP (Importer)	0.055***	0.000	Product Section 5	0.003	0.540
GDP (Exporter)	-0.041***	0.000	Product Section 6	0.003	0.378
GDP per capita (Importer)	0.222***	0.000	Product Section 7	0.001	0.854
GDP per capita (Exporter)	0.145***	0.000	Product Section 8	-0.014	0.007
RTA	0.109***	0.000	Product Section 9	0.005	0.176
Common currency	-0.336***	0.000	Product Section 10	0.001	0.822
Common border	-0.119***	0.000	Product Section 11	-0.004	0.261
Common language	-0.001	0.926	Product Section 12	-0.009	0.013
Common colonizer	0.073***	0.000	Product Section 13	0.005	0.280
Landlocked Imp	0.178***	0.000	Product Section 14	-0.009	0.265
Landlocked Exp	0.124***	0.000	Product Section 15	0.004	0.288
Distance	0.253***	0.000	Product Section 16	0.004	0.247
Time to import	0.024	0.320	Product Section 17	0.004	0.331
Product Section 1	-0.008	0.058	Product Section 18	0.008	0.040
Product Section 2	-0.008	0.026	Product Section 19	0.024	0.082
Product Section 3	-0.007	0.223	Product Section 20	-0.007	0.082
Product Section 4	-0.004	0.252			

Source: Authors´ model

A.4, Product chapter descriptions HS2002

Chapter number	Product description	HS-6 interval	Chapter number	Product description	HS-6 interval
01	Live animals	010000-019999	**50**	Silk	500000-509999
02	Meat & Edible meat offal	020000-029999	**51**	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	510000-519999
03	Fish & Crustaceans	030000-039999	**52**	Cotton	520000-529999
04	Dairy, Eggs, Honey & Ed, products	040000-049999	**53**	Vegetable textile fibres; paper yarn and woven fabrics of paper yarn	530000-539999
05	Animal originated products; not elsewhere specified or included	050000-059999	**54**	Man-made filaments; strip and the like of man-made textile materials	540000-549999
06	Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage	060000-069999	**55**	Man-made staple fibres	550000-559999
07	Vegetables and certain roots and tubers; edible	070000-079999	**56**	Wadding, felt and nonwovens, special yarns; twine, cordage, ropes and cables and articles thereof	560000-569999
08	Fruit and nuts, edible; peel of citrus fruit or melons	080000-089999	**57**	Carpets and other textile floor coverings	570000-579999
09	Coffee, tea, mate and spices	090000-099999	**58**	Fabrics; special woven fabrics, tufted textile fabrics, lace, tapestries, trimmings, embroidery	580000-589999
10	Cereals	100000-109999	**59**	Textile fabrics; impregnated, coated, covered or laminated; textile articles of a kind suitable for industrial use	590000-599999
11	Products of the milling industry; malt, starches, inulin, wheat gluten	110000-119999	**60**	Fabrics; knitted or crocheted	600000-609999
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants; straw and fodder	120000-129999	**61**	Apparel and clothing accessories; knitted or crocheted	610000-619999
13	Lac; gums, resins and other vegetable saps and extracts	130000-139999	**62**	Apparel and clothing accessories; not knitted or crocheted	620000-629999
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included	140000-149999	**63**	Textiles, made up articles; sets; worn clothing and worn textile articles; rags	630000-639999
15	Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes	150000-159999	**64**	Footwear; gaiters and the like; parts of such articles	640000-649999
16	Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof	160000-169999	**65**	Headgear and parts thereof	650000-659999
17	Sugars and sugar confectionery	170000-179999	**66**	Umbrellas, sun umbrellas, walking-sticks, seat sticks, whips, riding crops; and parts thereof	660000-669999
18	Cocoa and cocoa preparations	180000-189999	**67**	Feathers and down, prepared; and articles made of feather or of down; artificial flowers; articles of human hair	670000-679999
19	Preparations of cereals, flour, starch or milk; pastrycooks' products	190000-199999	**68**	Stone, plaster, cement, asbestos, mica or similar materials; articles thereof	680000-689999

20	Preparations of vegetables, fruit, nuts or other parts of plants	200000-209999	**69**	Ceramic products	690000-699999
21	Miscellaneous edible preparations	210000-219999	**70**	Glass and glassware	700000-709999
22	Beverages, spirits and vinegar	220000-229999	**71**	Natural, cultured pearls; precious, semi-precious stones; precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin	710000-719999
23	Food industries, residues and wastes thereof; prepared animal fodder	230000-239999	**72**	Iron and steel	720000-729999
24	Tobacco and manufactured tobacco substitutes	240000-249999	**73**	Iron or steel articles	730000-739999
25	Salt; sulphur; earths, stone; plastering materials, lime and cement	250000-259999	**74**	Copper and articles thereof	740000-749999
26	Ores, slag and ash	260000-269999	**75**	Nickel and articles thereof	750000-759999
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes	270000-279999	**76**	Aluminium and articles thereof	760000-769999
28	Inorganic chemicals; organic and inorganic compounds of precious metals; of rare earth metals, of radio-active elements and of isotopes	280000-289999	**77**	(No description)	770000-779999
29	Organic chemicals	290000-299999	**78**	Lead and articles thereof	780000-789999
30	Pharmaceutical products	300000-309999	**79**	Zinc and articles thereof	790000-799999
31	Fertilizers	310000-319999	**80**	Tin; articles thereof	800000-809999
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints, varnishes; putty, other mastics; inks	320000-329999	**81**	Metals; not elsewhere classified, cermets and articles thereof	810000-819999
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations	330000-339999	**82**	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof, of base metal	820000-829999
34	Soap, organic surface-active agents; washing, lubricating, polishing or scouring preparations; artificial or prepared waxes, candles and similar articles, modelling pastes, dental waxes and dental preparations with a basis of plaster	340000-349999	**83**	Metal; miscellaneous products of base metal	830000-839999
35	Albuminoidal substances; modified starches; glues; enzymes	350000-359999	**84**	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof	840000-849999
36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations	360000-369999	**85**	Electrical machinery and equipment and parts thereof; sound recorders and reproducers; television image and sound recorders and reproducers, parts and accessories of such articles	850000-859999

37	Photographic or cinematographic goods	370000-379999	**86**	Railway, tramway locomotives, rolling-stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electro-mechanical) traffic signalling equipment of all kinds	860000-869999
38	Chemical products not elsewhere classified	380000-389999	**87**	Vehicles; other than railway or tramway rolling stock, and parts and accessories thereof	870000-879999
39	Plastics and articles thereof	390000-399999	**88**	Aircraft, spacecraft and parts thereof	880000-889999
40	Rubber and articles thereof	400000-409999	**89**	Ships, boats and floating structures	890000-899999
41	Raw hides and skins (other than furskins) and leather	410000-419999	**90**	Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus; parts and accessories	900000-909999
42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)	420000-429999	**91**	Clocks and watches and parts thereof	910000-919999
43	Furskins and artificial fur; manufactures thereof	430000-439999	**92**	Musical instruments; parts and accessories of such articles	920000-929999
44	Wood and articles of wood; wood charcoal	440000-449999	**93**	Arms and ammunition; parts and accessories thereof	930000-939999
45	Cork and articles of cork	450000-459999	**94**	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere classified; illuminated signs, illuminated name-plates and the like; prefabricated buildings	940000-949999
46	Manufactures of straw, esparto or other plaiting materials; basketware and wickerwork	460000-469999	**95**	Toys, games and sports requisites; parts and accessories thereof	950000-959999
47	Pulp of wood or other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard	470000-479999	**96**	Miscellaneous manufactured articles	960000-969999
48	Paper and paperboard; articles of paper pulp, of paper or paperboard	480000-489999	**97**	Works of art; collectors' pieces and antiques	970000-979999
49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans	490000-499999			

Source: (UN, 2017)

A.5, Section description from HS2002

Section number	Section description	HS-6 interval	Section number	Section description	HS-6 interval
1	Live animals; animal products	010000-059999	**12**	Footwear, headgear, umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof; prepared feathers and articles made therewith; artificial flowers; articles of human hair	640000-679999
2	Vegetable products	060000-149999	**13**	Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware	680000-709999
3	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	150000-159999	**14**	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewellery; coin	710000-719999
4	Prepared foodstuffs: Beverages, spirits and vinegar; Tobacco and manufactured tobacco substitutes	160000-249999	**15**	Base metals and articles of base metal	720000-839999
5	Mineral products	250000-279999	**16**	Machinery and mechanical appliances; electrical equipment; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	840000-859999
6	Products of the chemical or allied industries	280000-389999	**17**	Vehicles, aircrafts, vessels and associated transport equipment	860000-899999
7	Plastics and articles thereof; Rubber and articles thereof	390000-409999	**18**	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof	900000-929999
8	Raw hides and skins, leather, furskins and articles thereof; Saddlery and harness; travel goods, handbags and similar containers; articles of animal gut	410000-439999	**19**	Arms and ammunition; parts and accessories thereof	930000-939999
9	Wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw, of esparto or of other plaiting material; basketware and wickerwork	440000-469999	**20**	Miscellaneous manufactured articles	940000-969999
10	Pulp of wood or of other fibrous cellulosic material; recovered paper or paperboard; paper and paperboard and articles thereof	470000-499999	**21**	Works of art, collectors' pieces and antiques	970000-989999
11	Textiles and textile articles	500000-639999			

Source: (UN, 2016)

A.6, Regression results from Cadot, Gourdon and van Tongeren's model[6]

Variable	Beta coefficient	Dependent variable: Unit value of imported good
GDP (Importer)	0.049*** (0.000)	
GDP (Exporter)	-0.038*** (0.000)	
GDP per capita (Importer)	0.216*** (0.000)	
GDP per capita (Exporter)	0.134*** (0.000)	
RTA Dummy	0.089*** (0.000)	
Common currency	-0.312*** (0.000)	
Common border	-0.105*** (0.000)	
Common Language	-0.020 (0.248)	
Common Colonizer	0.077*** (0.000)	
Landlocked Importer	0.171*** (0.000)	
Landlocked Exporter	0.135*** (0.000)	
Bilateral Distance	0.250*** (0.000)	
Time to import	0.033*** (0.000)	
Importer share	-0.088 (0.644)	
Exporter share	-0.080 (0.307)	
Observations	56 441	
Adjusted R-squared	0.1080	
Product fixed effects	YES	
Robust standard errors	YES	

Source: Authors' calculations

[6] *** = indicates that the variable is significance at a 1% level, ** = significance at a 5% level, * = significance at a 10% level and no star indicates that variable is insignificant. P-values are reported in parentheses under each variable.
All the continuous variables such as distance, time to import, GDP and GDP per capita have been log-transformed, whereas the dummy variables have not.