Boosting Intra-Africa Trade: Analysis of Alternative Trade Liberalization Policies.

HABTAMU SHIFERAW AMOGNE

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神戸大学大学院経済学研究科

経済学専攻

指導教員　萩原　泰治

Habtamu Shiferaw Amogne

博　士　論　文

Boosting Intra-Africa Trade: Analysis of Alternative Trade Liberalization Policies in Africa

（アフリカ域内貿易の促進：貿易自由化のための代替的政策の分析）

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List of Abbreviation

ACP	African Caribbean and Pacific
AGOA	African Growth Opportunity Act
CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
CET	Common External Tariff
CFTA	Continental Free Trade Area
COMESA	Common Market for Eastern and Southern Africa
EAC	East African Community
EBA	Everything But Arms
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EPA	European Partnership Agreement
GSP	Generalized System of Preferences
GTAP	Global Trade Analysis Project
MacMap	Market Access Map
MENA	Middle East and North Africa
MERAGE	Modeling International Relationships in Applied General Equilibrium
MERCOSUR	Mercado Común del Sur
NAFTA	North American Free Trade Agreement
OECD	Organization for Economic Cooperation and Development
REC	Regional Economic Communities
RTA	Regional Trade Agreements
SADC	Southern African Development Community
SSA	Sub Saharan Africa
TASTE	Tariff Analytical and Simulation Tool for Economists
TFA	Trade Facilitation Agreement
TFIs	Trade Facilitation Indicators
TFTA	Tripartite Free Trade Area
WITS	World Integrated Trade Solution
WTO	World Trade Organization

Chapter 1

1. Introduction

1.1. Regionalism in Africa

Regionalism refers to the efforts of a group of countries to enhance their economic, political, social, or cultural interactions (Lee, 2002). It can take different forms, including regional cooperation, economic (market) integration, development integration, and regional integration. Regionalism in Africa can be seen as modeled around the concepts of geographical closeness, the sharing of a common border, and political collaboration through economic cooperation (ECA, 2006). Moreover, the literature on regionalism can be divided into two categories: Rationalist and Ideational (Fjäder, 2012). According to rationalist ideology, material interdependency is the main driving force behind integration. However, for "Ideational," or Social Constructivist approach, shared regional identity and culture are driving forces that produce levels of "cognitive interdependence. For example, members of Arab Maghreb Union (AMU) in Africa have very strong geographical, religious, socio-cultural, and language affinities or similarities, which is one typical example for a social constructivist approach to establishing regional integration. Regionalism in Africa can also be explained with the rationalist's ideology of neorealism and neoliberalism. This ideology emphasis on national interest, security, and power politics for the emergence of regions and suggests that regional integration may be formed as a response to such external threats. The primary objective of the Organization of African Union (OAU) was ensuring security and sovereignty and promoting the unity and solidarity of its members, which is similar to the ideology of neorealism. Moreover, neoliberalism has also been at the forefront of economic policies in Africa, and its countries' membership in the WTO is an excellent example of neoliberalism (Lee, 2002). Besides, the vast majority of present-day regionalist schemes in Africa are founded on the notion that the regional economic integration project should be market driven and outward looking (Söderbaum, 2004).

Economic integration is characterized by the absence of discrimination in various areas. Economic integration includes various forms of integration such as a free trade area, customs union, common market, economic union, and total economic integration (Balassa, 1961). In a free-trade area, tariffs are removed between the participating countries, but each country retains its own tariffs against non-members. In a customs union, there is a free trade area among member countries, and member states impose a Common External Tariff (CET) against non-member states. In a common market, the customs union remains in place along with the free flow of the factors of production (capital and labor). Economic union as distinct from a common market consists of a common market along with the harmonization of monetary and fiscal policies. Finally, total economic integration consists of a common market along with the unification of monetary and fiscal policies.

The history of regional economic integration in Africa dates back to the colonial period, where many African countries use cross-border arrangements such as African Financial Community franc, CFA franc, which comprises the West African CFA franc and the Central African CFA franc. Regionalism has been pursued to enhance political unity (Pan-African Agenda) and two foster growth and development. The main industrialization strategy undertakes by most African countries were inward-looking and relied on import substitution industrialization strategy. By aiming to protect the domestic industries, most countries impose high protection on cheap and efficient products from abroad. The inward-looking strategy did not achieve its intended objective of increasing intra-regional trade partially because member countries produced similar products and therefore they did not have comparative advantages. Besides, there were substantial tariff and non-tariff barriers to trade (Lee, 2002). In mid-1980, most African countries adopt an outward-oriented strategy and implement the Structural Adjustment Program (SAP). The SAP was directed into three axes (Reform of the public sector, devaluation, and elimination of marketing boards) and had to be wholly applied by leaders to receive this “controversial’’ aid from IMF and World Bank. However, the structural adjustments programs pursued on the continent have generally not yielded the desired or expected results, and the industrial

sectors of parts of the continent have also suffered from its effects (Commission for Africa, 2005).

A new stage in the history of African regional integration inaugurated in Abuja, on 3 June 1991.[1] The Abuja treaty stresses the importance of creating the African Economic Community (AEC) through coordination, harmonization, and progressive integration of the activities of RECs by 2027. When AEC is completed, there will be common currency, full mobility of the factors of production, and free movement of goods and services among African countries. However, the treaty was criticized in many aspects. First, there was a lack of faith in the sequencing of the phases. Second, the treaty was too ambitious. Third, the treaty is a carbon copy of the European Union's blueprint (Cheru 2002). Moreover, the treaty did not take sufficient account of the actual political, economic and cultural realities of the African continent. Hence, the implementation of the Abuja treaty was very slow. In 2001, African Union (AU) and New Partnership for African Development (NEPAD) were established to strengthen the cooperation among African countries and fasten the implementation of the treaty. In 2012, members of AU recommended taking action to boost intra-Africa trade and advancing the establishment of the Continental Free Trade Area (CFTA).

Although many regional trade communities are established among African countries, most African countries are not benefiting from the existing trade agreements. The main challenge of economic integration in Africa is overlapping of the existing regional trade agreements, low intra-Africa trade, lack of complementary across regional economic communities, lengthy negotiation process, uneven signing, ratification and implementation, and uneven interest in the provisions of protocols. The regional trade communities in Africa are overlapping with each other. From the figure 1.1, we can see that most African countries are a member of more than one regional economic community. The overlapping of integration agreements is the manifestation of several points, but the most important in this regard is the lack of coherence in the integration process, something which was

[1] https://au.int/sites/default/files/treaties/7775-treaty-0016_-_treaty_establishing_the_african_economic_community_e.pdf

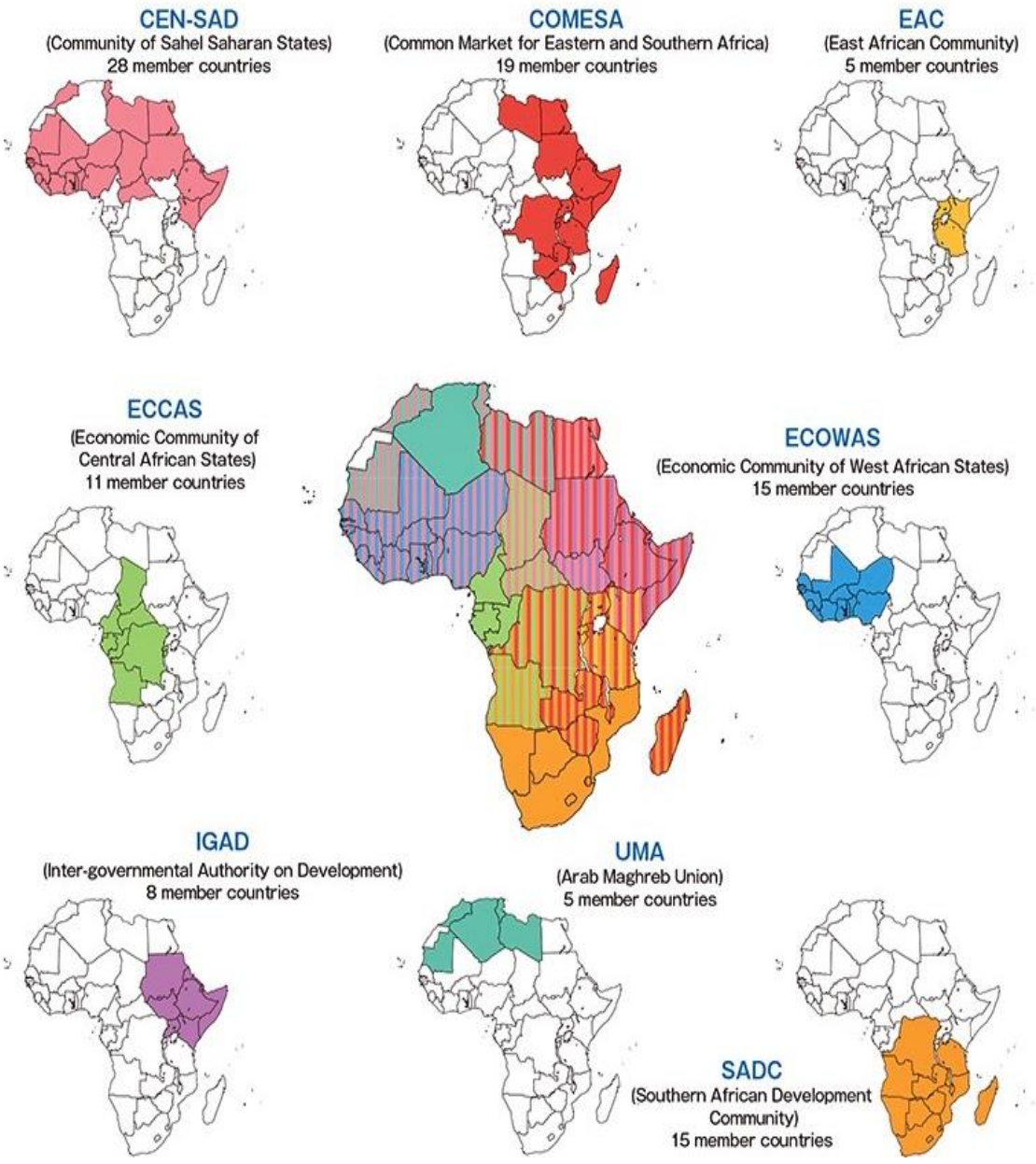
supposed to be championed by the African Union Commission. As a result, multiple arrangements and institutions, as well as overlapping membership in the same region, tend to confuse integration goals and lead to counterproductive competition between countries and institutions (ECA, 2008).

According to Olubomehin and Kwawonishe (2004), there are many factors that have contributed to the low volume of intra-African trade. First, the fact that most African countries produce raw materials for which there is virtually no demand elsewhere in Africa. Second, often only a few commodities make up the bulk of exports to the rest of the continent. Third, the manufacturing sector is not technologically advanced in Africa, and in most countries there are no Private Public Partnerships (PPP), meaning that the private sector is playing a marginal role in the economic integration process. Further, The ECA (2004) supports Olubomehin and Kwawonishe regarding the fact that the main reasons for this include weak inter-sectoral links and a limited range of products in African countries.

Besides, there is also a lack of complementarity across Regional Economic Communities (RECs) regarding trade protocols. Because regions' priorities are different across regional economic communities, each protocol emphasizes different issues. Moreover, all protocols have taken time to conclude, and as a result, these delays have made it difficult to adhere to the provisions of the treaties. Besides, some, if not most, member countries in Africa do not sign or ratify protocols or even submit them timeously. On the other hand, some member countries mainly island countries are not that eager to implement certain protocols. In other cases, countries sign but show less interest and commitment in ratifying protocols, because they stand to benefit less than other parties, or even to lose.

In light of the above challenges to regionalism in Africa, African countries signed the framework to establish a Continental Free Trade Area (CFAT) in 2018. The CFAT is initially signed by 44 of 55 African countries, and if all members of AU sign the agreement, it will be one of the largest free trade area in the world comprising of more than 1.26 billion people and a GDP of more than $2 trillion.

Figure 1-1. The eight regional economic communities approved by AU.



Source: https://www.mofa.go.jp/policy/other/bluebook/2015/html/chapter2/c020701.html

1.2. Organization of the study

The main objective of this thesis is to evaluate the macroeconomic and welfare impact of trade liberalization among African countries through the reduction of tariff barriers, non-tariff measures, and trade facilitation policies. This thesis adapts both econometric and GTAP CGE model to regional trade communities in Africa and conducts three empirical analyses. It measures the benefits and losses of implementing regional trade agreements and investigates the economic and trade liberalization effects of participating in regional trade agreements.

The second chapter is concerned with the analysis of alternative trade liberalization policies on the economies of COMESA countries. The Common Market for Eastern and Southern Africa (COMESA) is a Free Trade Area (FTA) regional trade agreement in Africa. Currently, Ethiopia is negotiating to join COMESA FTA. This study assesses the impact of three regional trade arrangements, COMESA FTA, customs unions, and the European Partnership Agreement (EPA) on the economy of Ethiopia. The analysis is based on a static Global Trade Analysis Project (GTAP) model, version 9 database. The main research questions in this chapter are; Does COMESA FTA has trade creating or trade diversion effect? Which country wins and which one loses from COMESA FTA and customs union? Which regional trade arrangement is welfare improving between COMESA and EU? EPA? Or Customs union? Which regional trade arrangement is welfare improving for Ethiopia? What is the welfare, GDP and trade effect of COMESA FTA, Customs union, and EPA on the economies of Ethiopia? Which sectors in Ethiopia lose and which one gains from the alternative trade arrangement? The results indicate that most COMESA regions win in terms of GDP and welfare, with full FTA among all COMESA regions while for customs unions and the EPA, the results are mixed. Customs unions result in large welfare losses for some countries due to an increase in protection. The world as a whole enjoys welfare gains thanks to the COMESA, FTA and EPA experiment, but world GDP declined slightly. Rwanda, Zambia, and Rest of South Central Africa (RSCA) emerge as the biggest winners in terms of welfare in all experiments. For Ethiopia, the aggregate trade balance improves

more from the customs unions and the EPA than from FTA, but there is large revenue loss. Further, COMESA, customs unions, and the EPA result in net welfare losses for Ethiopia, while COMESA and FTA improve welfare. Therefore, there is no strong reason for Ethiopia to move to the customs union and the EPA in the short run, but it is recommended for Ethiopia to join COMESA FTA.

In the third chapter, we look at the impact of trade facilitation policies on customs clearance time for middle and low-income countries. We use an econometric model to estimate the impact of trade facilitation policies on customs clearance time. Then, the simulation results are used to calculate a counterfactual analysis when the countries move to best practice, geography, and income mean in trade facilitation policies. Further, using the GTAP CGE model, we analyze the welfare and macroeconomic impact of trade facilitation policies. The main research questions are; which trade facilitation policies have a significant impact on time to export and import for border compliance? Which trade facilitation policies have a significant impact on time to export and import for border compliance? By how much time to export /import reduces when middle and low-income countries move to best practice, geography mean and income mean in the significant trade facilitation policies? Does the reduction of customs delay improve the welfare and GDP of the countries? By How Much? Do trade facilitation policies have trade diverting effect? Which regions are benefiting more from trade facilitation policies? The estimation result indicates that both formality documents, and fees and charges have a significant impact on export and import clearance time for documentary compliance, while only formality document significantly reduces border-related compliance. Besides, advance rulings have a significant negative impact on export clearance time for documentary compliance. The CGE result indicates that when countries move to best practice, geography and income mean in the TFPs, there are large welfare and trade gain. The gain is higher for low-income countries with large customs inefficiency. This study recommends the policymakers to strengthen the harmonization of international standards, increase the transparency and regular review of disciplines related to fees and charges, and facilitate the rules and process applied to specific goods as the main policy tool to reduce customs delay.

Finally, the fourth chapter evaluates the impact of three trade liberalization policies namely tariff, non-tariff measures and trade facilitation policies on the economies of African countries. The research questions are; what is the welfare and GDP effect reducing customs delay for African countries? Which country benefits more from reducing customs delay? Which countries win and lose from CFTA? Does the welfare lose/gain increase when African countries implement CFTA with trade facilitation? Which one is better for African countries in terms of welfare and GDP impact? CFTA? Or CCU? Does combining continental customs union with trade facilitation reduces the trade diversion effect? Which one of the three policies have a large impact in terms of welfare and GDP? Does combining continental Free trade area with reductions of customs delay and NTMs has more welfare improving impact than tariff removal only? The result indicates that trade facilitation has large welfare and trade gain for most African countries. The gain in trade facilitation is higher when countries move to best practice than geography and income mean. The estimation result signifies that countries with poor trade facilitation policy would benefit more from the reduction of customs delay. Moreover, the gap between countries exporting and importing time is also an important factor in determining the impacts of reducing customs delay across countries. Similarly, reduction of NTMs by 50% results in large welfare and trade gain, but significant GDP loss across African countries.

The analysis on CFTA shows that most African countries gain in terms of welfare and GDP while Benin, Guinea, Mauritius, and Zimbabwe lose. However, combining a free trade area with a reduction of customs delay and NTMs result in large welfare and GDP gain than tariff removal only. Egypt and South Africa enjoy the highest welfare gain when African free trade area is formed, and customs delay is reduced by moving to geography mean. Similarly, when CFTA is complimented with 50% reduction of NTMs, Tunisia, Benin, Zambia, Botswana, and Namibia gain in terms of welfare and GDP while some lose in both GDP and welfare (e.g., Guinea, Senegal, Ethiopia, and Kenya). Finally, combining trade facilitation and NTMs policy with continental free trade result in large welfare and GDP gain for most African countries. An exception to this trend is Senegal, Ethiopia, and Kenya, which report welfare and GDP loss. We also evaluate the impact of the continental

customs union as African countries are planning to move to customs union once CFTA is finalized. The result shows that some African countries gain in both welfare and GDP (e.g., Tunisia, Benin, Senegal, Togo, and Zambia) while others lose across ass experiments (e.g., Ethiopia, Kenya, Uganda, and Madagascar loses in terms of welfare and GDP). Comparing CCU with CFTA, for some countries, both are welfare improving (e.g., Senegal, Togo, Nigeria, Mozambique, Ruanda, Tanzania, Zambia, Egypt, Morocco, and Tunisia) while for others only CFTA result in welfare gain (e.g., Cote de Ivoire, Ghana, Burkina Faso, Guinea, Ethiopia, Kenya, Madagascar, Malawi, Uganda, Botswana, Namibia, and South Africa).

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Chapter 2

2. A GTAP Model Analysis of the Impact of Alternative Regional Trade Arrangements on the Ethiopian Economy

Chapter summary

The Common Market for Eastern and Southern Africa (COMESA) is a Free Trade Area (FTA) regional trade agreement in Africa. Currently, Ethiopia is negotiating to join COMESA FTA. This study assesses the impact of three regional trade arrangements, COMESA FTA, customs unions, and the European Partnership Agreement (EPA) on the economy of Ethiopia. The analysis is based on a static Global Trade Analysis Project (GTAP) model, version 9 database. Unlike previous studies, the customs union scenarios are designed at the detailed Harmonized System (HS) level. The results indicate that most COMESA regions win in terms of GDP and welfare, with full FTA among all COMESA regions while for customs unions and the EPA experiment, the results are mixed. Moreover, customs union (EXP2) result in large welfare losses for some countries due to an increase in protection. The world as a whole enjoys welfare gains thanks to the COMESA FTA (EXP1) and EPA experiment (EXP3), but world GDP declined slightly with other experiments. Rwanda, Zambia, and Rest of South Central Africa (RSCA) emerge as the biggest winners in terms of welfare in all experiments. For Ethiopia, the aggregate trade balance improves with all experiments except with COMESA FTA (EXP1), but there is significant import revenue loss across all experiments. Further, COMESA customs unions (EXP2) and the EPA (EXP3) result in net welfare losses for Ethiopia, while COMESA FTA (EXP1) improves welfare. Therefore, there is no strong reason for Ethiopia to join the COMESA customs union and reciprocate its tariff with EU through EPA in the short run, but it is recommended for Ethiopia to join COMESA FTA.

2.1. Introduction

Regional trade agreements (RTA) have proliferated around the world in the past two decades, and now virtually all the members of the World Trade Organization (WTO) are party to at least one (Baldwin & Low, 2009). In terms of quantity, there is an increasing trend of RTA formation, although the total number of RTA decreased slightly due to the expansion of existing RTAs. In addition to the quantity increment, Fiorentino et al. (2009) explain the current wave of RTA in four different but related ways. First, there is an increase in North-South RTA, a gradual replacement of the long-established nonreciprocal system of preference, and an increasing number of south-south RTA. Second, there is an increasing number of cross-regional agreements. Third, there is a decreasing propensity for plurilateral RTA and a net increase in the number of bilateral RTA. Fourth, Free Trade Areas (FTA) are more attractive to countries that are committed to comprehensive trade liberalization compared to customs unions and partial scope agreements

Several theoretical explanations are given for the formation and proliferations of RTAs in the form of FTA, customs unions or preferential trade agreements. The probability of FTA formation is higher when the partners are closer geographically, more distant from the rest of the world, larger and more similar in economic size, and further apart regarding per capita incomes (Baier & Bergstrand, 2004). However, countries with similar economic structure but different FTA structure may have different propensities to form new FTAs. Hence, the existing relationship between FTA negotiating countries and third countries also force the two countries to form FTA (Chen & Joshi, 2010). A more recent study further argues that the signing or deepening of one FTA can induce excluded nations to sign new FTA; thus, FTAs are contagious (Baldwin & Jaimovich, 2012).

Empirical studies show that FTA increases member countries bilateral trade through their trade creation effect when a member country's domestic production of an item falls and is displaced by low-cost production by a partner country (Baier and Bergstrand, 2007). However, there is also a trade diversion effect on nonparticipating countries resulting from the issue of rules of origin. Most RTA prepares common external tariffs or forms customs

unions to reduce the trade diversion effect of FTA. Nevertheless, FTA results in more trade diversion than customs unions, while a customs union can never result in more trade diversion than an FTA because of tariff changes. Further, the additional foreign investment may be attracted under customs unions than under FTA. Hence, on welfare grounds, a customs union is always Pareto-superior to an FTA (Krueger, 1997). Although there is more welfare gain associated with customs unions, some countries may not agree to join customs unions in the first place, but the trade-diversion effects of customs union formation can induce those nations that were previously against membership to join, and the economic incentive to join increases with the customs union's size (domino effect of customs unions) (Baldwin, 1993).

African countries established various Regional Economic Communities (REC) in the form of free trade areas, customs unions, and common markets that eventually converged to form the Continental Free Trade Area (CFTA), whereby economic, fiscal, social, and sectoral policies are uniform at the continental level. Common Market for Eastern and Southern Africa (COMESA) is one of the building block regional economic integrations selected by the African Union for the formation of CFTA. Several studies on Africa reveal that regional economic integrations are not sufficient to increase intra-Africa trade, but there is strong evidence of a trade creation effect (Mevel and Karingi 2012; Mureverwi 2016; and Ngepah and Udeagha 2018). There is overall welfare gain from trade liberalization in most African REC, but the country-level welfare effect is unbalanced, and some countries experience welfare loss (Sawkut and Boopen, 2010). The abovementioned studies show that the welfare and trade effects of FTA and customs unions depend on the pre-existing trade share between negotiating countries; the larger the share is, the larger the net trade creation and the smaller the trade diversion effect. The initial tariff rate also has an effect; the larger the pre-existing tariff rate is, the smaller the amount of trade that will be diverted.

The main objective of this chapter is to analyze the impact of tariff reduction under three regional trade arrangements on the economy of Ethiopia. First, Ethiopia is a member of COMESA but not a signatory of the free trade area. Therefore, we evaluate the

macroeconomic and welfare impact of the free trade area between Ethiopia and COMESA member countries. Second, COMESA member countries agreed to levy a Common External Tariff (CET) on non-member countries and form a customs union. Hence, we extend our analysis to the case where Ethiopia joins the COMESA customs union in an operational free trade area. Third, there are ongoing trade negotiations between African countries and the European Union (EU) European Partnership Agreement (EPA) to remove the tariffs imposed by African countries on EU products[2]. Many African policy-makers, business representatives, and Non-Governmental Organizations (NGO) argue that the EPA agenda is too broad and intrusive for African countries. Through the EPA, bigger EU companies could flood the continent with cheaper products, destroying emerging local industries. Additionally, cutting tariffs will lower government revenues that many countries need to invest in certain areas, including agriculture, health, and education (Bilal and Roza, 2007). However, the impact of the EPA differs from country to country depending on trade relations between countries and the existing tariffs levied on imports from the EU (Vollmer, Inmaculada, D, Felicitas, & Nils, 2009). Therefore, it is essential to analyze the economic and welfare impacts of the EPA on the economy of Ethiopia and to make a comparison with the COMESA FTA and customs union. We use static Global Trade Analysis Project (GTAP) Computable General Equilibrium (CGE) model, version 9 database to achieve the three objectives. Besides, the unemployment closure of the model is changed to introduce unemployment in the unskilled labor force for COMESA regions. Further, 140 regions and 57 sectors are aggregated into 18 regions and 18 sectors.

Several studies have been carried out on the COMESA free trade area and customs union. However, an analysis of deep regional integration among COMESA in general, and Ethiopia in particular, is vital for the following reasons. First, Ethiopia is the fourth largest economy in Sub-Saharan Africa (SSA), and the country has an abundant cheap labor force and a market of over 100 million people. Second, the Ethiopian economy is highly protected in Africa by a substantial tariff rate and has very low trade with COMESA

[2] The EPA is a reciprocal free trade agreement between African Caribbean and Pacific (ACP) countries and the EU, and Ethiopia is currently negotiating with the EU to sign the interim-EPA.

countries. Third, from a geopolitical perspective, Ethiopia has a significant place in the Horn of Africa (Mesfin, 2012).

This chapter contributes to the existing literature in the following ways. First, despite several studies on COMESA, there has been little analysis of different regional trade arrangements. In this chapter, an important distinction is made between free trade areas, customs unions and the European Partnership Agreement. Second, unlike previous studies, the COMESA customs union scenarios are designed at the detailed HS6 level. We use the applied tariff protection data from the Market Access Map (MacMap) database and the COMESA common external tariff nomenclature data. Further, we exempted the list of sensitive products submitted by COMESA member countries at the detailed Harmonized System (HS) level from the customs union analysis. Third, we provide the results for ten separate COMESA countries and four aggregated COMESA regions, but particular emphasis is given to Ethiopia, while previous studies' results are more aggregated, which makes it difficult to identify the losers and winners of the alternative trade liberalization scenarios.

A brief description of COMESA member countries' economies is analyzed using social and macroeconomic variables in section 2.2. After that, the protection patterns of COMESA and Ethiopia with other regions are explained using the Tariff Analytical and Simulation Tool for Economists (TASTE) for GTAP 9 database. The analysis focuses on identifying highly protected sectors and the trade relationships among regions. Next, the empirical literature on different regional trade agreements in Africa, particularly between East and South Africa, is reviewed in section 2.3. We explain the model database and simulations in section 2.4. Section 2.5 discusses the macroeconomic and welfare results under different scenarios, and section 2.6 concludes.

2.2. The COMESA Economy: A descriptive exposure

2.2.1. Economic character of COMESA

Demographic differences across countries influence the level and composition of trade, both through their impact on comparative advantages and on patterns of demand. As shown in Table 2-1, Ethiopia, Egypt, and D.R. Congo are the most populated countries, while Seychelles, Djibouti, and Comoros have small populations. Regarding arable land, Sudan and Ethiopia have large surface areas among COMESA member countries.

Table 2-1 further reports the relative size of economies of COMESA member countries measured by Gross Domestic Product (GDP); Egypt, Sudan, Ethiopia, and Kenya are the four largest economies among COMESA member countries. Besides, the GDP per capita of COMESA member countries varies widely and ranges from USD 712 in D.R. Congo to USD 25,172 in Seychelles. The large GDP per capita in Seychelles, Mauritius, and Libya shows the high growth performance in the economies of these countries. Table 2-1, column 5, reports the trade-to-GDP-ratio measured by the sum of exports and imports divided by GDP. This indicator measures a country's 'openness' or 'integration' in the world economy. Trade constitutes 181% of Seychellois's GDP, 114% of Mauritius's GDP, and 147% of Libya's GDP. In contrast, Sudan, Egypt, Ethiopia, Burundi, Rwanda, and Uganda have a relatively small trade-to-GDP ratio – below 50% – suggesting plenty of room to increase openness.

The breakdown of value added by activity indicates a considerable variation of economic structure across COMESA member countries throughout 2010-2014. Agriculture is a dominant sector, with agriculture’s value-added constituting more than 40% for Ethiopia and Burundi. On the other hand, industry sectors account for more than one-quarter of GDP for Swaziland, Egypt, D.R. Congo, Zambia, Zimbabwe, and Mauritius. The value added by the service sector is greater than that of the agriculture and industry sectors for most COMESA member countries except Ethiopia. Overall, the economic characteristics of COMESA member countries are generally diverse, and more trade liberalization in these countries would have a mixed effect.

Table 2-1. Economic character of COMESA region.

Country	Arable Land (000, Hectares)	Population (million., 2014)	GDP (US$ million, 2014)	GDP per capita (in US$, 2014) at PPP	Trade, (as % of GDP) (2014)	Average Value added (As % of GDP) (2010 - 2014)		
						Agri.	Ind.	Svces.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Burundi	1200.00	10.80	7944.82	734.48	41.31	40.09	17.31	42.60
Comoros	65.00	0.80	1049.93	1363.56	79.92	38.24	11.57	50.19
D.R.Congo	7100.00	74.90	53238.84	711.52	80.06	22.76	33.71	43.53
Djibouti	2.00	0.90	2733.70	3120.04	N.A	N.A	N.A	N.A
Egypt	2738.00	89.60	900147.80	10045.78	37.41	12.34	38.37	49.29
Eritrea	690.00	5.10	N.A	N.A	N.A	N.A	N.A	N.A
Ethiopia	15119.00	97.00	138728.89	1430.8	40.74	44.84	11.50	43.66
Kenya	5800.00	44.90	126449.16	2818.26	51.12	29.18	20.36	50.46
Libya	1720.00	6.30	93133.61	14879.99	147.58	N.A	N.A	N.A
Madagascar	3500.00	23.60	32308.91	1373.19	69.38	27.24	16.24	56.52
Malawi	3800.00	16.70	18611.30	783.83	73.40	31.07	16.20	52.74
Mauritius	75.00	1.30	22365.09	17730.90	114.57	3.40	25.11	71.49
Rwanda	1182.50	11.30	17975.00	1584.21	46.17	32.96	14.18	52.83
Seychelles	0.08	0.10	2303.93	25172.44	181.29	2.24	13.23	68.59
Sudan	17220.00	39.40	152767.42	3882.25	19.12	27.44	23.90	48.66
Swaziland	175.00	1.30	10039.74	7910.84	N.A	6.75	45.49	47.76
Uganda	6900.00	37.80	63831.94	1689.44	46.83	26.28	19.80	53.92
Zambia	3700.00	15.70	56946.17	3724.53	N.A	9.96	35.28	54.77
Zimbabwe	4000.00	15.20	26057.36	1709.14	79.56	13.38	31.12	55.50

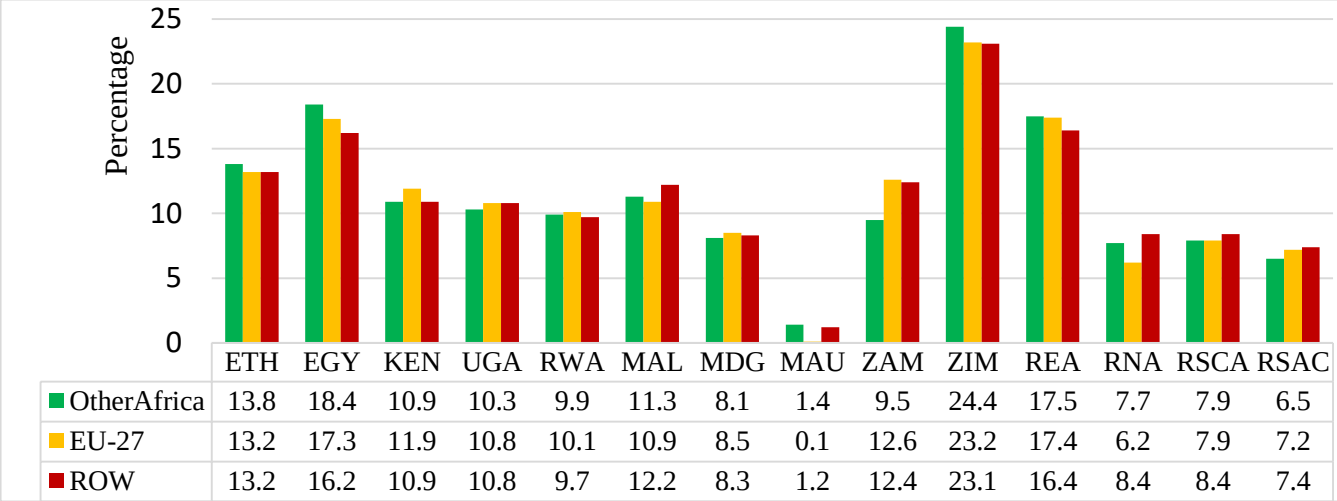
Source. World Development Indicators

2.2.2. Trade and protection pattern of COMESA

Figure 2-1 reports the average tariff imposed by COMESA on imports from other African countries, EU-27, and the rest of the world for all commodities. Egypt, Zimbabwe and the rest of the East African regions are highly protected COMESA regions, imposing a more than 15% average tariff on their imports. Ethiopia, Kenya, Uganda, Malawi, and Zambia have a medium level of protection, ranging from 10-15%. Among all COMESA countries, the least protected country is Mauritius, imposing a less than 5% average tariff on its imports from outside the COMESA region. For Ethiopia, Egypt, Mauritius, Zimbabwe, and

Rest of East Africa (REA), the average tariff is higher for their imports from African countries than for those from outside Africa, which is one reason for low intra-African trade. For the customs union scenario, the tariffs imposed on all regions outside Africa are reduced or increased depending on the initial tariff rate, and the CET rate agreed to by all COMESA countries. Similarly, for the EPA scenario, the tariffs imposed on the EU-27 are removed. Therefore, we expect large trade gains for most COMESA countries, which are highly protected across each scenario.

Figure 2-1. Tariff imposed by COMESA on its Import from other Africa, EU, and ROW.



	ETH	EGY	KEN	UGA	RWA	MAL	MDG	MAU	ZAM	ZIM	REA	RNA	RSCA	RSAC
OtherAfrica	13.8	18.4	10.9	10.3	9.9	11.3	8.1	1.4	9.5	24.4	17.5	7.7	7.9	6.5
EU-27	13.2	17.3	11.9	10.8	10.1	10.9	8.5	0.1	12.6	23.2	17.4	6.2	7.9	7.2
ROW	13.2	16.2	10.9	10.8	9.7	12.2	8.3	1.2	12.4	23.1	16.4	8.4	8.4	7.4

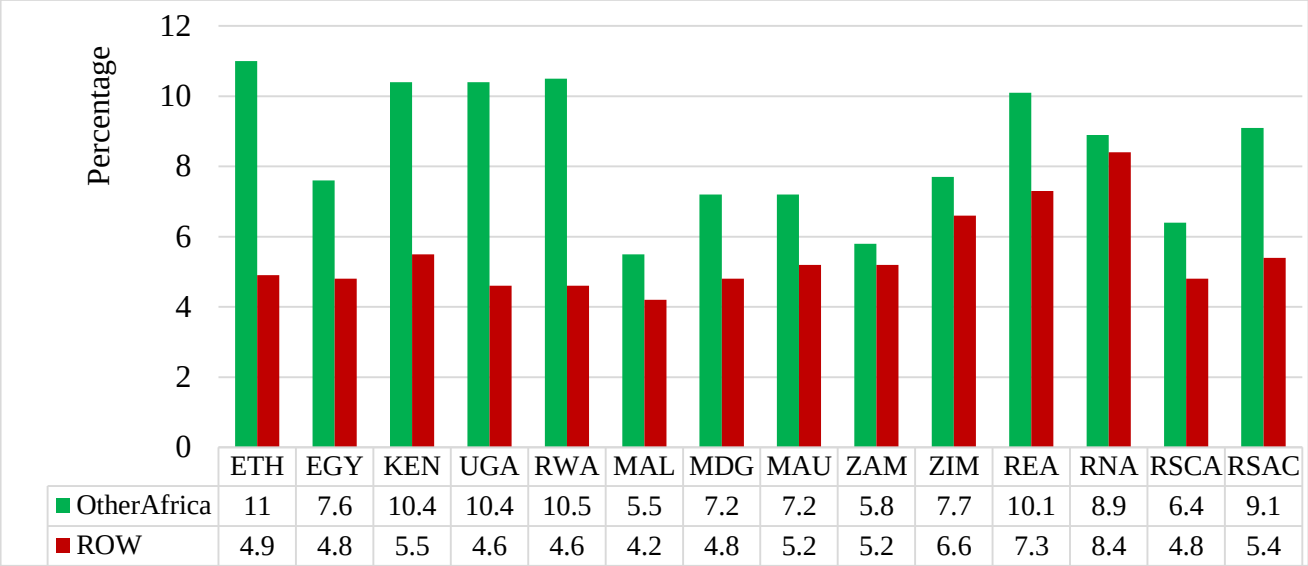
Source: Author calculation based on TASTE for GTAP 9.

Note: Ethiopia (ETH), Egypt (EGY), Kenya (KEN), Uganda (UGA), Rwanda (RWA), Malawi (MAL), Madagascar (MDG), Mauritius (MAU), Zambia (ZAM), Zimbabwe (ZIM), Rest of East Africa (REA), Rest of North Africa (RNA), Rest of South Central Africa (RSCA), Rest of South Africa Customs Union (RSAC).

The COMESA region benefits from relative market access when exporting to the rest of the world rather than to other African countries (Figure 2-2). This is mainly due to the availability of preferential trade treatments given to African countries by most developed countries, such as Everything But Arms (EBA), the African Growth Opportunity Act (AGOA), the Generalized System of Preferences (GSP), and others. For exports to Europe, 17 COMESA countries face zero tariffs due to the unilateral preferential trade agreement with the EU.

Figure 2-3 indicates the tariff protection structure of Ethiopia by sector. Hence, vegetables and fruits, beverages and tobacco, textiles and apparel, leather, other crops, other manufacturing, and motor vehicle parts are highly protected sectors with an average import tariff of more than 20%, whatever the source. We expect a relatively large trade and output effect on highly protected sectors following alternative liberalization policies. However, for the customs union scenario, the tariff imposed by Ethiopia on some sectors is smaller than the agreed CET rate and may lead to trade loss. In general, there are large disparities across sectors, with grains and oilseeds being the least protected sectors for Ethiopia.

Figure 2-2. Tariff faced by COMESA on its export to other Africa and ROW.



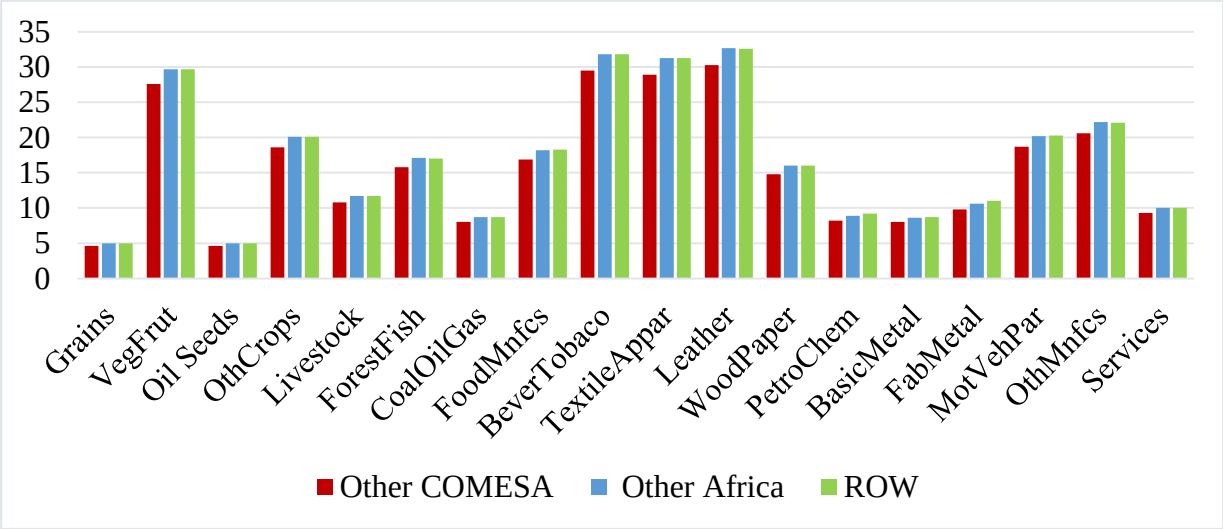
	ETH	EGY	KEN	UGA	RWA	MAL	MDG	MAU	ZAM	ZIM	REA	RNA	RSCA	RSAC
OtherAfrica	11	7.6	10.4	10.4	10.5	5.5	7.2	7.2	5.8	7.7	10.1	8.9	6.4	9.1
ROW	4.9	4.8	5.5	4.6	4.6	4.2	4.8	5.2	5.2	6.6	7.3	8.4	4.8	5.4

Source: Author calculation based on TASTE for GTAP 9.

As shown in Figure 2-4, Ethiopia's exports face relatively low tariffs from Rest of World (ROW) than its exports to other African and COMESA countries. This is due to the preferential treatment scheme given to Ethiopia by developed regions. However, exports of grain, food manufacturing, beverages and tobacco, petroleum and chemical, and fabricated metal equipment, and motor vehicle parts face tariffs of more than 10% when exported to ROW. Further, Ethiopia's exports to other COMESA countries face relatively lower tariffs on most commodities compared to other African countries. Exports of vegetables and fruits, other crops, livestock, textiles and apparel, and leather to other African countries face

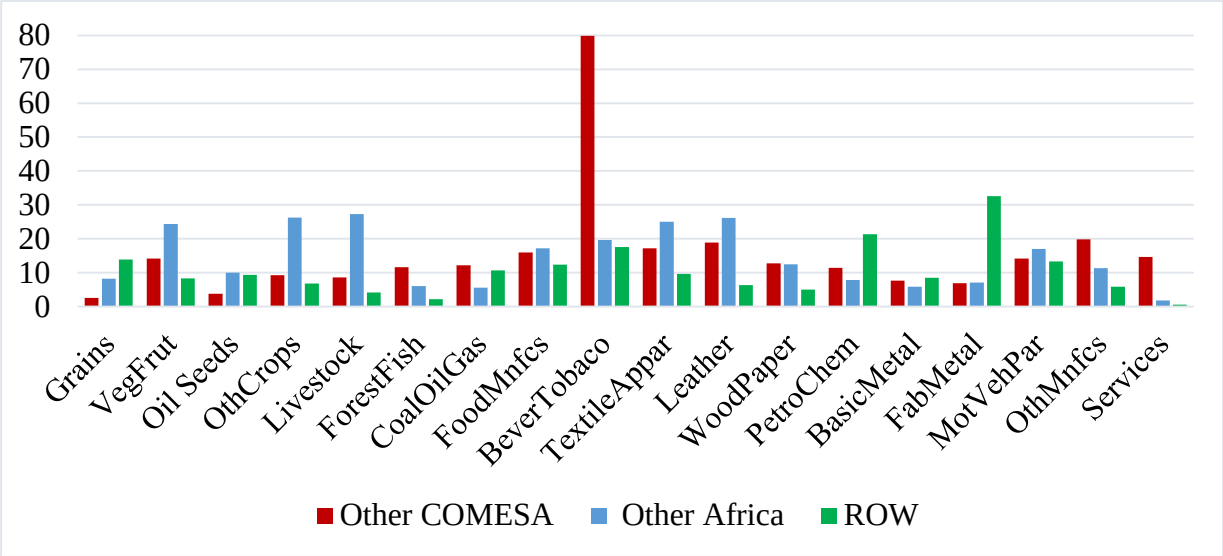
tariffs of more than 20%. Beverages and tobacco are exceptional and face the largest tariffs – approximately 80% – when exported to other COMESA regions since they are considered to be a sin commodity by most countries.

Figure 2-3. Tariff imposed by Ethiopia on its import from other COMESA, Other Africa, and ROW.



Source: Author calculation based on TASTE for GTAP 9.

Figure 2-4. Tariff faced by Ethiopia on its export to other COMESA, Other Africa, and ROW.



Source: Author calculation based on TASTE for GTAP 9

2.3. Literature Review

The proliferation of regional trade blocs has attracted interest among academics and policymakers in Africa. Several studies have been done to analyze the welfare and macroeconomic impact of different regional trade arrangements in terms of free trade areas, customs unions or preferential arrangements in Africa, particularly in the COMESA, East African Community (EAC) and Southern African Development Community (SADC) regions. However, the policy scenarios of trade liberalization measures, the period of assessment and the structures of the model employed vary among these studies. Moreover, most studies use partial equilibrium models, such as the gravity model, which focus mainly on the trade effect of trade liberalization policies, while others use general equilibrium models to analyze both welfare and the trade effect. The use of general equilibrium models over partial equilibrium ones has the advantage of capturing the complex relationship between and within sectors as a result of trade liberalization measures. In this section, we focus on studies that use both partial and general equilibrium models.

A gravity model estimation shows that there is a large trade creation effect of FTAs for two regional trade arrangements, namely, COMESA and Mercado Común del Sur (MERCOSUR). The FTAs increase intra-COMESA and intra- MERCOSUR trade with little trade diversion from non- MERCOSUR member countries. This finding further stresses that the trade creation effect for COMESA regions is concentrated in the sectors where COMESA FTA member countries have varying comparative advantages (Conroy, 2013). Similarly, a study of three regional trade agreements in Africa, namely, COMESA, Economic Community of West African States (ECOWAS), and Economic Community of Central African States (ECCAS), indicates that the trade creation effect of forming an FTA differs across the three regions depending on the depth of trade liberalization reforms undertaken. There is more of a trade creation effect for ECOWAS and COMESA, with net welfare gains, while there is no trade creation impact for ECCAS (Musila, 2005). In contrast, Karamuriro (2015) shows that participation in the COMESA trading bloc has no significant impact on the economic growth of member countries since trade among member

countries is characterized by the export of basic metal and primary products, the low level of structural complementarity of African economies, and poor infrastructural services.

A CGE model-based study on grand regional integration in eastern and southern Africa indicates that, with trade liberalization, a new trade is created and the welfare of society is improved through access to cheap products. However, the gain differs across participating countries depending on their initial protection structure, existing trade relationship with other member countries, and the level of nontariff measures imposed by each country. A study on the Tripartite Free Trade Area (TFTA) indicates that the SADC region, which has a less protected and more diversified economy, experienced large benefits from the TFTA followed by the EAC and COMESA (Karingi, 2009). Similarly, Makochekanwa (2014), using a World Integrated Trade Solution (WITS)-SMART model, estimated that, with the TFTA, $2 billion in trade would be created, and $454 million in trade will be diverted, resulting in net trade of more than $1 billion. The most trade will be created by the SADC region, followed by COMESA and the EAC, while there is more trade diversion impact from the COMESA region.

Few studies use the GTAP CGE model to analyze the impact of trade liberalization policies in the form of free trade areas and customs unions among COMESA member countries. A study by Karingi et al. (2002) analyzes the impact of COMESA free trade areas and customs unions on the economies of member countries. The study shows that free trade areas give good outcomes, but customs unions must be preferred, and the member countries benefit from customs unions in terms of real incomes and a reduction in poverty. These results emphasize that the impact of customs unions depends on whether the average existing tariff rate is higher or lower than the CET rate; the larger the average existing tariff rate, the higher is the gain from forming a customs union, as it creates an opportunity for non-member countries to export to the COMESA region. Moreover, the sectoral result shows that to benefit more from customs unions, the transition period between free trade areas and customs unions should be larger. A similar study on COMESA finds a positive welfare and trade gain from customs unions, but the best impact in terms of real GDP and welfare occurs when COMESA customs unions are formed after the COMESA free trade

area is operational among all member countries (Sawkut and Boopen, 2010). In contrast, a study using the Modeling International Relationships in Applied General Equilibrium (MERAGE) CGE model finds that customs unions will not be beneficial to a majority of the member countries, and some countries experience tariff revenue and real income loss (Nzuma et al. 2009).

Traditional tariff barriers have been reducing across time for developing countries due to the proliferation of regional trade agreements and the unilateral preferential trade agreements with developed countries, which allow the developing countries free access to developed countries' markets. However, international trade still faces large trade costs and nontariff measures that reduce the benefit of trading across the borders. A study on the eastern and southern part of Africa divides trade costs into three components: trade facilitation, nontariff barriers, and costs of business services. The results indicate that deep integration among the EAC, COMESA and SADC regions results in significant gains in trade and welfare, but the estimated gains vary across countries and regions. Further, trade facilitation tends to increase incomes of the poor and reduce inequality, while service liberalization increases inequality (Balistreri et al., 2016). Similarly, another study on EPA negotiation finds that facilitating trade by reducing both export and import time delays would have a positive impact on trade flow (Persson, 2008).

The negotiations between African Caribbean and Pacific (ACP) countries and the EU continue to attract the attention of African policymakers as the EU has decided to remove their unilateral trade preference for countries that have not signed or ratified the EPA. Several studies indicate that the majority of ACP countries experience overall welfare gains but also budgetary difficulties as a result of the loss of trade tax revenue under the EPA and associated adjustment costs related to tax policy and administration reform (Bilal and Roza, 2007; Karingi et al. 2006). Moreover, the EPA also has a severe impact on deepening regional economic integration in Africa, as some trade would be diverted from the region toward the EU. Therefore, African countries should combine both regional integration agendas and the EPA (Hamouda et al. 2006; S. Karingi et al. 2006). A similar study on the SSA finds that some SSA countries, such as Botswana, Cameroon, Mozambique, and

Namibia, would significantly benefit from the interim EPA agreements, while the trade effects for Côte d'Ivoire, Ghana, Kenya, Tanzania, and Uganda would be close to zero (Vollmer et al., 2009).

The empirical literature explained above signifies the following key points. First, COMESA, FTA and customs unions improve the aggregate welfare of COMESA, as well as the world, while some individual countries experience welfare losses. The trade creation effect of both FTA and customs unions outweighs the trade diversion effect but, depending on the initial trade share and protection level, some countries may experience more significant trade diversion effect. Third, there is substantial revenue loss associated with free trade areas, customs unions, and the EPA, as import tariffs are a primary source of revenue for most African economies.

Several studies are analyzing the effects of free trade, customs unions and the EPA on the economies of Eastern and Southern parts of Africa but, to the best of our knowledge, no previous study has looked at this issue in the context of Ethiopia's relations with COMESA countries. Most importantly, this chapter focuses on comparing three regional trade arrangements using tariff reduction as a liberalization policy, namely, COMESA free trade areas, COMESA customs unions, and the EPA for Ethiopia, since the country is negotiating to join all of them. Besides, we prepare our tariff scenarios for customs unions at the detail HS6 level, rather than at the aggregated level.

2.4. Methodology

2.4.1. The GTAP Model

We employ a multicounty, multisector CGE modeling approach. UNCTAD, and WTO (2012) states that a general equilibrium analysis explicitly accounts for all the links between the sectors of an economy: households, firms, governments, and countries. It imposes a set of constraints on these sectors so that expenditures do not exceed income, and income, in turn, is determined by what the factors of production earn. These constraints establish a direct link between what the factors of production earn and what households can spend. It further explains that the purpose of CGE simulations is to determine the effects of a change in trade policy on the endogenous variables of the model: prices, production,

consumption, exports, imports, and welfare. The CGE simulation represents what the economy would look like if the policy change or shock had occurred. The difference in the values of the endogenous variables in the baseline and the simulation represents the effect of the policy change. Therefore, the model should be able to predict the effect on macroeconomic, trade, welfare and production patterns if the trade policy was changed. Furthermore, based on the change in welfare, the policy-maker would be able to judge whether and to what extent the country benefited from the change in policy or not.

We use the global economy-wide model known as the GTAP model (Hertel, 1997). We use the static GTAP model with unemployment closure for unskilled labor force for COMESA member countries. The standard features of the GTAP model are perfect competition, constant return to scale, Armington assumption in trade flows, disaggregated import usage by activity, non-homothetic consumer demands and explicit modeling of international trade and investment. The GTAP model has the advantage of overcoming the effects of policy changes at the national, bilateral or multilateral levels, as well as on production levels, input factors, volumes of trade and other induced influences on welfare. Furthermore, the GTAP model is focused on the reallocation of resources between different sectors of the economy; it is an appropriate instrument for identifying the sectors and countries and for determining which gain and which lose with the change in policy induced by trade liberalization policy. The data used in this study are from version 9 of the GTAP database (Aguiar et al., 2016). The reference year for the database is 2011.

The standard GTAP model assumes full employment in both the skilled and unskilled labor force, but there is vast unemployment in COMESA regions, particularly in the unskilled labor force. Therefore, we modifay the standard closure of the GTAP model by changing the assumption of full employment for the unskilled labor force for COMESA regions.

• Regional and Sectoral Aggregation

The GTAP-9 database features 140 countries/regions and 57 tradable commodities. In this analysis, we mapped the 140 countries/regions, and the 57 sectors into 18 regions and sectors (Appendices A-1 and A-2). The GTAP 9 database identifies only 10 out of the 19

COMESA member countries as separate regions, while we aggregate the other nine COMESA countries into four GTAP composite regions. Furthermore, the regional aggregation includes four non-COMESA regions: the EU-27, the USA, the rest of Africa, and ROW.

2.4.2. Experiment Design

The analysis begins with the GTAP 9 database in the base year 2011, aggregated to the set of regions and sectors specified in Appendices A-1 and A-2. In experiment one (COMESA FTA), there is full FTAs among 19 COMESA member countries. Our primary objective here is to analyze the impact of Ethiopia joining COMESA FTA. However, two COMESA member countries namely Eritrea and Swaziland are also negotiating to join FTA. Therefore, we remove import tariff among all member countries.

For experiment two (COMESA customs union), a new baseline data is constructed using the updated result from experiment one. Then, all COMESA member countries move from FTA to the customs union and levy Common External Tariff (CET) on non-COMESA regions.[3] The agreed-upon CET rates have three categories: 0% for raw materials and capital goods, 10% for intermediate goods and 25% for finished products[4]. In the creation of a customs union, some of the initial tariff rates are higher than the recommended CET rate, while in other cases, they had to be raised to bring them to the CET rate. As a result, a customs union may reduce or increase protection.

There are two main challenges in preparing the customs union shock file for the aggregated GTAP sectors. First, the CET rates negotiations are agreed at detail HS6 code level, but the analysis is done at aggregated 18 GTAP sector level. Second, some COMESA member countries provide a list of sensitive products at HS6 code level that can be excluded from the CET rate.[5] Therefore, to compute applied tariff shocks for GTAP models, we need much more detailed data on trade flows and on bound and applied rates.

[3] The baseline data for experiment two is experiment one, full FTA among all COMESA member countries.
[4] The CET rate can be downloaded from http://www.comesa.int/comesa-common-tariff-nomenclature-and-common-external-tariff-hs-2017/.

[5] Refer to the 2011 Gazette, Volume 16 Annex 1: list of sensitive products for Kenya, Madagascar, Malawi, Mauritius, and Swaziland. http://www.comesa.int/wp-content/uploads/2016/06/2011Gazette-Vol.-16-Annex-

Tariff Analytical and Simulation Tool for Economists (TASTE) compresses the MAcMapHS6 dataset into a single CD and allows the ordinary GTAP user to process the whole dataset rapidly.[6] We use TASTE for GTAP 9 database for the transformation of scenarios about formula-based changes in bound rates into files of percent change shocks to applied rates, which could be used by RunGTAP. Resulting changes in applied rates are averaged to our aggregated sectors and regions and stored in a format which can be directly used by the standard GTAP model.

The Cotonou Agreement calls for the strengthening of intra-regional cooperation and integration among ACP countries. As a result, in the first two experiments, the principle of deep regional integration in COMESA is taken into account by establishing FTA among themselves and levying CET on non-member countries. However, one of the key principles of the European Partnership Agreement (EPA) is reciprocity. Besides, Ethiopia is negotiating to reciprocate its tariff with the EU under Eastern and Southern African (ESA) EPA group. Hence, in the third experiment, we provide an option for Ethiopia to strength its integration with COMESA through FTA and build its capacity to compete with the EU market. Then, the option for a reciprocal free trade area between Ethiopia and the EU is explored. Hence, in experiment three, all tariff barriers between Ethiopia and the EU are removed after excluding 2% of sensitive products based on revenue loss criteria.[7]

Experiment four is a combination of experiment two and three. Hence, in experiment four, COMESA levies CET rate on non-COMESA regions excluding EU member countries and a free trade area is established with EU member countries. Similar to experiment two and three, the baseline data for experiment four is experiment one (COMESA FTA).

II-ist-of-sensitive-products.pdf. Besides, for countries that did not submit a list of sensitive products, the top 2% of a number of HS-6 products are selected as sensitive products using the loss of tariff revenue criteria (Jean et.al, 2008).

[6] TASTE for GTAP 9 is based on applied and bound tariff data of 2011 provided by ITC (Market Access map). The data is based on and consistent with the ITC-Market Access Map tariff dataset employed in GTAP 9. It has trade and tariff data for 236 trading regions, 5052 HS6 commodities, and 1299 GTAP-compatible HS4 sectors.

[7] The baseline data is experiment one (COMESA FTA). Besides, we also remove all tariffs between EPA negotiating COMESA member countries and EU.

Experiment five is similar to experiment three, but the FTA with EU is introduced after the COMESA customs union is established. Hence, the baseline data for experiment five is experiment two (COMESA customs union).

Table 2-2. Experiment Design

Experiments	Regional Integration	Description of experiments	Participating Countries
EXP1	COMESA FTA	All COMESA member countries established FTA among themselves.	COMESA member countries
EXP2	[COMESA FTA] +CU	All COMESA member countries move from FTA to customs union.	All countries
EXP3	[COMESA FTA] +EPA	EPA negotiating COMESA countries form a free trade area with EU-27 after COMESA FTA is established.	COMESA member countries, and EU- 27
EXP4	[COMESA FTA] +CU+EPA	EPA negotiating COMESA countries form a free trade area with EU-27 after COMESA FTA is established, but CET is levied on other countries.	All countries
EXP5	[COMESA customs Union] +EPA	EPA negotiating COMESA countries form a free trade area with EU-27 after COMESA customs union is established.	All countries

Source: Authors experiment design

2.5. Results and Discussion

All scenarios' results are designed as a variation of the baseline scenario. The analyses are comparatively static; hence, they do not address questions relating to the sequencing of reforms and the potential dynamic benefits of trade liberalization. When bilateral tariffs are eliminated, relative prices change and, in response, trade flows between countries change, which eventually affects resource allocations in the economy. It is expected that different sectors in the economy will adjust their outputs according to relative price shifts. In bilateral terms, when an importer reduces tariffs on its partners, the amount of increase or decrease in imports depends on the trade creation and diversion effects. Trade creation arises when more efficiently produced imported goods replace relatively inefficient domestic production. On the other hand, trade diversion occurs when the sources of supply divert from the more efficiently producing nonmember countries to the less efficiently

producing member countries under the tariff-free access granted to signatory countries (Narayanan and Sharma, 2016). The following section explains the macroeconomic, welfare, revenue, and industry output impacts of the different experiments described above.

2.5.1. Aggregate Macroeconomic and Welfare Results

In the GTAP model, welfare changes are measured by Equivalent Variation (EV). EV is a money metric measure that compares the cost of pre- and post-shock levels of consumer utility, both valued at base year prices (Burfisher, 2011). In the standard GTAP model, welfare is a function of the terms of trade change (i.e., interregional shifting of welfare), allocative efficiency change (i.e., changes in production or consumption efficiency due to the presence of distortion), and investment-saving balance. In many trade simulations, authors change the standard model closure by varying technology, population, and endowment, thus affecting regional welfare. In this paper, we change the factor market model closure by fixing the wage of the unskilled labor force. As a result, the endowment effect captures the change in regional welfare due to changes in the employment of the unskilled labor force. The net welfare impact of tariff reduction depends on the relative sizes of trade creation and trade diversion effects.

Table 2-3 shows the GDP and welfare effect for COMESA and non-COMESA regions under five experiments. Ethiopia only sees welfare gains with COMESA FTA (EXP1), but gains in terms of Real GDP in all experiments except experiment five. The overall welfare gains for Ethiopia are mainly attributed to the endowment effect due to the massive employment of the unskilled labor force following tariff removal in many sectors. Similarly, Kenya, Madagascar, and Mauritius enjoy welfare gain only from the COMESA FTA. Whereas, for Egypt and Malawi, there is a substantial gain in terms of welfare from the COMESA FTA (EXP1), customs union (EXP2), and EPA (EXP3), but their welfare reduces with the experiment three and five; Uganda and Zimbabwe have a similar result, but they are exceptional in that the former loses with experiment four while the later loses with experiment one.

Comparing experiment three and five, most COMESA countries report welfare loss, and the loss is relatively low when EPA is implemented after COMESA FTA (EXP3) than

after customs union (EXP5).This is due to an increase in protection for those countries with customs union. Whereas, Rwanda, and Zambia, which enjoys welfare in both experiments. Furthermore, implementing both customs unions and the EPA together (EXP4) results in more welfare gains for Egypt, Malawi, Rwanda, Zambia, and Zimbabwe. Overall, Rwanda, Zambia, and Rest of South Central Africa (RSCA) emerge as the winners in terms of welfare in all experiments.

Table 2-3. Changes in GDP and Welfare

	% change in Real GDP					Welfare in Equivalent Variation (US$ million)				
	EX1	EXP2	EXP3	EXP4	EXP5	EXP1	EXP2	EXP3	EXP4	EXP5
Regions	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ethiopia	0.10	0.49	0.01	0.54	-0.05	22.63	-77.13	-184.56	-146.86	-212.06
Egypt	0.01	0.01	-0.01	0.00	-0.01	48.81	330.98	-64.96	296.46	-55.38
Kenya	0.06	0.34	-0.16	0.24	-0.21	34.94	-107.47	-248.45	-275.38	-270.99
Malawi	0.07	0.32	-0.02	0.31	-0.02	11.85	21.61	-5.94	17.71	-6.43
Madagascar	0.01	0.22	0.11	0.36	-0.09	0.81	-12.34	-18.56	-13.14	-42.95
Mauritius	0.12	-2.59	-0.04	-2.09	-0.05	42.22	-124.49	-13.06	-149.16	-12.07
Rwanda	0.03	0.16	0.19	0.32	0.18	2.83	11.03	9.99	18.17	9.55
Uganda	0.04	0.08	-0.05	0.05	-0.06	4.24	1.33	-22.41	-14.89	-24.64
Zambia	0.01	0.48	0.16	0.59	0.15	1.00	62.12	25.28	80.22	23.43
Zimbabwe	0.46	0.46	-0.16	0.37	-1.21	-56.25	39.87	-41.63	16.48	-183.95
REA	0.11	0.36	0.28	0.59	0.20	90.20	41.09	86.63	158.33	-0.47
RNA	0.02	-0.39	0.00	-0.39	0.00	63.55	-994.92	-13.73	-1002.17	-14.05
RSCA	0.08	0.01	0.02	0.02	0.02	91.66	64.42	59.42	101.92	59.03
RSAC	1.50	-0.41	-0.02	-0.37	-0.13	166.63	-51.38	-4.23	-48.91	-17.02
EU27	0.00	0.00	0.00	0.00	0.00	-92.46	-62.44	1156.11	748.35	1275.56
USA	0.00	0.00	0.00	0.00	0.00	-57.29	93.27	-19.01	82.01	-21.81
Ro.Africa	0.00	0.00	0.00	0.00	0.00	-20.74	-22.92	-91.78	-86.51	-104.48
ROW	0.00	0.00	0.00	0.00	0.00	93.29	498.67	-418.01	188.40	-448.49
Total						447.93	-288.69	191.12	-28.95	-47.22

Source: Model Simulation result

From non-COMESA regions, the EU-27 gains in terms of welfare in all experiments, except with COMESA FTAs (EXP1) and customs unions (EXP2). The welfare gain for the EU is mainly due to the large tariff reduction by COMESA on its imports from the EU. The rest of Africa loses in terms of welfare in all experiments, which shows the trade diversion effect of the liberalization policies, especially in the EPA experiment. The world as a whole

enjoys welfare gains in the COMESA FTA (EXP1) and EPA (EXP3), but world GDP and welfare declines with other experiments.

Columns 1-4 of Table 2-4 break down the total Equivalent Variation (EV) into parts for Ethiopia. The first component of EV is allocative efficiency, which measures the reallocation of resources in the economy when economic distortions, such as tariffs, are removed. As shown in column 1 of Table 2-4, there is a positive allocative efficiency gain in experiments 1, 2 and 4, which mainly results from the gain in consumption and production taxes, although import taxes are reduced slightly. However, for experiments 3 and 5, the loss of import tariff revenue dominates the gain in allocative efficiency through increased import volume, resulting in efficiency loss. The second component of EV measures the impact of changing endowments on regional welfare. In our model, we change the model closure and allow for a change in the employment of the unskilled labor force for COMESA regions by fixing their wage bill. As tariffs are removed across scenarios, there is more demand for unskilled labor in many sectors, which results in a positive endowment effect. The terms of trade components in column 3 of Table 2-4 indicate that Ethiopia loses in all experiments due to lower import prices than export prices arising from tariff reduction. Finally, the investment-saving effect, which is adjusted to equate the real trade balance, is also negative in all scenarios. Overall, for experiments 2 and 4, the welfare loss due to the terms of trade and investment-saving effect dominates the gain from endowment and allocative efficiency, resulting in a net welfare loss for Ethiopia. However, for experiments 3 and 5, the large welfare loss is attributed to the loss in allocative efficiency, terms of trade, and investment-saving balance.

Table 2-4. Changes in Welfare for Ethiopia, by Decomposition (US$ million)

	Allocative Efficiency Effect	*Endowment Effect*	*Terms of Trade Effect*	*Investment-Saving Effect*	*Total*
Experiments	(1)	(2)	(3)	(4)	(5)
EXP1	6.74	23.18	-2.99	-4.30	22.63
EXP2	41.92	109.79	-89.69	-139.16	-77.13
EXP3	-38.19	42.67	-72.99	-116.05	-184.56
EXP4	41.40	126.32	-121.75	-192.83	-146.86
EXP5	-59.08	42.76	-78.88	-116.86	-212.06

Source: Model Simulation result

Table 2-5 further explains the sources of loss in the value of GDP for Ethiopia across all experiments by decomposing GDP into different components.[8] For Ethiopia, the decline in the consumption of domestic commodities is the primary source of the loss of GDP in all scenarios, although there is an expansion of export and import. For experiment 1, the deterioration of the trade balance contributes to the loss of GDP from domestic consumption. This decline in domestic consumption is due to an increase in both exports and imports in all scenarios. Hence, there is a potential for change in the production and consumption structure of Ethiopia; more production is exported than in the base case, and more of consumption is imported. The relatively small reduction in domestic consumption with the COMESA FTA signifies the existing low level of intra-COMESA trade. The results in column 1 further show that the loss in GDP is large in experiment 4 since there is large global tariff reduction when both customs unions and the EPA are implemented together. As a result, there will be a flood of imported goods to Ethiopia, mainly from the EU-27.

[8] The result in table 2-5 is the change in value of GDP, which includes both the price and quantity effect, while the percentage change in table 2-3 is the Real GDP effect.

Table 2-5. Changes in the value of GDP by components for Ethiopia (US$ million)

GDP component	*Consumption*	*Investment*	*Government*	*Export*	*(-) Import*	*Total*
EXP1	-14.58	11.69	-0.87	40.52	55.09	-18.32
EXP2	-690.84	-149.32	-76.87	280.47	240.73	-877.29
EXP3	-635.22	-151.59	-71.60	230.26	173.05	-801.19
EXP4	-953.44	-208.53	-106.09	379.01	321.17	-1210.23
EXP5	-652.19	-148.61	-73.60	255.51	201.04	-819.94

Source: Model Simulation result

2.5.2. Trade and Revenue results

Removal of import tariffs among COMESA countries is expected to result in significant changes in the level and direction of trade among member countries by reducing the domestic market price of an import. The reduction of import prices of raw materials results in a rise in demand for import by firms, private households, and the government. The availability of cheap imports reduces domestic production costs and increases the competitiveness of exports in these countries. However, the extent of the rise in exports depends on the relative change in price in different sectors driven by tariff reduction. As a result, there is a slight difference in the growth of exports and imports across COMESA countries. As expected, more significant flooding of imports is reported in the customs union (EXP2) and EPA experiments (EXP3, EXP4, and EXP5) than with the COMESA FTA (EXP1) due to the low level of intra-COMESA trade and cheap sources of imports outside the region. However, for some COMESA regions with initial tariffs below the CET rate, imports and exports may decline under a customs union. Besides, two COMESA regions, namely, Egypt and RNA, are not signatories of the EPA, so we expect a trade diversion from these regions to other COMESA regions in all EPA experiments (EXP3, EXP4, EXP5).

Table 2-6 indicates that most COMESA countries benefit from the import and export surge under the COMESA FTA (EXP1); Zambia, Zimbabwe, and Kenya report the most substantial increase in both exports and imports with customs union (EXP2) and EPA

experiments (EXP3, EXP4, and EXP5), whereas the trade impact on other COMESA member countries is tiny.

Table 2-6. Changes in volume of Export and Import

	% change in volume of import					% change in volume of export				
	EXP1	EXP2	EXP3	EXP4	EXP5	EXP1	EXP2	EXP3	EXP4	EXP5
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ethiopia	0.60	2.72	1.95	3.62	2.19	1.01	8.91	7.25	12.07	7.49
Egypt	0.17	-1.30	-0.10	-1.35	-0.08	0.14	-2.14	-0.05	-2.16	-0.03
Kenya	0.40	1.08	0.62	1.64	0.76	0.40	4.99	3.82	7.71	4.06
Malawi	0.74	1.72	0.30	1.92	0.26	-0.28	-0.13	0.60	0.30	0.60
Madagascar	0.00	5.62	4.71	8.17	4.97	0.00	5.36	4.76	7.90	5.30
Mauritius	0.78	-10.91	-0.23	-7.31	-0.20	-0.20	-13.73	0.00	-8.40	0.03
Rwanda	0.26	0.64	1.08	1.66	1.14	0.18	0.58	1.12	1.68	1.19
Uganda	0.56	0.25	0.59	0.81	0.70	0.60	0.53	0.77	1.19	0.89
Zambia	0.04	1.73	0.83	2.41	0.90	0.02	1.04	0.44	1.41	0.48
Zimbabwe	1.83	1.42	0.15	1.50	0.48	8.86	3.80	1.26	4.49	3.78
REA	0.79	3.76	1.96	4.64	2.21	0.75	5.06	2.70	6.27	3.01
RNA	0.11	-2.56	-0.02	-2.57	-0.02	0.05	-1.02	0.00	-1.02	0.00
RSCA	1.53	0.37	0.24	0.49	0.24	0.59	0.07	0.07	0.12	0.07
RSAC	12.90	-3.62	-0.14	-3.30	-0.98	1.74	-0.38	-0.09	-0.43	-0.22
EU27	0.00	0.00	0.03	0.02	0.03	0.00	0.00	0.00	0.00	0.00
USA	0.00	0.01	0.00	0.01	0.00	0.00	-0.01	0.01	0.00	0.01
Ro.Africa	-0.01	-0.02	-0.05	-0.06	-0.05	-0.01	-0.01	-0.02	-0.03	-0.03
ROW	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	0.00	-0.01	0.00

Source: Model Simulation result

The reduction of import tariffs against non-COMESA regions through customs unions (EXP2) and EPA experiments (EXP3, EXP4, and EXP5) reduces the imports of Egypt, Mauritius, RNA, and RSAC, while for other COMESA regions; there is an expansion of both exports and imports. The existing tariffs of some COMESA member countries are below the CET rate, and customs unions may, in turn, increase protection for most COMESA countries. As a result, the reduction in imports for Mauritius and RSAC is larger under customs unions than with other experiments. For the rest of Africa, there is a decline in exports and imports across all experiments. This implies that there is trade diversion effect on other African regions as COMESA regions trade more with the EU and the rest of the world following tariff reduction. Although tariffs are reduced for both Africa and the

rest of the world under the customs union scenario, many African countries are not competitive with the rest of the world. Hence, the impact on other African countries is relatively tiny.

Table 2-7. Changes in Trade Balance and Import tax revenue (US$ million)

Regions	*Changes in Trade Balance*					*Changes in Import tax revenue*				
	EXP1	EXP2	EXP3	EXP4	EXP5	EXP1	EXP2	EXP3	EXP4	EXP5
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ethiopia	-14.58	39.74	57.21	57.84	54.47	-50.10	-383.57	-297.78	-511.40	-322.46
Egypt	-37.87	39.81	31.18	55.92	25.79	-48.52	1067.64	-8.85	1061.03	-10.59
Kenya	-25.19	156.10	144.83	239.44	149.10	-10.58	-185.10	-221.74	-365.14	-244.13
Malawi	-17.06	-39.67	1.35	-38.42	2.01	0.37	-40.89	-15.46	-52.01	-15.07
Madagascar	-0.05	-53.22	-36.30	-72.77	-34.94	0.20	-163.13	-121.99	-215.69	-144.65
Mauritius	-40.40	187.32	9.68	150.46	9.06	0.12	468.88	-1.07	270.22	-2.34
Rwanda	-0.85	-0.74	-1.90	-2.66	-1.97	-0.55	-7.23	-18.79	-26.42	-19.77
Uganda	-2.68	-0.80	-6.58	-7.23	-6.99	-14.74	-27.21	-56.01	-74.69	-59.86
Zambia	-1.53	-39.25	-28.00	-60.86	-30.89	-0.32	-88.02	-44.71	-123.45	-51.14
Zimbabwe	83.21	7.83	22.06	20.63	65.47	-104.37	-22.15	-36.45	-44.76	-143.41
REA	-20.27	-4.00	12.85	0.77	6.09	-65.48	-1006.32	-549.40	-1217.14	-645.58
RNA	-16.47	981.39	3.48	983.57	3.54	-8.29	1842.69	-1.12	1841.72	-1.92
RSCA	-181.31	-103.88	-62.41	-127.92	-62.17	-97.28	-99.13	-93.58	-153.47	-94.01
RSAC	-103.95	40.53	-5.97	29.19	1.16	8.18	-0.68	-6.67	-7.56	-7.41
EU27	72.12	-156.12	-648.58	-571.51	-719.83	0.75	-9.39	45.29	22.04	50.26
USA	84.50	-288.16	142.07	-186.36	153.44	6.94	-0.01	-3.34	-3.18	-4.60
Ro.Africa	9.74	1.06	38.87	28.46	42.32	-6.94	0.69	-10.48	-8.98	-13.16
ROW	212.58	-767.95	325.98	-498.54	344.33	-6.36	20.91	-42.21	-14.60	-46.64

Source: Model Simulation result

As shown in Table 2-7, Madagascar, Rwanda, Uganda, Zambia, and RSCA, report a trade deficit in all experiments. However, for other COMESA regions, there is only a trade deficit under the COMESA FTA. exception to this trend are Malawi, REA, and RSAC. Overall, Zimbabwe is the only country in the COMESA region with a trade surplus across all experiments.

Table 2-7 further reports that free trade among COMESA countries reduces import tax revenue for most countries, except Malawi, Mauritius, Madagascar, and RSAC. Zimbabwe, REA, RSCA, Ethiopia, and Egypt reported massive revenue losses under the COMESA FTA, while the impact on other COMESA regions is minimal. The revenue effect for customs unions depends on the change in tariffs; for some countries, such as Egypt, Mauritius, and RNA, customs unions increase protection and result in a revenue gain, while for other COMESA regions, there is a substantial revenue loss. However, the EPA (EXP3) results in a revenue loss for all COMESA regions, since the tariff is removed entirely, while the EU 27 reported a revenue gain of $45.3 million. Similarly, for experiments 4 and 5, most COMESA regions lose in terms of import tariff revenue due to large tariff reductions from customs unions and the EPA; exceptions are Egypt, Mauritius, and RNA, which reported revenue gains in experiment 4.

2.5.3. Sectoral Results for Ethiopia

2.5.3.1. Changes in Export and Import

In this section, we focus more on sectoral results for Ethiopia, focusing on the export, import, and output effects of each liberalization policy. We expect some divergence across sectors depending on the relative change in export and import prices following tariff reduction. The results here are percentage changes in the volume of exports, imports, and outputs, while the aggregated results are changes in value, which include both the price and quantity effects. Therefore, we expect some differences in the aggregated and sectoral results.

A significant effect of trade liberalization is that it causes a reallocation of resources, such as labor, capital, and land, which further leads to a structural adjustment in the factor market. In general, the sectors protected by high tariff rates will lose more production when tariffs are reduced. In contrast, trade liberalization brings about efficiency gains that increase income and production across sectors by allocating resources to sectors in which the country has a comparative advantage.

As shown in Table 2-8, when all COMESA counties remove import tariffs among themselves, the Ethiopian economy reports larger export growth than import growth for most manufacturing sectors, including wood paper, petroleum chemicals, fabricated metal equipment, and motor vehicle parts, implying that exports are more competitive and, hence, increase more than imports. For some other sectors, such as other crops, livestock, forestry and fishery, and textiles and leather, imports grow more than exports, which is mainly due to the larger fall in import prices than export prices, implying that exports are relatively expensive and, hence, increase less than imports.

The move from the COMESA FTA to customs unions results in large export and import growth for the coal, oil and gas, textiles and apparel, and leather sectors. For the coal, oil and gas, leather, petroleum and chemicals, and fabricated metal equipment sectors, the growth of exports is higher than imports, although the fall of import prices is larger than that of export prices (Table 2-9). On the other hand, the large export growth for other manufacturing, motor vehicle part, basic metals, wood paper, and food manufacturing results from the larger fall in export price than import, implying that exports are more competitive.

The reciprocal free trade agreement with the EU-27 results in relatively larger export growth for most sectors than import growth, except for some agricultural sectors, such as oilseeds, other crops, livestock, beverages and tobacco, leather and other manufacturing. The large import growth for leather and other manufacturing results from the relatively larger drop in import prices than export prices (Table 2-9). Therefore, imports are relatively less expensive and thus increase more than exports. Similarly, for experiments 4 and 5, the winning sectors with large export and import growth are coal, oil and gas, textiles and apparel, leather, and other manufacturing. For basic metal, export prices fall more than import prices, implying that exports are more competitive and thus increase more than imports.

Table 2-8. Changes in Aggregate Export and Import, by sector for Ethiopia (percentage)

	Aggregate Import					*Aggregate Export*				
	EXP1	EXP2	EXP3	EXP4	EXP5	EXP1	EXP2	EXP3	EXP4	EXP5
Sectors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Grains	-0.20	-7.48	-5.40	-9.58	-5.59	0.72	11.06	8.73	15.17	9.17
VegetablFrut	0.25	-0.98	-2.55	-1.68	-2.31	1.99	-2.15	0.79	-2.10	0.71
Oilseed	0.13	-4.99	6.01	4.39	6.06	0.47	7.15	5.84	9.76	5.80
OtherCrops	1.83	-3.22	16.29	14.48	16.36	0.05	9.49	7.98	13.00	7.91
Livestock	0.71	3.76	5.17	7.58	5.18	0.59	-2.24	-3.03	-3.22	-3.67
ForestFisher	3.78	6.53	-1.96	6.08	-2.11	0.43	7.43	7.36	10.41	7.46
CoalOilGas	1.44	10.19	12.18	17.64	13.88	1.27	27.55	19.11	36.13	17.88
FoodMnfcs	3.34	-4.55	3.51	1.46	3.47	4.21	13.82	10.12	17.91	10.36
BeverTobaco	1.07	5.48	18.96	19.77	18.98	2.56	4.49	3.51	5.91	3.65
TextileAppar	2.21	25.93	8.55	29.25	8.85	0.82	21.00	15.53	27.87	15.74
Leather	13.17	11.37	63.59	61.95	69.45	1.96	21.99	16.41	29.17	16.72
WoodPaper	1.09	-1.57	2.41	1.59	2.48	18.80	10.55	5.92	13.00	7.14
PetroChemica	0.45	0.35	-0.42	0.17	-0.43	25.73	11.05	8.52	14.47	8.87
BasicMetals	0.49	-2.34	-2.28	-2.95	-2.33	0.87	22.62	15.49	29.24	15.74
FabMetalEqu	0.45	1.74	1.20	2.55	1.39	23.52	15.86	13.84	21.09	14.83
MotorVehpar	0.14	-1.46	7.87	7.08	8.00	48.58	12.87	7.10	13.51	7.38
OtherMnfcs	20.23	-4.98	25.69	21.61	25.60	12.10	21.07	12.82	25.84	13.42
Services	-0.04	12.61	5.27	10.83	5.47	0.21	8.93	7.19	12.13	7.29

Source: Model Simulation result

2.5.3.2. Changes in Trade Balance and Output

The trade balance effect, which is the relative change in exports and imports, indicates that Ethiopia's trade balance improves more in the customs union and EPA scenarios than from the COMESA FTA, which is mainly due to large tariff reduction. As shown in table 2-10 for grains, oilseeds, other crops, leather, and basic metal, Ethiopia's trade balance improves under all scenarios, except the COMESA FTA, while the reverse is true for vegetables and fruits and the livestock sector. Wood paper and other manufacturing sectors are exceptional in that their trade balance only improves with the COMESA customs union. In a few sectors, such as beverages and tobacco, textiles and apparel, and fabricated metal equipment, Ethiopia's trade balance deteriorates in all experiments. For the motor vehicle parts sector, there is a trade surplus under the COMESA FTA and customs union, but it

turns out to be a deficit when we remove tariffs with the EU-27, resulting in large output loss.

Table 2-9. Changes in Aggregate Export and Import price, for Ethiopia (percentage)

	% Changes in Ethiopia's Import price					*% Changes in Ethiopia's Export price*				
Sectors	EXP1	EXP2	EXP3	EXP4	EXP5	EXP1	EXP2	EXP3	EXP4	EXP5
Grains	0.00	0.40	-0.04	0.35	-0.05	-0.09	-2.17	-1.71	-2.87	-1.74
VegetablFrut	-0.09	-1.64	-0.55	-2.00	-0.65	-0.02	-2.16	-1.78	-2.90	-1.81
Oilseed	0.00	1.56	-3.19	-2.75	-3.19	-0.02	-1.62	-1.35	-2.18	-1.34
OtherCrops	-0.54	-0.73	-5.34	-5.73	-5.36	-0.04	-1.71	-1.43	-2.31	-1.42
Livestock	-0.31	-3.91	-4.15	-6.26	-4.20	-0.03	-2.17	-1.81	-2.91	-1.84
ForestFisher	-1.72	-5.61	-0.92	-6.10	-0.92	0.13	-2.01	-2.02	-2.78	-2.04
CoalOilGas	-0.57	-4.75	-3.65	-6.69	-3.92	-0.10	-2.12	-1.53	-2.68	-1.44
FoodMnfcs	-1.16	-0.74	-3.53	-4.02	-3.56	-0.06	-2.49	-1.95	-3.23	-1.97
BeverTobaco	-0.82	-7.39	-13.64	-16.4	-13.68	-0.07	-2.42	-2.00	-3.23	-2.02
TextileAppar	-0.55	-10.65	-3.21	-11.77	-3.30	-0.07	-2.64	-1.99	-3.39	-2.02
Leather	-2.43	-5.69	-12.18	-13.84	-12.7	-0.08	-2.6	-1.96	-3.33	-1.99
WoodPaper	-0.73	-1.61	-3.1	-4.19	-3.13	-0.22	-2.64	-2.06	-3.57	-2.09
PetroChemica	-0.83	-3.45	-1.02	-3.88	-1.04	-0.27	-3.00	-1.82	-3.65	-1.85
BasicMetals	-0.30	-0.98	-0.23	-1.16	-0.23	-0.12	-2.75	-1.95	-3.45	-1.98
FabMetalEqu	-0.22	-3.54	-2.36	-4.52	-2.42	-0.07	-2.89	-2.11	-3.6	-2.14
MotorVehpar	-0.04	-0.72	-6.45	-6.80	-6.46	-0.06	-2.72	-2.16	-3.56	-2.18
OtherMnfcs	-4.78	-1.13	-7.31	-7.77	-7.27	-0.09	-2.6	-1.99	-3.37	-2.01
Services	0.00	-8.49	-4.49	-8.49	-4.56	-0.06	-2.39	-1.94	-3.17	-1.95

Source: Model Simulation result

Overall, Ethiopia's trade surplus is higher with broad trade liberalization policies that include more countries (Experiment 4) than with small trade liberalization policies that include only a few countries (Experiments 1, 2 and 3), since the global tariff reductions are much larger. This leads to a large reduction in the import price of intermediate inputs that are used to produce exportable goods and, consequently, expanding exports.

Table 2-10. Changes in Trade Balance and output for Ethiopia, by sector.

Sectors	Changes in Trade Balance (US$ million)					% Changes in Output				
	EXP1	EXP2	EXP3	EXP4	EXP5	EXP1	EXP2	EXP3	EXP4	EXP5
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Grains	1.06	33.12	24.14	42.73	23.62	0.10	0.67	0.02	0.67	-0.08
VegetablFrut	7.68	-16.79	-3.31	-19.29	-3.65	0.25	-0.45	-0.44	-0.65	-0.54
Oilseed	1.68	20.51	16.12	27.25	16.91	0.39	6.24	4.82	8.26	4.83
OtherCrops	-0.23	78.91	62.58	103.61	67.05	0.03	4.23	3.31	5.60	3.44
Livestock	0.88	-7.03	-7.74	-9.77	-8.42	0.11	-0.30	-0.66	-0.57	-0.76
ForestFisher	0.04	0.93	1.07	1.35	1.15	0.06	-0.02	-0.20	-0.07	-0.24
CoalOilGas	-0.09	3.43	1.05	3.35	0.94	-0.08	1.60	1.19	1.91	1.34
FoodMnfcs	-7.21	23.37	-4.70	6.54	-3.14	-0.22	0.81	-0.99	-0.31	-1.03
BeverTobaco	-0.24	-1.65	-5.97	-6.17	-6.30	0.05	-0.56	-1.36	-1.35	-1.48
TextileAppar	-4.51	-45.15	-7.44	-47.41	-11.16	-0.22	-5.78	-0.64	-6.00	-0.67
Leather	0.55	23.53	8.47	23.28	10.21	0.09	3.56	0.63	3.15	0.98
WoodPaper	-1.65	3.45	-4.65	-2.82	-4.67	-0.57	1.82	-1.71	-0.84	-1.68
PetroChemica	-8.57	-0.99	20.11	7.43	20.65	-0.45	-0.59	1.51	-0.17	1.52
BasicMetals	-1.12	35.10	26.98	44.93	30.59	0.00	8.84	6.76	11.46	7.27
FabMetalEqu	-0.77	-30.22	-19.53	-44.95	-22.96	0.25	-0.31	0.20	-0.53	0.25
MotorVehpar	1.40	8.36	-41.35	-36.84	-41.37	0.71	4.50	-7.47	-5.07	-7.30
OtherMnfcs	-6.59	5.07	-10.64	-7.00	-9.58	-1.03	0.75	-1.64	-1.02	-1.52
Services	3.12	-94.21	2.03	-28.38	-5.41	0.06	0.02	-0.01	0.08	0.01

Source: Model Simulation result

Table 2-10 further indicates a mixed prospect in terms of output in many sectors when Ethiopia reduces its tariffs under alternative trade liberalization experiments. In a few sectors, such as oilseeds, other crops, leather, and basic metals, output increases across all experiments. In contrast, in certain other sectors, such as vegetables and fruits, livestock, and beverages and tobacco, output increases only under the COMESA FTA. Similarly, for food manufacturing, wood paper, and other manufacturing sectors, output increases only under the COMESA customs union. The overall results show that for most sectors, output grows more under customs unions (EXP2) than under the COMESA FTA (EXP1) and the EPA (EXP3) since global tariffs are reduced more under the customs union experiments.

2.6. Conclusion

The purpose of this chapter is to provide an in-depth analysis of the impact of the Ethiopia-COMESA FTA, COMESA customs union and the EPA on the economies of COMESA in general, and the economy of Ethiopia in particular. This analysis is relevant for policymakers in Ethiopia and COMESA regions to facilitate the existing trade negotiation among member countries by providing empirical evidence of the impact of tariff reduction. We use the standard GTAP model version 9 databases with unemployment closure for the unskilled labor force. Trade barriers broadly include tariffs and nontariff barriers. However, this chapter considers cases where the countries take policy initiatives to eliminate only their import tariffs. The results are interpreted in terms of changes in Real GDP, trade, welfare, and industrial output. Further, the simulation analysis considers five distinct trade integration scenarios that differ in their level of ambition. It is unlikely that regional trade agreements would result in the complete removal of tariffs on all products. As a result, for all experiment except COMESA FTA (EXP1), lists of sensitive products are exempted from the CET rate calculation.

The simulation results indicated that most COMESA regions win in terms of GDP and welfare with full FTA among all COMESA regions. A few noticeable exceptions to this trend are Zimbabwe, which shows losses in their GDP. For the EU-27, the USA, and the rest of Africa, the COMESA FTA is not welfare improving, but overall global welfare improves. For the customs union and EPA experiments, the results are mixed; some regions lose and some gain depending on the scope of tariff reduction and the initial tariff rate. The world as a whole enjoys welfare gains under the COMESA FTA (EXP1) and EPA scenarios (EXP3), even though world GDP declined slightly with another experiment. Overall, Rwanda, Zambia, and RSCA emerge as the winners in terms of welfare in all experiments.

Another impressive result from our analysis concerns its implications for trade patterns in the regional bloc. The results indicate that there is more trade in a full free trade area among all COMESA member states and that there is a significant improvement in their exports and imports. Similarly, in the customs union (EXP2) and EPA experiments (EXP3,

EXP4, EXP5), we observe significant improvements in the exports and imports of most COMESA regions, but some regions, such as Egypt, Mauritius, RNA, and RSAC, report a significant reduction in their imports.

We also examine the sectoral level effect of alternative trade liberalization policies for Ethiopia. The results indicate that the Ethiopian economy reports larger export growth than import growth for most manufacturing sectors such as wood paper, petroleum chemicals, fabricated metal equipment, and motor vehicle parts under the COMESA FTA. Similarly, the move from the COMESA FTA to customs unions (EXP2) results in large export and import growth for the coal, oil and gas, textiles and apparel, and leather sectors. Furthermore, the EPA results in relatively larger export growth than import growth for most sectors, except for some agriculture sectors, such as oilseeds, other crops, livestock, beverage, and tobacco, leather and other manufacturing. Overall, grains, oilseeds, forestry and fishery, and leather are the winning sectors, reporting trade surpluses across all experiments, while beverages and tobacco, textiles and apparel, and fabricated metal equipment are losing sectors, having trade deficits across all experiments. The aggregate trade balance improves more for Ethiopia under all experiments except COMESA FTA (EXP1) experiment, but there is large revenue loss under all experiments. In addition, there is a substantial loss in terms of welfare and GDP under the customs union (EXP2) and the EPA (EXP3, EXP4, EXP5) for Ethiopia. Therefore, there is no strong reason for Ethiopia to join COMESA customs union and reciprocate tariff with EU in the short run and a transition period is necessary, but it is recommended for Ethiopia to join COMESA FTA.

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Chapter 3

3. Analysis of trade facilitation policies on customs clearance time

Chapter summary

Trade liberalization through both regional and multilateral approach reduces both tariff and non-tariff barriers over time. However, international trade continues to involve higher trade costs in money and time than domestic trade. In this chapter, we provide econometric estimates of the impact of Trade Facilitation Policies (TFPs) on customs clearance time for 104 middle and low-income countries. Further, the welfare impact of TFPs is analyzed using the GTAP model version 8.1. The estimation result indicates that both formality documents, and fees and charges have a significant impact on export and import clearance time for documentary compliance, while only formality document significantly reduces border-related compliance. Besides, advance rulings have a significant impact on export clearance time for documentary compliance. The CGE result indicates that when countries move to best practice, geography and income mean in formality documents, there are large welfare and trade gain. The gain is higher for low-income countries with considerable customs inefficiency. We recommend the policymakers to strengthen the harmonization of international standards, increase the transparency and regular review of disciplines related to fees and charges, and facilitate the rules and process applied to specific goods as the main policy tool to reduce customs delay.

3.1. Introduction

Over the past two decades, the international community has made significant progress in dismantling barriers to trade. Trade cost has been reducing due to policy-related reasons (tariff and non-tariff barriers), technological reasons related to transport, and communication cost. For developed countries, the establishment of the European Union (EU) and the North American Free Trade Agreement (NAFTA) contribute to the reduction of the tariff rate. For developing countries, tariffs have also become less of an impediment because of Generalized System of Preferences (GSP) programmes and other preferential schemes, bringing duty-free access for most of them to major developed countries (WTO, 2008). However, trade cost in the developing world are still higher than the developed world, and both tariff and non-tariff barriers are substantial (Arvis, Duval, Shepherd, Utoktham, & Raj, 2016). Besides, tariff rates, as well as selected non-tariff barriers, generally remain higher in developing countries than in the developed world (Kee, Nicita, & Olarreaga, 2009)

Although traditional trade barriers have been reduced across time due to regional and preferential trade agreements, international trade continues to involve higher transaction costs in money and time than domestic trade. As a result, there is a dramatic shift towards non-tariff measures in recent multilateral and preferential trade agreements. Removing unnecessary barriers to timely delivery is therefore of utmost importance and identifying the type of trade facilitation policies responsible for the reduction of customs clearance delay is a crucial policy issue.

Despite the importance of Trade Facilitation Policies (TFPs) to reduce trade cost and improve customs performance, relatively little has been done on identifying specific TFPs, which significantly reduces customs delay. An improvement in the area of availability of trade-related information, formality related to documents, the streamlining of procedures and the use of automated processes are estimated to reduce trade cost by 14%, 15%, and 13% for low income, lower middle, and upper-middle-income countries respectively (Moïsé et al., 2013). Similarly, good governance and impartiality significantly affect time to trade, and a move by all World Trade Organization (WTO) member countries in all

policies is estimated to reduce customs delay by an average of 1.6 days for import and two days for export (Hillberry and Zhang, 2015). Furthermore, using an average of days to clear customs as the outcome variable, fees-charges, formalities-documents, and formalities procedures are estimated to have a significant impact on reducing import time while formalities-documents and formalities procedures have a significant impact on reducing export time (Walmsley and Minor, 2016). However, a recent study finds that customs and logistics performance across countries are better explained by the difference in cross-country characteristics related to geography, income, and the general quality of governance than do the measures of TFPs (Hillberry and Zhang, 2017).

In this chapter, we use similar econometric approach to Walmsley and Minor (2016) in modeling the impact of trade facilitation policies on customs clearance time, but our analysis differs in the following ways. First, we use the latest World Bank Trading Across Border (TAB) database, which provides the values of customs clearance time in an hour than days while their analysis was based on the old methodology of calculating the time to trade. Second, this is the first paper to use customs clearance time for border and documentary compliance as an outcome variable. This is important to identify which trade facilitation policies are related to which type of compliance. Third, we made counterfactual analysis to estimate the reductions of customs delay when countries move to best practice, geography mean, and income mean, while their analysis was done for best practice only. Fourth, in Walmsley and Minor (2016) study, the welfare and macroeconomic impact are examined using willingness to pay approach while in this chapter we use iceberg approach in introducing trade facilitation policies into GTAP model. Lastly, besides to the difference in the outcome and policy variable, this analysis is restricted to middle and low-income countries.

This chapter has three objectives. First, to estimate the impact of TFPs on customs clearance time for border and documentary compliance. Second, to conduct counterfactual analysis for three alternative scenarios based on the model simulation result. Third, to calculate the welfare and macroeconomic impact of trade facilitation policies. We use multiple linear regression models to achieve the first objective while GTAP CGE model is

used for welfare analysis. The World Bank trading across border data is used to measure time to export and import for border and documentary compliance. Our main policy variables are Organization for Economic Cooperation and Development (OECD) Trade Facilitation Indicators (TFIs) as discussed in Moïsé et al. (2011). These indicators are a quantitative representation of 11 different aspects of border management policies. The OECD TFIs cover 163 countries, but our analysis is restricted to 104 middle and low-income countries.[9] For the CGE analysis, we use the GTAP database version 8.1, which is aggregated into 19 regions and eight sectors.

Estimation of trade facilitation policies on customs clearance time has some challenges. First, there is missing value in most TFI variables. Consequently, we conduct a test to check if the missing value is random or not. The test result shows that the missing values are at random, so we made our analysis using complete observations. Besides, since our sample is relatively small, we also conduct exclusion F-test and remove TFI variables that do not have a statistically significant impact on the outcome variables. Third, some of the variables used to construct formality-document indicator are also used by the World Bank to calculate the time to trade data. Therefore, we adjust the formalities-documents variable to solve a possible endogeneity concern. To address this issue, a new formality-documentation indicator is constructed using two observations; use of copies and international compliance standards.

Against this background, the remaining part of this paper is organized as follows; Section two reviews the relevant empirical literature on TFPs. Section three describes the performance of regions based on trade cost and trade facilitation data. Section four briefly discusses the methodology of the study. We discussed the estimation result of TFPs in section five. Section six discusses the macroeconomic and welfare effect of TFPs. Section seven concludes.

[9] All EU member countries are excluded from the analysis since their time to trade data is zero. Besides, high income countries have better performance in TFIs, and are excluded from this analysis.

3.2. Literature review

Several studies have been done to analyze the impact of improving trade facilitation policies on customs performance.[10] Most of them apply two methods: Partial Equilibrium methods (Gravity models) and CGE modeling. We group empirical studies that relate to this study into four categories. The first categories use customs performance measures as independent variables and investigate the impact of reducing these measures on trade volume using gravity model: example includes Freund and Rocha (2010), Djankov et al. (2010), and Shepherd and Dennis (2007). The second categories use TFIs as an independent variable and examine their impact on trade volume: example includes Moïsé et al. (2011), Moïsé et al. (2013), and Beverelli et al. (2014). The third categories use AVEs of time delay and examine the welfare and macroeconomic impact of trade facilitation policies using GTAP CGE model: example includes Hertel et al. (2001), Fox et al. (2003), Allen Dennis (2006), P. Minor and Tsigas (2008), and Jensen and Sandrey (2015). The last category, which is similar to this paper uses TFPs as the independent variable and estimate their impact on customs clearance time: example includes Hillberry and Zhang (2015, 2017), and Walmsley and Minor (2016). Walmsley and Minor (2016) extend their analysis to the macroeconomic and welfare impact of TFPs using willingness to pay approach.

Empirical evidence shows that poor-quality border management and logistics reduced trade volume with a significant effect on time-sensitive goods. For Sub-Saharan Africa, a one-day increase in inland transit time reduces exports by 7 percent on average or a one-day reduction in inland travel times translates into nearly a 1.5 % decrease in all importing-country tariffs (Freund and Rocha, 2010). Similarly, Djankov et al. (2010) estimated that each additional day that a product is delayed reduces trade by at least 1%. They also show that delays have a relatively higher impact on exports of time-sensitive goods, such as perishable agricultural products. Further, Shepherd and Dennis (2007) using export cost data shows that a 1% reduction in the cost of international transport or cost of exporting is associated with an export diversification gain of 0.4 percent or 0.3 percent respectively.

[10] We use customs performance (customs clearance time), and trade facilitation policies (trade facilitation indicators) interchangeably for the whole paper.

A series of studies analyze the relationship of the TFIs to bilateral trade patterns and trade costs. Using a gravity model, Moïsé et al. (2011) show that advance rulings lead to the highest increase in trade flow for OECD member countries[11]. Furthermore, the sector-specific analysis reveals that TFIs are particularly significant for manufactured goods but less so for agricultural goods. Besides, measures to streamline procedures and advance rulings have a significant impact on reducing trade cost. In a follow-up study for developing countries, Moïsé et al. (2013) estimated that TFPs have a potential cost reduction of 14.5% for low-income countries, 15.5% for lower-middle-income countries and 13.2% for upper-middle-income countries.[12] Using a two-step estimation procedure to estimate the impact of TFPs on welfare and trade, Zaki (2014) finds that the gain in terms of welfare and trade is higher for developing regions than a developed one. Further, trade facilitation improves both intra-regional and inter-regional trade.

Apart from the gravity model, several studies use CGE models to analyze the welfare and macroeconomic impact of TFPs. These studies use the AVEs of per day time delay estimates provided by Hummels (2001) and the World Bank TAB data. Using the estimates of time and direct cost saving due to customs automation, Hertel et al. (2001) show that customs automation benefits all trading partners. According to this approach, traded goods incur indirect trade transactions costs (iceberg costs) in proportion to how long their transit is. The iceberg cost captures the inefficiencies of lost time in transit. Most previous GTAP model paper uses Hertel et al. (2001) approach to analyze the impact of TFPs. However, a recent analysis divides the effect of reducing Trade Transaction Cost (TTC) into the two component namely direct cost (logistic duties), and indirect TTC (iceberg costs) in proportion to how long their transit is (Fox et al. (2003), and OECD (2003))[13]. Following, this improvement in methodology, Minor and Tsigas (2008) uses Hummels et al. (2007) estimates of AVEs of one day delay and shows that trade facilitation efforts that reduce export delays result in greater export diversification effect for sub-Saharan countries.

[11] Trade costs are estimated from bilateral trade flow based on the methodology developed by Novy (2008)
[12] They use trade flow to calculate trade cost using Novy (2013) methodology.
[13] The direct trade transaction cost (TTC) are incorporated into GTAP CGE model by using the "Alter tax" option to adjust the benchmark trade duties accordingly. While the indirect TTC are incorporated through "ams" variable in the GTAP model.

Minor (2013) and Hummels and Schaur (2013) provide a database of per day ad valorem time costs for use with the GTAP 8.1 database. Following this database, several studies analyze the welfare and trade impact of reducing time delay. A study on the continental free trade agreement shows that the 20% reduction in time delay results in a welfare gain for all African countries (Jensen and Sandrey, 2015). Similarly, trade facilitation tends to increase the share of income captured by the poorest 40 percent of the population while services reform decreases the share (Balistreri et al., 2016). However, previous studies that use AVEs of time delay estimate assume a flat reduction in trade transaction cost across countries as a measure of trade facilitation.

Recent studies on TFPs focuses on estimating the impact of specific trade facilitation policies on customs clearance time using econometrics model. Using discrete-time transition model, Hillberry and Zhang (2015) find that full implementation of trade facilitation is equivalent to a cross-country average tariff reduction of 0.9% for import and 1.2% reduction for the export tariff. Similarly, Walmsley and Minor (2016) use an average of days to clear customs as the outcome variable and finds that fees-charges, formalities-documents, and formalities procedures have a significant impact on reducing import clearance times while only formalities-documents and formalities procedures significantly reduce export clearance time. The result further shows that a move to best practice in each of TFIs by OECD countries reported a reduction in customs delay of 0.6 days for import while other regions reported import customs reduction of 0.9 to 1.9 days. Similarly, most regions are expected to reduce export customs delay by 0.8 to 0.9 days. However, a recent study by Hillberry and Zhang (2017) finds that customs and logistics performance across countries are better explained by the difference in cross- country characteristics related to geography, income, and the general quality of governance than do the measures of TFPs. Nevertheless, they also find some evidence that improving procedures could produce substantial reductions in total time to import.

3.3. Descriptive exposure on time to trade and trade facilitation policies

3.3.1. A measure of customs clearance time

The World Bank doing business indicators on trading across borders were among the first global measures of the administrative, regulatory and logistical burdens that add to the time and cost of trading internationally. Since 2015 the TAB database uses the new methodology and measures the time and cost (excluding tariffs) of export and import for documentary compliance, border compliance, and domestic transport.

Under the new methodology, the case studies are designed to reflect the actual volume and direction of international trade, as well as the administrative and regulatory burdens, faced by traders. It also allows an economy to be in a customs union with its case study trading partners to emphasize the role of multilateral and regional trade agreements on reducing trade barriers. Besides, the new database measures the time to trade in hours rather than in days to acknowledge the increasing trend in the adoption of electronic data interchange and other technologies that allow the fast and more efficient flow of information.

For exports, the TAB data measures the time and cost to export a shipment of 15 metric tons of the economy's top non-Extractive export product. The case study follows the shipment from a warehouse in the economy's largest business city to the most widely used land border or port through which the shipment would be exported. For imports, the product should be transported from the countries' most widely used land border or port to a warehouse in its largest business city. Further, the shipment consists of 15 metric tons of containerized auto parts for all economies, and the trading partner should be the primary import partner for the product. (Doing Business, 2016).

Documentary compliance measures the time and cost associated with compliance with the documentary requirements of all government agencies of the origin economy, the destination economy, and any transit economies. The documentary compliance includes the time and cost of obtaining, preparing, processing, presenting, and submitting documents.

Border compliance measures the time and cost associated with compliance with the economy's customs regulations and with regulations relating to other inspections that are mandatory for the shipment to cross the economy's border. It includes time and cost for customs clearance and inspection.[14]

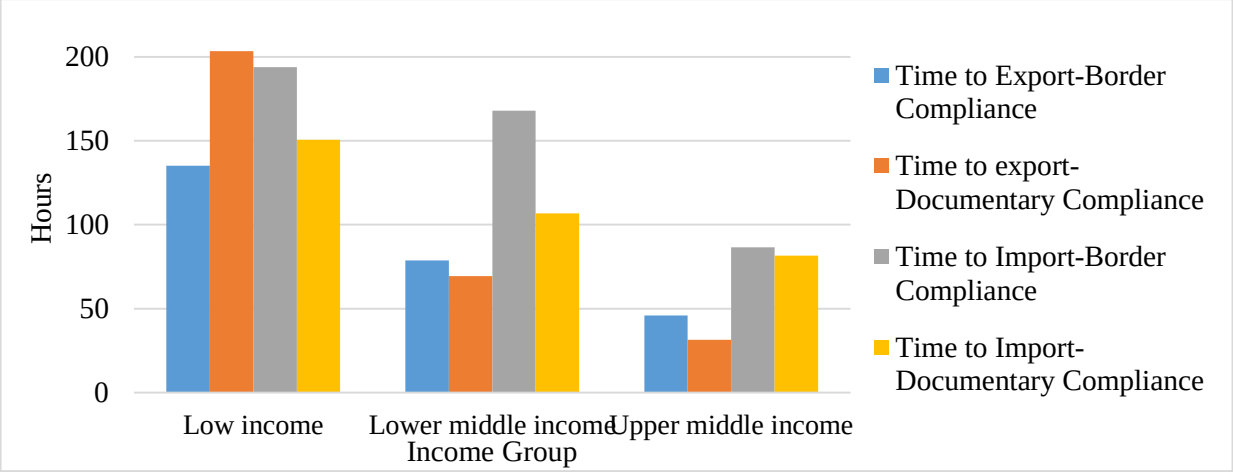
Figure 3-1 below shows that there is a considerable difference across income groups in customs clearance time. The customs clearance time increase as we move across the income group from upper-middle income to low-income countries. Border compliance takes 90 additional export hour in low-income countries than upper-middle-income countries, while documentary compliance takes 117 more export hour on average than upper-middle-income countries.

Importing auto parts involves more time and cost on average than exporting does for both types of compliance. Intuitively, it makes sense that imports face more inspections (increasing border compliance time) as well as more procedures (increasing documentary compliance time) while export procedures are relatively simple with less special documents required. However, for some economies such as Asia, Africa, and Latin America use designated Pre Shipment Inspections (PSI) leads to a shift of procedures from the importing to the exporting side (OECD, 2003).

Figure 3-2 below shows the disparity in the quality of border procedures across regions. Central Asia and the Asia Pacific are regions with relatively better customs efficiency or low clearance time. Similarly, customs clearance time for import takes more time than export for both types of compliance except Central Asia regions. Sub Saharan Africa (SSA) region reported relatively large customs clearance time in all type of compliance except import clearance time for documentary compliance.

[14]For detail, visit http://www.doingbusiness.org/Methodology/Trading-Across-Borders

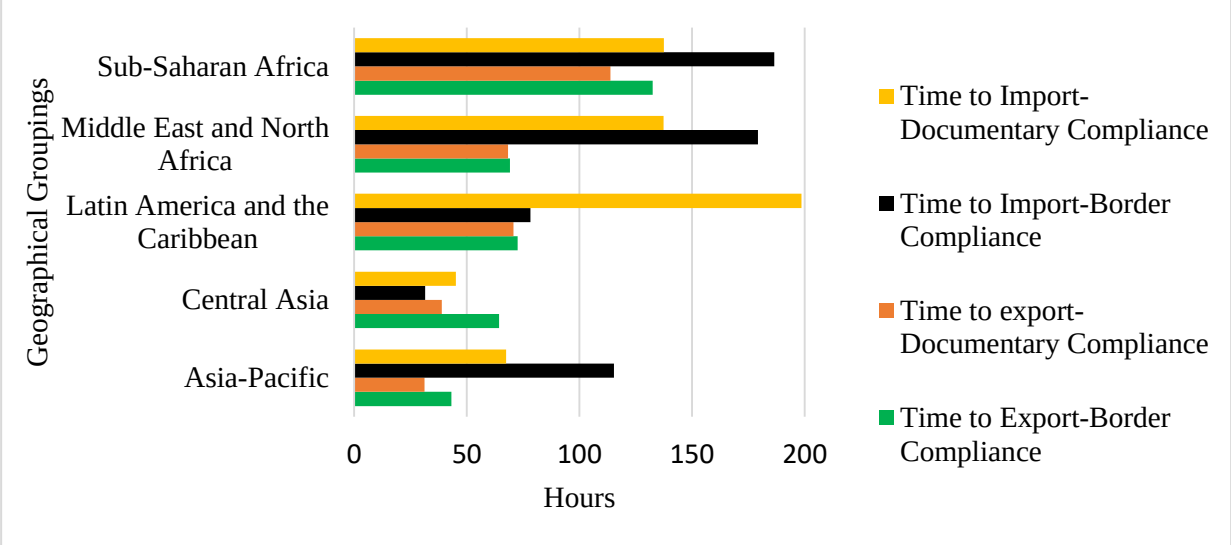
Figure 3-1. Weighted Average customs clearance time, by Income groupings



Note: Time to export and import are export and import-weighted respectively.

Source: World Bank doing business database (2015).

Figure 3-2.Weighted Average customs clearance time, by geographical groupings



Note: Time to export and import are export and import-weighted respectively.

Source: World bank doing business database (2015).

3.3.2. Trade facilitation policies

Following the completion of the WTO Trade Facilitation Agreement (TFA), OECD has developed a set of trade facilitation indicators aiming to boost the benefit of international trade by improving the border procedures and reducing trade cost. This indicator help

governments to identify the areas for improvement. The 2015 OECD trade facilitation indicators database covers 163 countries (34 OECD and 129 non-OECD countries) across income levels, geographical regions, and development stages. The indicators are prepared for 23 low income, 45 lower middle income, 42 upper middle income, 19 high-income non-OECD, as well as 34 OECD countries. Besides, the database provides six geographical classifications of regions, including 34 the Asia Pacific, 47 Europe, and Central Asia, 27 Latin America and the Caribbean, 14 the Middle East and North Africa, 2 North America and 39 Sub-Saharan Africa regions. The database is a representative sample of countries covering all continents, including landlocked, least developed as well emerging economies, and several high-income non-OECD countries.

The 2015 TFIs database has 11 indicators composed of 77 variable for Non-OECD countries and 90 variables for OECD countries.[15] The value of the indicators ranges from 0 to 2, where 2 represents the best performance that can be achieved. The TFIs are the simple average of the scores for each variable composing them. Estimates based on these indicators provide a basis for governments to prioritize trade facilitation actions and mobilizes technical assistance and capacity-building efforts for developing countries in a more targeted way. Table 3-1 below lists the 11 TFIs prepared by OECD.

Figure 3-3 and 3-4 below shows the general observations on the trade facilitation areas covered by each of the indicators for the full sample used in this paper, 104 countries.[16] Figures 3-3 compares the performance of regions by broad geographical classification. There are more significant disparities among regions in the areas of *Information*, *Advance rulings*, and *Governance* than in *Fees- charges*, and *Formality- procedures*. Sub-Saharan countries are the lowest performing regions in many indicators except *Formality-procedures*. The difference in performance across regions depends on the quality and extent of trade facilitation effort taken by each region.

[15]The 2012 TFIs database has 12 indicators composed of 77 variables and 20 additional transit variables for 113 countries.

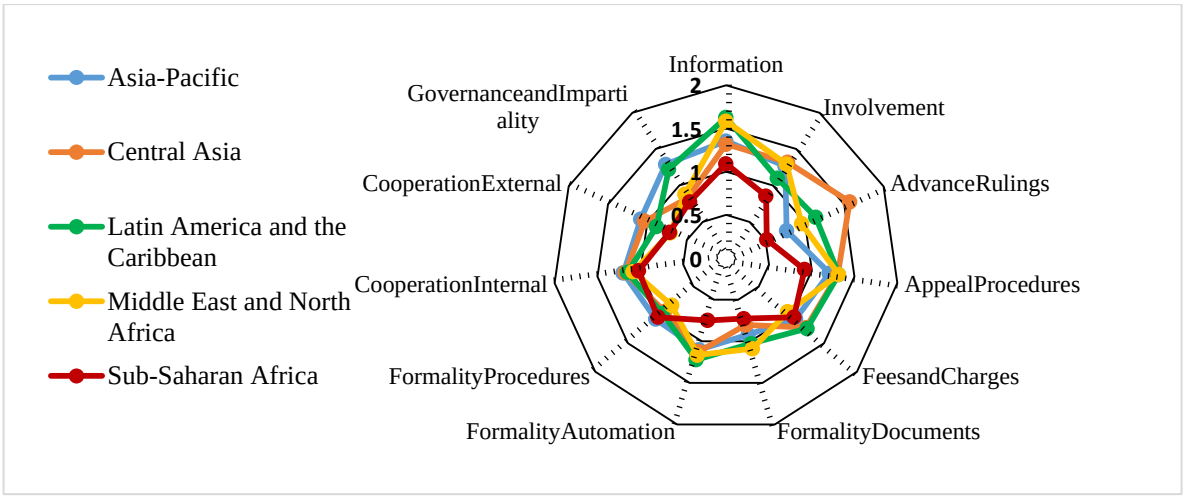
[16] The numbers in each indicator are the available observation out of 104 countries. For detail, explanation of the source and methodologies of each TFI data visit OECD website and trade policy working papers (http://www.oecd.org/tad/facilitation/indicators.htm#About-TFI).

Table 3-1.OECD Trade facilitation Indicators.

Indicator	Descriptions
(A) Information Availability	Inquiry points; publication of trade information, including on Internet; transparency of required documentation; user manuals; available legislation
(B) Involvement of the Trade Community	Structures for consultations; established guidelines for consultations; publications of drafts; the existence of notice-and-comment frameworks.
(C) Advance Ruling	Prior statements by the administration to requesting traders concerning the classification, origin, valuation method applied to specific goods at the time of importation; the rules and process applied to such statements.
(D) Appeal Procedure	The possibility and modalities to appeal administrative decisions by border agencies.
(E) Fees & Charges	Disciplines on the fees & charges imposed on imports and exports; transparency and regular review of fees & charges; disciplines on transparency and implementation of penalties systems.
(F) Formalities – Documents	Acceptance of copies, simplification of trade documents; harmonization in accordance with international standards
(G) Formalities – Automation	Electronic exchange of data; use of automated risk management; automated border procedures; electronic payments; automated pre-arrival processing; digital signatures.
(H) Formalities – Procedures	Streamlining of border controls; single submission points for all required documentation (single windows); post-clearance audits; Authorised operators; measures on perishable goods; risk management systems; expedited shipments.
(I) Co-operation – External	Co-operation with neighboring and third countries.
(J) Co-operation – Internal	Control delegation to Customs authorities, and cooperation between various border agencies of the country.
(K) Governance and Impartiality	Customs structures and functions; accountability; ethics policy.

Source: ESCAP-OECD handbook

Figure 3-3. Trade facilitation performance, by geographical groupings.



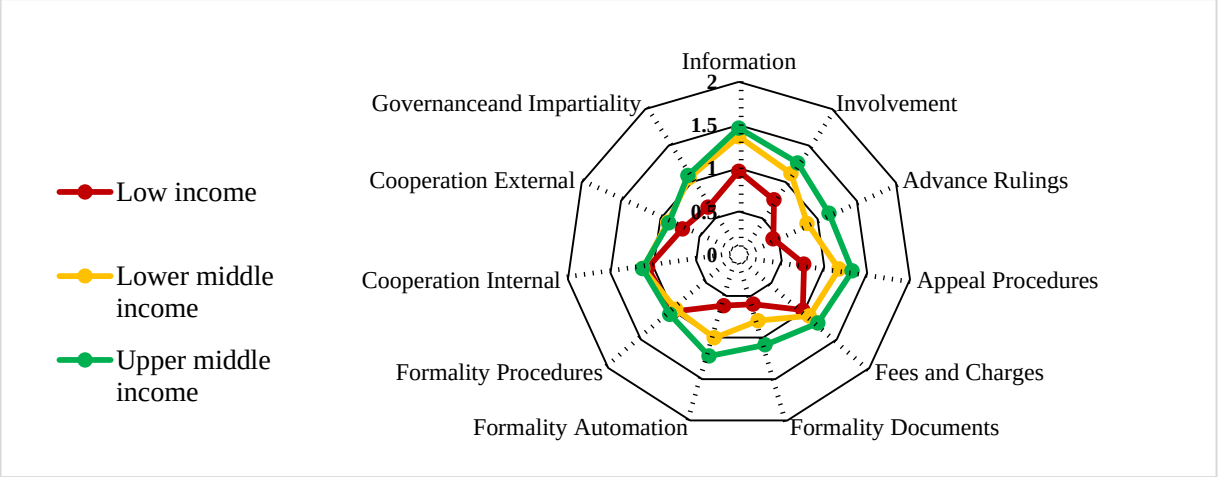
Source: OECD TFI database.

Figure 3-4 below shows that there is a significant disparity in TFIs across income groups except on cooperation-internal, formality-procedure, and fees & charges indicators. Countries with higher per capita income are better in most TFIs than Low-income regions mainly due to the availability of a financial resource to automate customs procedures.

In this analysis, we use the OECD's reported score for each of the 11 policy groups as the quantitative measure of TFI in each category for the year 2015. However, four of the six variables used to construct formalities-documents data are also used to prepare customs clearance data in TAB database. Therefore, we adjust the formalities-documents variable to solve a possible endogeneity concern.[17] To address this issue, the four TAB variables are removed, and a new formality-documentation indicator is constructed using two indicators, use of copies and international compliance standards.

[17]The six variables used to construct OECD formality-document variable are Number of documents for import, Number of documents for export, Time to prepare documents for import (days) and Time to prepare documents for export (days), use of copies, and international standard compliance.

Figure 3-4. Trade facilitation performance, by income groupings.



Source: OECD TFI database

3.4. Impact of trade facilitation policies on time to trade

We use multiple linear regression models to estimate the impact of TFPs on customs clearance time. Our estimation framework has four main outcome variables; time to export for documentary compliance, time to export for border compliance, time to import for documentary compliance, and time to import for border compliance. For the outcome variable, we use World Bank trading across border data, while for the policy variable OECD trade facilitation indicators are used. Moreover, as shown in table 3-2, our econometric model includes landlocked and surface area variable. These variables are expected to affect both the level of international trade and the performance of border agencies (customs performance). First, logged square kilometers is included to measure the impact of the difference in the countries size (surface area) on time to clear customs. Large countries are expected to take considerable time to import and export than small size countries. The source of data for surface area is world development indicators database. Second, a dummy variable is included to indicate if a country is landlocked or not. The primary source of data for a landlocked variable is Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). The customs clearance indicators take into account the time and cost of border procedures in the landlocked country itself and at other border posts between the relevant port and the country of interest. Therefore, the landlocked

dummy thus acts as a control for the fact that the quality of customs in neighboring countries may influence landlocked countries' customs clearance time.

The econometric estimation is done for 104 middle and low-income countries[18]. However, due to the difficulty in collecting international data, most OECD TFIs data are incomplete. As shown in table 3-2, Out of 104 observations, we find a missing value for seven TFIs such as involvement, advance rulings, appeal procedure, fees and charges, cooperation-internal, cooperation-external, and governance, and impartiality. However, when we use the reduced model, the missing value reduces a lot.

One of the challenges that previous studies face is related to the potential multicollinearity among TFIs and between TFIs and other policy variables. Hence, we check pairwise correlations among all the TFI variables and between TFIs and control variables. The test result shows that there is no strong correlation among TFIs, and between TFIs and control variables, but some TFIs such as information, appeal procedure, formality-procedure, formality automation, and governance are correlated with each other. Hence, there is some concern for multicollinearity among some TFIs, and we need to check that using appropriate multicollinearity test. We use the *Variance Inflation Factor* (VIF) to check for possible multicollinearity. As a rule of thumb, a variable whose VIF values are greater than ten may need further investigation. Tolerance, defined as 1/VIF, is also used by many studies to check on the degree of collinearity. Our VIF test result tells us that there is no multicollinearity; the mean VIF for all independent variables is 1.83. Moreover, we also conducted another test of multicollinearity using the command *Collin* to check the global instability of the regression coefficient. A large condition number, 10 or more, is an indication of instability. Our test result tells us that, the conditioning number for our model is 4.85, which shows that our model is stable and no problem of multicollinearity.

[18] All high income and EU member countries are excluded from this analysis.

Table 3-2. Summary statistics

Variable	# of Obs	Mean	Std. Dev.	Min	Max
Basic Control Variables					
log Surface	104	11.97	2.18	5.70	16.65
landlocked	104	0.28	0.45	0	1
Trade Facilitation Policy Variables					
Information availability	104	1.31	0.56	0	2
Involvement of trading community	98	1.09	0.55	0	2
Advance rulings	102	0.88	0.66	0	2
Appeal procedures	95	1.14	0.44	0	2
Fees and charges	95	1.11	0.44	0	2
Formality - documents	104	0.99	0.51	0	2
Formality - automation	104	1.00	0.55	0	2
Formality - procedure	104	1.01	0.34	0.22	1.67
Cooperation- internal	99	1.11	0.62	0	2
Cooperation- external	76	0.86	0.71	0	2
Governance & impartiality	97	0.98	0.58	0	2
Outcome Variables					
Log Time to export for DC	104	3.75	1.21	0.69	6.55
Log Time to import for DC	104	3.92	1.34	0.69	6.99
Log Time to export for BC	104	3.95	1.01	1.10	5.85
Log Time to import for BC	104	4.08	1.24	0	6.04

Note: BC = Border Compliance, and DC = Documentary Compliance.

Source: OECD TFIs database and World Development Indicators

Moreover, when we conduct the regression using all TFIs variable, most of the variables are not significant. First, we conduct F-test for the exclusion of TFI variable. For each group of variables, we report results of an F-test of the hypothesis that all coefficients on the relevant variables equal zero. The F test results in table 3-3 show that there is no statistically significant joint effect of the excluded TFI variables in any of our outcome variables ($P>0.05$). Therefore, we exclude the insignificant TFI variables from our regression model. Excluding insignificant TFI variables increase our sample size from 71 observations to more than 93 countries. In appendix B.1 we include the estimation result including all trade facilitation indicators. However, all the model results in this chapter are using the reduced model as shown in equation 3.1-3.4 below.

- **Final Econometric model**

$$\ln TEDC_i = B_0 + B_1 \ln surface_i + B_2 Advance\ rulings_i + B_3 feesandcharges_i + B_4 formalitydocuments_i + e_i$$ ---Equation 3-1

$$lnTEBC_i = B_0 + B_1 \ln surface_i + B_2 landlocked_i + B_3 formalitydocuments + e_i$$--- Equation 3-2

$$lnTIDC_i = B_0 + B_1 \ln surface_i + B_2 feesandcharges_i + B_3 formalitydocuments_i + e_i$$ -- Equation 3-3

$$lnTIBC_i = B_0 + B_1 lnsurface_i + B_2 landlocked_i + B_3 formalitydocuments + e_i$$--- Equation 3-4

Where,

TEBC = Time to Export for Border Compliance.

TEDC = Time to Export for Documentary Compliance.

TIBC = Time to Import for Border Compliance.

TIDC = Time to Import for Documentary Compliance.

Surface area and landlocked are basic control variables.

Fees and charges, formality-documents, and advance rulings are policy variables

3.4.1. Estimate result for time to export

The result in table 3-3 indicates that advance rulings, fees and charges, and formality-document significantly reduce time to export for documentary compliance. Both variables have coefficients that are economically significant - a one-point move in each index (on a 0-2 scale) produces a reduction in reported time to export for documentary compliance of over 35%, 64%, and 55% respectively. In the case of border compliance, only formality-documents is significant at 5% levels. A one-point move in each index (on a 0-2 scale) produces a reduction in reported time to export for border compliance of over 43%.

Our econometric specification includes surface area (country size) besides to policy variables to capture cross-country variation on time to trade. The result in table 3-3 indicates that countries with large surface area tend to require more than 35% time to export for documentary related compliance while border compliance takes more than 14%

export time for large countries. For border compliance, the landlocked variable is included to control for the fact that the quality of customs in the neighboring country may influence landlocked countries time to export. The result in table 3-3 shows that landlocked countries have more than 39% fewer time to export for border-related compliance on average than coastal.

3.4.2. Estimate result for time to import

Table 3-3 reports the estimated coefficient for the specification of the model with time to import for both compliances as the outcome variable. For documentary compliance, both fees & charges, and formality-documents have a statistically significant coefficient, with an expected sign - a one-point move in each index (on a 0-2 scale) produces a reduction in reported time to import for documentary compliance of 61% and 58% respectively. Both policy variables affect customs clearance time for both export and import documentary compliance. The impact of fees & charges is small for import time than export time while formality-documents have a substantial impact on import clearance time. Besides, countries with a large surface area are estimated to have more than 32% time to import for documentary related compliance.

In case of border compliance, only formality-document is significant at 1% level - a one-point move in each index (on a 0-2 scale) produces a reduction in reported time to import for border compliance of over 62%. The estimated impact of formality-documents on import clearance time is relatively higher than export clearance time for border-related compliance. Further, countries with a large surface area are estimated to have more clearance time for border-related compliance. Besides, landlocked countries are estimated to have small clearance time around 56% for border-related compliance than coastal. Table 3-3 further shows that landlocked countries are estimated to have small import clearance time than export time for border-related compliance than coastal countries.

Table 3-3. Estimation result using significant TFI variable.

Variable	logTEDC	logTEBC	logTIDC	logTIBC
logsqkm	0.357***	0.142***	0.328***	0.133***
	(-0.0574)	(-0.0406)	(-0.0661)	(-0.0479)
Adv. Rulings	-0.355**			
	(-0.164)			
Fees and Charges	-0.648*		-0.614**	
	(-0.34)		(-0.268)	
Formality Documents	-0.554***	-0.432**	-0.586**	-0.627***
	(-0.193)	(-0.186)	(-0.252)	(-0.22)
landlocked		-0.399*		-0.569**
		(-0.202)		(-0.238)
_cons	0.947	2.093***	0.185	2.176***
	(-0.772)	(-0.546)	(-0.87)	(-0.644)
N	93	104	95	104
r2	0.365	0.297	0.396	0.352
F	15.05	6.818	9.631	8.775
Regional dummy	No	Yes	Yes	Yes
Standard errors in parentheses * p<0.10, ** p<0.05, *** p<0.01				
F-test of joint exclusion				
F-test on insignificant TFI	F(9, 58) = 1.27 Prob > F = 0.2753	F(11, 57) = 1.19 Prob > F = 0.3146	F(9, 58) = 0.58 Prob > F = 0.8066	F(11, 57) = 1.14 Prob > F = 0.3468

Source: Econometric estimation result

3.4.3. Counterfactual analysis for border and documentary compliance

We calculate the number of hours reduced to clear customs for both types of compliance when the countries move to best practice, geography mean, and income means in TFIs while holding the other variables fixed at their observed values. First, we calculate the estimated value of time to export and import when countries move from their reported TFI value to best practice, geography and income mean[19]. Then, the difference between the reported and simulated time to export and import gives the change in time to clear customs due to the improvement in significant trade facilitation indicators. For high-income countries, the simulated customs clearance time is zero since the analysis includes only middle and low-income countries.

Table 3-4 reports the trade-weighted average reported and simulated days to export and import for border compliance[20]. The first two columns report the reported customs clearance time to export and import while the last six columns report the estimated clearance time when all countries move in all significant TFI to best practice, geography means and income mean. For example, when all countries move to the best practice in formality-documents, the average time to export for border compliance reduces to 1.61, 2.42 and 5.96 days for upper-middle, lower-middle, and low-income countries respectively. Similarly, moving to geography mean reduces export time to 2.15, 3.14, and 8.95 days for upper-middle, lower-middle, and low–income countries respectively. The result for income means is slightly lower than geography mean. The net time reduction is higher when countries move to best practice than geography and income mean, which shows that most countries are either near to their geography and income mean or they are above the mean.

Table 3-4 further indicates that when all countries move to the best practice in formality-documents the average time to import for border compliance reduces to 2.12, 4.64 and 4.52 days for upper-middle, lower-middle, and low–income countries respectively. Similarly,

[19] For geography and income mean estimation, we move only countries that have reported TFI below regional and income average to their geography and income mean respectively. However, for countries that surpass the income and geography mean, no change is made. For best practice estimation, we move all countries from their reported TFI to 2 for full compliance with WTO TFA agreement.

[20] The estimated result is in hour but we convert it into days.

moving to geography mean reduces import time to 3.12, 6.66, and 8.01 days for upper-middle, lower-middle, and low–income countries respectively.

Table 3-4. Reported and simulated time to export and import for border compliance (Days)

Region	Reported time		Simulated time, Best mean		Simulated time, Geography mean		Simulated time, Income mean	
	Export	Import	Export	Import	Export	Import	Export	Import
High Income								
Average HI	0.56	0.48	0	0	0	0	0	0
EU	0.49	0.05	0	0	0	0	0	0
Cen.Asia	0.67	1.71	0	0	0	0	0	0
Asia Pacific	0.69	1.15	0	0	0	0	0	0
Lat.A & Ca	0.25	0.27	0	0	0	0	0	0
MENA	2.88	4.85	0	0	0	0	0	0
Upper Middle Income								
Average UMI	2.17	3.14	1.61	2.12	2.15	3.12	2.08	3.02
EU	0.06	0.01	0	0	0	0	0	0
Cen.Asia	2.91	1.18	2.34	0.85	2.9	1.17	2.9	1.17
Asia Pacific	1.31	3.51	1.05	2.57	1.31	3.51	1.31	3.51
Lat.A & Ca	3.91	3.69	2.44	1.95	3.83	3.6	3.38	3.1
MENA	4.41	4.52	2.89	2.49	4.41	4.52	4.19	4.22
SSA	3.89	5.33	3.13	3.9	3.89	5.33	3.89	5.33
Lower Middle Income								
Average LMI	3.24	6.89	2.42	4.64	3.14	6.66	3.17	6.71
Cen. Asia	1.21	2.37	0.9	1.47	1.14	2.1	1.15	2.16
Asia Pacific	3.38	7.78	2.59	5.5	3.3	7.68	3.35	7.78
Lat.A & Ca	1.92	2.84	0.87	0.89	1.62	2.18	1.39	1.75
MENA	2.14	5.24	1.16	2.24	1.81	4.26	1.81	4.24
SSA	5.07	8.95	3.94	6.3	5.05	8.92	5.07	8.95
Low Income								
Average LI	9.51	8.92	5.96	4.52	8.95	8.01	8.86	8.09
Asia Pacific	2.67	2.75	1.39	1.07	2	1.81	2.25	2.15
SSA	9.62	9.13	6.03	4.64	9.06	8.22	8.96	8.29
Row	0	0	0	0	0	0	0	0

Source: Econometric model estimation result.

Table 3-5 shows the reported and simulated time to export and import for documentary compliance. A move to the best practice by all countries on advance ruling, formality-documents and fees and charges reduce the average time to clear export to 0.57, 0.92, and 0.97 days for upper middle, lower-middle, and low-income countries respectively. Whereas,

the move to geography and income mean has relatively little effect on reducing both export and import clearance time for a document related compliance compared to the case when they move to best practice.

Table 3-5. Reported and simulated time to export and import for documentary compliance

Region	Reported time to export		Simulated time, Best mean		Simulated time, Geography mean		Simulated time, Income mean	
	Export	Import	Export	Import	Export	Import	Export	Import
High Income								
Average HI	0.18	0.24	0	0	0	0	0	0
European Union	0.06	0.05	0	0	0	0	0	0
Cen.Asia	0.21	0.46	0	0	0	0	0	0
Asia Pacific	0.09	0.10	0	0	0	0	0	0
Lat.A & Ca	0.12	0.34	0	0	0	0	0	0
MENA	2.84	2.79	0	0	0	0	0	0
Upper Middle Income								
Average UMI	1.69	3.46	0.57	1.48	1.53	3.21	1.39	2.92
European Union	0.06	0.04	0	0	0	0	0	0
Cen.Asia	1.44	1.31	0.58	0.53	1.31	1.14	1.32	1.15
Asia Pacific	0.78	2.11	0.4	1.35	0.78	2.11	0.78	2.11
Lat.A & Ca	4.66	11.25	1.04	3.66	4	10.1	3.25	8.6
MENA	4.81	3.11	1.03	0.79	4	2.64	3.15	2.11
SSA	2.66	1.33	1.14	0.63	2.63	1.33	2.6	1.33
Lower Middle Income								
Average LMI	2.94	4.48	0.92	1.84	2.5	3.95	2.5	4.04
Cen. Asia	3.87	6.37	1.32	2.49	3.26	5.36	3.59	5.87
Asia Pacific	2.63	3.89	1	1.88	2.39	3.72	2.45	3.83
Lat.A & Ca	2.91	2.09	0.53	0.42	2.19	1.34	1.94	1.14
MENA	2.18	4.25	0.28	0.84	1.37	2.76	1.34	2.62
SSA	4.57	7.87	0.85	2.62	3.57	6.56	3.14	6.41
Low Income								
Average LI	7.35	6.21	0.97	1.56	4.74	4.47	4.21	4.4
Asia Pacific	0.79	2	0.05	0.24	0.24	0.7	0.33	0.87
SSA	7.45	6.35	0.99	1.61	4.81	4.6	4.26	4.52
Row	0	0	0	0	0	0	0	0

Source: Econometric model estimation result.

Moreover, comparing across income groups, there is a relatively large reduction in time to export and import with geography and income mean for low-income countries than for lower-middle and upper-middle-income countries. The large reduction for low-income

countries shows the relatively large inefficiency in customs management and relatively poor performance in TFIs than for middle-income countries.

3.4.4. Ad valorem Equivalent of customs clearance time

A CGE model relies on strict accounting relationships and economic linkages modeled through a "social accounting matrix." The use of CGE models to estimate effects of time delay requires time to be expressed in dollar or ad valorem equivalents of time cost values whereas customs clearance time from doing business database are recorded in days or hours.[21]

Hummels and Schaur (2013) estimate the willingness to pay of US importers to pay to reduce international shipping times at Harmonized System (HS) four categories. They employ a data set of US imports divided between air and ocean transport along with the difference in shipping via either mode and the time savings implied by employing airfreight over ocean freight. Consumers reveal their willingness to pay to reduce shipping times by modal choice and the price premium they pay per day saved is the willingness to pay for more rapid delivery.

Minor (2013) and Hummels and Schaur (2013) provides AVEs of time cost data for use with the GTAP 8.1 database. The database is based on the econometrics estimates of time-saving by Hummels and Schaur (2013). Our study uses Minor (2013) database to calculate AVEs of our econometrics estimates of time delay saved for border compliance. First, we estimate the customs clearance time saved when all countries move to best performance, geography mean, and income mean in all significant trade facilitation indicators. Then, AVEs of reported and estimated time to export and import for border compliance is calculated. The Minor and Hummel's database provides average ad valorem time cost by country for three alternative scenarios. The three scenarios differ based on how they replace missing values arising from aggregating hummels data into GTAP sectors and regions. In this chapter, we use the highest estimate (TAW-3) where the missing values are replaced by the average of significant values for a GTAP commodity. We multiply the reported and estimated time by TAW-3 estimates to get AVEs of reported and estimated

[21] Since 2015 the doing business database records time to trade in an hour.

time to export and import by commodity, source and destination country. Then, the TFA shock is calculated as the difference between AVEs of reported and estimated time.

Using Minor (2013) database, the AVEs of customs delay saved for import border compliance is calculated for the aggregated 19 regions and eight sectors.[22] Table 3-6 reports the AVEs of import time reduced for border compliance for three scenarios, best practice, geography, and income mean, by commodity and importing country.[23] As shown in table 3-6, AVE of time reduction is large for Mining and Extraction, followed by heavy and light manufacturing while agriculture shows relatively small change. Comparing across the three scenarios, there is large reduction of customs delay with best practice than geography and income mean. This shows that most regions are far from best practice performance in significant TFIs, but near or above to their geography or income mean.

Furthermore, moving across income group, we observe large reduction of customs delay for Low-income countries, which is mainly due to existing large customs clearance inefficiency or low performance in implementing trade facilitation policies in this region. Finally, for some regions such as lower and upper-middle-income Asia Pacific, and SSA regions, moving to income mean does not reduce customs delay since the trade facilitation performance of countries within these group are above their income means. Similarly, the AVE of time reduced is zero for the upper-middle-income Asia Pacific, MENA and SSA regions, when countries within this geographical groupings moving to their geography mean. Finally, there are no shocks for two sectors namely coal, oil, and gas, and service sector since the AVEs of one-day delay estimates by Hummel's is zero for these sectors.

[22]The AVE estimation is calculated as the difference between the estimated and simulated time to import for border compliance multiplied by the AVEs of one-day delay estimate from Minor and Hummel's database.
[23]The AVEs database is appropriate only for border related compliance.

Table 3-6. Ad valorem Equivalent of time to import by sector and importing region[24]

	Upper Middle Income					Lower Middle Income					Low Income	
	CA	AP	LAC	MENA	SSA	CA	AP	LAC	MENA	SSA	AP	SSA
Best Practice												
Agriculture	12.3	18.06	42.17	49.39	36.22	28.26	45.04	46.02	61.25	39.27	42.25	90.42
LiveAnimal	5.75	16.56	27.21	29.67	23.65	15.07	41.73	30.65	49.77	42.61	26.06	77.01
MinExtract	10.04	20.99	53.48	65.4	41.97	23.97	54.74	67.53	97.24	82.06	54.72	144.37
CoalOilGas	0	0	0	0	0	0	0	0	0	0	0	0
Procfood	6.05	18.25	31.8	29.84	23.54	17.95	39.79	34.44	58.17	44.14	26.6	84.01
LightMnfc	5.38	16.15	31.12	37.37	26.64	16.41	41.39	48.04	65.31	60.06	36.2	81.32
HeavyMnfc	8.15	21.75	41.07	53.07	33.53	21.95	54.96	49.67	83.57	63.43	36.94	107.31
Service	0	0	0	0	0	0	0	0	0	0	0	0
Geography Mean												
Agriculture	0.37	0	2.13	0	0	8.38	1.92	15.3	19.39	0.43	23.36	17.43
LiveAnimal	0.17	0	1.39	0	0	4.49	1.79	10.26	15.96	0.47	14.48	15.11
MinExtract	0.3	0	2.69	0	0	7.12	2.33	22.33	30.67	0.89	30.21	27.58
CoalOilGas	0	0	0	0	0	0	0	0	0	0	0	0
Procfood	0.18	0	1.62	0	0	5.35	1.71	11.5	18.59	0.49	14.78	16.41
LightMnfc	0.16	0	1.58	0	0	4.89	1.78	15.98	20.77	0.66	20.06	15.91
HeavyMnfc	0.25	0	2.08	0	0	6.53	2.34	16.52	26.49	0.69	20.46	20.8
Service	0	0	0	0	0	0	0	0	0	0	0	0
Income Mean												
Agriculture	0.37	0	14.06	7.09	0	6.51	0	25.41	19.8	0	14.83	16.07
LiveAnimal	0.17	0	9.14	4.32	0	3.49	0	17	16.29	0	9.22	13.94
MinExtract	0.3	0	17.79	9.38	0	5.54	0	37.16	31.31	0	19.16	25.43
CoalOilGas	0	0	0	0	0	0	0	0	0	0	0	0
Procfood	0.18	0	10.66	4.35	0	4.16	0	19.08	18.98	0	9.4	15.14
LightMnfc	0.16	0	10.43	5.42	0	3.8	0	26.54	21.2	0	12.75	14.68
HeavyMnfc	0.25	0	13.73	7.65	0	5.07	0	27.44	27.04	0	13	19.18
Service	0	0	0	0	0	0	0	0	0	0	0	0

Note: Central Asia (CA), Asia-pacific (AP), Latin America & Caribbean (LAC), Middle East and North Africa (MENA), and SSA

Source: Authors calculation using Minor (2013) data and counterfactual result.

[24] The result is only for border compliance.

3.5. Modeling Trade facilitation in the GTAP model

Most studies that use the GTAP CGE model use the iceberg approach to introduce trade facilitation policies in the GTAP model. In this approach, the reduction in customs delay is introduced as a technical shift in the Armington import demand function. However, A recent paper by Walmsley and Minor (2016) argued that the iceberg approach tends to overestimate the impact of trade facilitation and suggest for a new approach of introducing trade facilitation, willingness to pay approach. In the willingness to pay method, the reduction in customs delay is introduced as a demand shock that increases a consumer willingness to pay for faster delivery. In this chapter, we use an iceberg approach to analyze the macroeconomic and welfare effect of trade facilitation policies.

- **Iceberg Approach**

The iceberg approach explained here is from the work of Hertel et al. (2001). They use the notion of effective price of a commodity *i* imported from source country *r* to destination country *s* (PMS^*_{irs}) to introduce non-tariff measures in to GTAP odel and analyse its impact on trade and welfare. The relation between the observed price (PMS_{irs}), and effective price (PMS^*_{irs}) is expressed as follow: PMS* = PMS / AMS. The value of AMS is one in the initial equilibrium and the changes in the value of unobserved technical coefficient (AMS) measures the impact of non-tariff measures o import price from a particular exporter. Thus an improvement in AMS_{irs} confirms a fall in the effective domestic price of good *"i*" exported from source country *r* to destination country *s*. The "effective quantity" of exports associated with effective price is defined as; QXS* = QXS / AMS. Therefore, trade balance is maintained.

The import demand equation implemented in GTAP is based on total differentiation of the Armington function and its conversion into percentage change form as follow[25].

- Import Demand Equation in GTAP model

$$qxs_{irs} = -ams_{irs} + qim_{is} + \sigma^i{}_m(pms_{irs} - ams_{irs} - pim_{is})$$----------Equation 3-5

[25] A simple Armington model with tariff and non-tariff measure is available in appendix 4-1.

- Composite Import price equation

$pim_{is} = \sum_k \theta_{iks} * (pms_{iks} - ams_{iks})$----------Equation 3-6

Where:

i = the set of traded commodities.

r = the set of countries exporting.

s = the set of countries importing.

qxs_{irs} = is the percentage change in exports of commodity *i* from region *r* to region *s*.

qim_{is} = is the percentage change in the quantity demand of imported commodity *i* in region *s*.

ams_{irs} = demand shift equal to AVEs of time delays for commodity *i* from region *r* to region *s*.

$\sigma^i{}_m$ = the Armington elasticity of substitution for commodity *i* between all importers *m*.

pms_{irs} = the percentage change in the price of commodity *i* from region *r* to region *s*.

pim_{is} = A price index of imported commodity *i* in region *s*.

θ_{iks} = The share of commodity *i* shipped from region *r* to region *s*.

From equation 3-5 and 3-6, we can see that the impact of a shock to the ams (iceberg) have three distinct effects.

- A one percent shock to ams_{irs} will lower the effective price of imports of good *i* from exporter country *r* in to importer country *s* (more substitution towards exporter with higher ams and away from another exporter).
- A one percent shock to ams_{irs} will increase the effective quantity of the good, and less is required to meet the needs of the importer (there is a potential of less spoilage, theft or loss in shipment). This effect is opposite to the first one.
- From the composite import price equation, a one percent shock to ams_{irs} will lower the average import price, thereby encouraging an expansion of imports at the expense of domestic purchases.

3.6. Macroeconomic and welfare implication of trade facilitation policies

3.6.1. GTAP model and database

Several studies use either partial Equilibrium methods (Gravity models) or CGE modeling framework to analyze the impact of trade facilitation policies. However, there are two weakness in using the gravity method as a tool to analyze trade facilitation policies (Hummels et al. (2007). First, the equation assumes a causal relationship between TTC variables and trade, which omits the differentiation of particular trade costs. Second, gravity equations link trade volumes with other variables such as border waiting time but do not estimate these delays in monetary terms. Hence, gravity model outcomes are only partial and outline the relationship between trade flows and TTC related factors. However, trade facilitation policies can affect trade flows (exports and imports) and hence production, factors of production and remuneration, and welfare impacts across the entire economy. The benefits of trade facilitation policies are permeated the entire economy and, thus, assessing these impacts in a general equilibrium closure is imperative. In this paper, we use the result of the econometric model to analyze both the welfare and trade effect of trade facilitation policies.

We employed a multi-country, multi-sector general equilibrium modeling approach to analyze the welfare impact of trade facilitation policies. The purpose of CGE simulations is to determine the effects of a change in trade policy on the endogenous variables of the model – prices, production, consumption, exports, imports, and welfare. The CGE simulation reflects what the economy would look like if a shock had occurred. The effect of the policy change will be the difference in the values of the endogenous variables in the baseline and the simulation. Therefore, the model should be able to predict the effect on macroeconomic, trade, welfare and production patterns if the trade policy was changed. The study uses the global economy-wide model known as GTAP model, version 8.1 database (Narayanan, Hertel, & Walmsley, 2012). We use the static GTAP model with standard macroeconomic closure. The standard features of the GTAP model are perfect

competition, constant return to scale, Armington assumption in trade flows, disaggregated import usage by activity, non-homothetic consumer demands and explicit modeling of international trade and investment (Hertel et al. 1997).

The GTAP 8.1 database features 134 countries/regions and 57 tradeable commodities. As shown in table 3-7, we mapped the 134 countries/ regions into 19 regions, and the 57 sectors into eight aggregated sectors (Appendices B-2 and B-3). We divide the 19 regions into four income groups namely High Income (HI), Upper Middle Income (UMI), Lower Middle Income (LMI), and Low Income (LI). Further, each income group is divided into six geographical groupings namely the European Union (EU), Central Asia (CA), Asia-pacific (AP), Latin America & Caribbean (LAC), Middle East and North Africa (MENA), and SSA. We follow the OECD approach for classifying countries based on income and geographical groupings.

Table 3-7. Regional and Sectoral Aggregation

Income Group	Geographical Group	Sectoral aggregation
High Income	European Union Central Asia Asia Pacific Latin America Middle East & North Africa	Agriculture Live Animal Mining and Extraction Coal, Oil, Gas Processed food Light Manufacturing Heavy Manufacturing Service
Upper Middle Income	European Union Central Asia Asia Pacific Latin America Middle East & North Africa Sub Saharan Africa	
Lower Middle Income	Central Asia Asia Pacific Latin America Middle East & North Africa Sub Saharan Africa	
Low Income	Asia Pacific Sub Saharan Africa	
Rest of World	Rest of World	

Source: Authors aggregation from GTAP 8.1 Database.

In this chapter, the impact of TFPs (reduction of customs clearance time) is modeled using the iceberg approach. Therefore, the AVEs of clearance time reduced are introduced as import-augmenting technical change (ams) in the GTAP model, which allows us to simulate the removal of an iceberg cost by applying a positive shock to the technical efficiency of the trade flow. Thus, larger border compliance time is associated with higher costs and a melting down of the value of the good. Hence, the implementation of trade facilitation policies is expected to reduce border clearance times and associated costs, thereby, leading to a lower import price of the traded goods. For the CGE result, the main trade facilitation policy responsible for the reduction of import time delay for border-related compliance is formality-documents. Specifically, formality document is related to acceptance of a copy of documents by customs and border agencies, and international standardization of compliance. For example, for countries that did not use the Harmonized System (HS) coding system, the introduction and harmonization of HS coding system is expected to reduce import clearance time and facilitate trade with partners. The macroeconomic and welfare result in this study shows the effect of reducing customs clearance time for border-related compliance[26]. Besides, our econometric estimation result explained in section 3.4 provides time delay reduction of border-related compliances for both export and import. However, our CGE result is only for import clearance time[27].

3.6.2. Macroeconomic result

Table 3-8 to 3-10 reports the change in some macroeconomic variables for best practice, geography mean, and income mean scenarios. The result indicates that the real GDP impact is relatively higher for best practice than geography and income. This is due to the large TF shock imposed for best practice scenario than geography and income mean scenarios. Further, the result reveals that the growth in real GDP is relatively higher for regions with large time delay reduction such as lower-middle and low-income regions than upper-middle

[26]The estimated result for documentary compliance is not used for CGE analysis since the AVEs of time database estimated by Hummel's is related with willingness to pay for reduction of time for border related compliance than documentary compliance.

[27] We also calculate the impact of reducing export clearance time, but the difference in the two result is related to the size of the shock.

income regions[28]. Low-income SSA and lower-middle-income MENA regions reported large GDP growth of 1.99 % and 1.37% for best practice scenario. Similarly, for geography and income mean scenario, low-income SSA and lower-middle income MENA regions report relatively large GDP growth than other regions.

The terms of trade effect measure the relative price of export to import price. Reduction of customs clearance time reduces import price, and production cost in the importing countries, this results in a reduction of domestic price, and hence export price when the products are exported to the foreign market. As shown in table 3-8 to 3-10 below, there is a drop in both export and import price for most LMI regions resulting in terms of trade gain. An exception to this trend is the Asia Pacific region that reports a loss in terms of trade. From low-income regions, Asia Pacific region reported terms of trade gain while there is deterioration of terms of trade for SSA regions. Similarly, there is a drop in export and import price for most UMI regions, but some regions report terms of trade loss.

Table 3-8, 3-9 and 3-10 further indicates that there is more growth in import than export for most regions under the three scenarios. A noticeable exception to this trend is for high-income regions, ROW and upper-middle-income EU countries that report large growth in export than import. For high-income countries, there is no shock to trade facilitation; however, they still benefit from their export to other regions. Comparing the three scenarios, there is more export and import growth with best practice than geography and income mean scenarios due to large Trade Facilitation (TF) shock.

[28] In this paper, the time saved for all high-income, and EU member countries is zero. These regions are excluded from the regression in section 3.4 since their customs clearance time is relatively low or zero.

Table 3-8. Macroeconomic result, moving to Best practice.

Region	Quantity of import (%)	Quantity of export (%)	RGDP (%)	Terms of trade	Import price	Export price
High Income						
EU	-0.04	0.05	0.00	0.00	-0.11	-0.11
Central Asia	0.05	0.08	0.00	0.03	-0.08	-0.11
Asia Pacific	0.15	0.14	0.00	0.08	-0.05	-0.13
Lat.A & Caribbean	0.00	0.16	0.00	0.00	-0.12	-0.12
MENA	0.16	0.14	0.00	0.00	-0.12	-0.12
Upper Middle Income						
EU	-0.02	0.10	0.00	0.01	-0.1	-0.11
Central Asia	0.28	0.31	0.1	-0.04	-0.14	-0.1
Asia Pacific	0.81	0.84	0.3	-0.08	-0.2	-0.11
Lat.A & Caribbean	2.06	1.07	0.33	0	-0.13	-0.13
MENA	1.17	0.36	0.78	-0.06	-0.17	-0.11
SSA	1.90	0.85	0.51	0.08	-0.05	-0.13
Lower Middle Income						
Central Asia	0.71	0.07	0.49	0.17	0.06	-0.11
Asia Pacific	1.41	1.47	0.65	-0.11	-0.23	-0.12
Lat.A & Caribbean	1.55	0.79	1.09	0.10	-0.02	-0.12
MENA	1.67	0.48	1.37	0.16	0.05	-0.11
SSA	1.37	0.26	0.79	0.01	-0.10	-0.11
Low Income						
Asia Pacific	1.46	-0.07	0.61	0.65	0.49	-0.16
SSA	2.74	0.48	1.99	-0.02	-0.13	-0.11
Row	0.10	0.08	0.00	0.07	-0.03	-0.10

Source: Model simulation result.

Table 3-9. Macroeconomic result, moving to Geography Mean

Region	Quantity of import (%)	Quantity of export (%)	RGDP (%)	Terms of trade	Import price	Export price
High Income						
EU	0.00	0.01	0.00	-0.001	-0.008	-0.007
Central Asia	0.00	0.01	0.00	0.003	-0.004	-0.007
Asia Pacific	0.00	0.01	0.00	0.001	-0.006	-0.007
Lat.A & Caribbean	-0.01	0.01	0.00	-0.001	-0.008	-0.007
MENA	0.01	0.01	0.00	0.001	-0.006	-0.007
Upper Middle Income						
EU	-0.01	0.02	0.000	-0.002	-0.009	-0.007
Central Asia	0.01	0.01	0.003	0.000	-0.007	-0.006
Asia Pacific	0.00	0.01	-0.001	0.001	-0.006	-0.007
Lat.A & Caribbean	0.11	0.06	0.017	0.002	-0.006	-0.008
MENA	0.01	0.01	0.000	0.001	-0.006	-0.007
SSA	0.03	0.01	0.001	0.013	0.006	-0.007
Lower Middle Income						
Central Asia	0.16	0.00	0.144	0.023	0.018	-0.006
Asia Pacific	0.06	0.07	0.028	-0.005	-0.012	-0.007
Lat.A & Caribbean	0.49	0.25	0.361	0.009	-0.001	-0.010
MENA	0.50	0.13	0.437	0.031	0.024	-0.007
SSA	0.04	0.02	0.010	0.005	-0.001	-0.006
Low Income						
Asia Pacific	0.41	-0.30	0.323	0.132	0.124	-0.008
SSA	0.54	0.08	0.389	0.000	-0.007	-0.006
Row	0.00	0.01	0.000	0.002	-0.003	-0.006

Source: Model simulation result.

Table 3-10. Macroeconomic result, moving to Income Mean

Region	Quantity of import (%)	Quantity of export (%)	RGDP (%)	Terms of trade	Import price	Export price
High Income						
EU	-0.008	0.012	0.000	-0.002	-0.014	-0.012
Central Asia	0.007	0.015	0.000	0.005	-0.008	-0.013
Asia Pacific	0.000	0.021	0.000	0.001	-0.010	-0.011
Lat.A & Caribbean	-0.001	0.032	0.000	0.000	-0.012	-0.012
MENA	0.011	0.015	0.000	0.000	-0.011	-0.011
Upper Middle Income						
EU	-0.013	0.037	0.000	-0.004	-0.017	-0.012
Central Asia	0.011	0.019	0.003	-0.002	-0.012	-0.011
Asia Pacific	-0.005	0.009	-0.001	0.000	-0.012	-0.012
Lat.A & Caribbean	0.684	0.336	0.111	-0.003	-0.020	-0.018
MENA	0.172	0.052	0.113	-0.002	-0.014	-0.012
SSA	0.021	0.020	0.000	0.011	-0.002	-0.013
Lower Middle Income						
Central Asia	0.139	0.012	0.113	0.027	0.016	-0.011
Asia Pacific	0.000	0.018	0.000	0.002	-0.010	-0.011
Lat.A & Caribbean	0.837	0.422	0.600	0.032	0.013	-0.019
MENA	0.521	0.142	0.446	0.036	0.023	-0.012
SSA	0.017	0.028	0.001	0.001	-0.01	-0.011
Low Income						
Asia Pacific	0.229	-0.185	0.204	0.069	0.060	-0.009
SSA	0.490	0.080	0.358	-0.004	-0.015	-0.012
Row	0.010	0.014	0.000	0.007	-0.004	-0.011

Source: Model simulation result.

3.6.3. Welfare result

Trade facilitation results in welfare gain for all middle and low-income regions since they are directly affected by TF shock. However, depending on the amount of TF shock, there are large disparities on the welfare gain across regions. For some regions with large reported time to import, the impact of trade facilitation policy is high. Besides, the farther away the country is from the best practice, geography and income mean, the higher the reduction in time with trade facilitation. Furthermore, the result for all scenario shows that most middle and low-income regions report large welfare gain attributed to technological

efficiency (iceberg effect) and allocative efficiency effect. The technological efficiency effect is zero for all high income, Rest of the World (ROW) and some middle and low-income regions with zero TFA shock.

The terms of trade impact on welfare depend on the relative change in the price of export and import. The gain in productivity change because of more efficient customs procedure results in a low cost of production and reduced import price. Besides, productivity change reduces the price of a domestic good that will be exported, and hence increase the price of export. Therefore, more efficient customs procedure result in terms of trade improvement for middle and low-income countries. The investment-saving balance also contributes to welfare gain for lower middle-income and low-income regions.

Table 3-11 indicates that with best practice scenario, all countries reported overall welfare gain except high income EU and MENA regions. However, for some high-income regions such as central Asia, Asia Pacific, and MENA regions, the TFA shock is zero but reported overall welfare gain. This is due to a large gain in terms of trade. Overall, middle-income Asia Pacific regions reported relatively large welfare gain with best practice scenario.

For geography mean scenario most HI and UMI regions reported overall welfare gain although TFA shock is zero, except EU and high-income Latin America regions, where overall welfare reduces due to allocative efficiency and terms of trade loss. Table 3-12 shows that, for regions with positive TFA shock, there is large welfare gain due to both allocative and technological change effect. The gain in technical efficiency is mainly due to productivity gain (reduction of production cost). Table 3-12 further shows that some regions with zero TFA shock, there is a reduction in welfare from negative allocative efficiency.

Similarly, with income mean, most regions report overall welfare gain, except for some high and middle-income regions (Table 3-13). For high-income central Asia, UMI Sub-Saharan Africa, LMI Asia Pacific, LMI Sub-Saharan Africa, and ROW regions, the TF shock is zero, but report overall welfare gain due to both allocative efficiency and terms of trade gain. Overall, our finding suggests that trade facilitation policies aimed at reducing

customs clearance time at the border have a large welfare gain. However, this analysis does not include the investment cost needed to improve customs efficiency or reduce clearance time.

Overall, world welfare improves by $55686 million, $3844 million, and $6343 million for best mean, geography and income mean respectively. The difference in welfare gain across regions result from the difference in customs delay reduction across countries, for regions with large reduction is customs delay there is large welfare gain.

Table 3-11. Welfare result, moving to Best practice.

Region	Allocative Efficiency	Technological Change Effect	Terms of trade	Investment - Saving effect	Total Welfare
High Income					
EU	-221.95	0.00	-25.43	-74.72	-322.09
Central Asia	-8.26	0.00	173.66	-29.47	135.93
Asia Pacific	152.81	0.00	1560.79	-219.04	1494.55
Lat.A & Caribbean	-42.91	0.00	230.69	-45.38	142.40
MENA	18.56	0.00	-20.37	-173.66	-175.47
Upper Middle Income					
EU	1.21	0.00	1.37	4.67	7.25
Central Asia	171.25	1405.68	-192.19	20.40	1405.13
Asia Pacific	2061.79	9597.63	-1334.88	243.50	10568.04
Lat.A & Caribbean	1198.62	7256.64	-5.30	75.10	8525.05
MENA	472.17	4422.30	-161.16	506.44	5239.76
SSA	186.09	1420.64	77.26	-11.48	1672.50
Lower Middle Income					
Central Asia	53.11	923.49	154.84	-25.16	1106.29
Asia Pacific	1822.04	12572.26	-625.74	-256.63	13511.94
Lat.A & Caribbean	64.91	863.70	25.25	-100.55	853.31
MENA	196.64	3108.61	124.99	-21.03	3409.22
SSA	201.35	1952.82	10.63	86.86	2251.66
Low Income					
Asia Pacific	8.01	54.48	8.59	11.66	82.75
SSA	864.14	4907.82	-23.7	9.09	5757.34
Row	1.51	0.00	18.99	0.12	20.62
Total	7201.11	48486.07	-1.72	0.72	55686.18

Source: Model simulation result.

Table 3-12. Welfare result, moving to Geography Mean

Region	Allocative Efficiency	Technological Change Effect	Terms of trade	Investment - Saving effect	Total Welfare
High Income					
EU	-35.59	0.00	-64.72	19.76	-80.55
Central Asia	-0.79	0.00	18.74	1.23	19.18
Asia Pacific	-4.06	0.00	17.45	11.25	24.64
Lat.A & Caribbean	-14.65	0.00	-34.06	-2.07	-50.79
MENA	0.80	0.00	6.02	-5.11	1.71
Upper Middle Income					
EU	-0.03	0.00	-1.28	-1.05	-2.36
Central Asia	2.41	42.44	-0.92	5.04	48.97
Asia Pacific	-26.24	0.00	10.41	20.09	4.25
Lat.A & Caribbean	59.64	366.86	7.21	7.95	441.67
MENA	1.19	0.00	2.34	-0.76	2.77
SSA	2.17	0.00	13.16	0.55	15.87
Lower Middle Income					
Central Asia	11.99	275.21	21.11	-11.65	296.66
Asia Pacific	76.47	538.08	-30.05	-5.34	579.16
Lat.A & Caribbean	20.89	287.69	2.53	-35.61	275.49
MENA	59.41	994.38	24.91	-12.31	1066.39
SSA	5.03	21.53	5.21	-0.55	31.21
Low Income					
Asia Pacific	2.98	30.24	1.60	3.07	37.88
SSA	169.33	957.24	-0.39	5.34	1131.51
Row	0.00	0.00	0.73	0.19	0.92
Total	330.94	3513.66	-0.01	-0.01	3844.57

Source: Model simulation result.

Table 3-13. Welfare result, moving to Income Mean

Region	Allocative Efficiency	Technological Change Effect	Terms of trade	Investment - Saving effect	Total Welfare
High Income					
EU	-44.56	0.00	-111.11	-5.83	-161.49
Central Asia	-1.70	0.00	26.98	-2.33	22.95
Asia Pacific	-12.70	0.00	19.99	-7.56	-0.27
Lat.A & Caribbean	-14.56	0.00	9.59	-2.15	-7.13
MENA	0.49	0.00	1.08	-12.57	-11.00
Upper Middle Income					
EU	-0.09	0.00	-2.70	-1.63	-4.42
Central Asia	1.65	42.44	-6.64	-1.75	35.70
Asia Pacific	-36.96	0.00	0.77	-2.62	-38.82
Lat.A & Caribbean	400.64	2421.59	-14.62	33.21	2840.82
MENA	67.63	639.88	-6.54	75.58	776.54
SSA	1.35	0.00	11.16	0.17	12.68
Lower Middle Income					
Central Asia	10.73	213.93	24.35	-7.82	241.17
Asia Pacific	3.79	0.00	10.25	0.14	14.17
Lat.A & Caribbean	35.46	477.67	8.74	-57.69	464.18
MENA	61.26	1014.91	29.09	-11.73	1093.53
SSA	1.96	0.00	0.93	-1.68	1.21
Low Income					
Asia Pacific	1.78	19.24	0.77	1.75	23.54
SSA	154.40	882.93	-4.14	4.48	1037.67
Row	0.21	0.00	2.03	0.04	2.27
Total	630.76	5712.57	-0.01	-0.01	6343.31

Source: Model simulation result

3.7. Conclusion

In this chapter, we analyze the impact of trade facilitation policies on customs clearance time for border and documentary compliance. We use an econometric model to analyze the impact of trade facilitation policies on customs clearance time. The simulation results are then used to calculate a counterfactual analysis when the countries move to best practice, geography, and income mean in formality-document. Further, we use the GTAP CGE model to analyze the welfare and macroeconomic impact of trade facilitation policies. This study is relevant for policymakers to identify specific trade facilitation policies that are relevant for reducing customs delay. Besides, the result is relevant for ongoing mega-regional trade agreements such as CFTA as it shows the benefit of incorporating trade facilitation policies on their negotiation agenda.

The estimated result indicates that Fees & Charges, formality-document and advance rulings have statistically significant coefficients with the expected sign while other policy variables are insignificant, and they often carried the wrong sign, indicating they were a poor fit in our model. The estimation result indicates that both formality documents, and fees and charges have a significant impact on export and import clearance time for documentary compliance, while only formality document significantly reduces border-related compliance. Besides, advance rulings have a significant impact on export clearance time for documentary compliance. The counterfactual analysis shows that there is large reduction in customs delay with best practice as most middle and low-income countries are far away from best practice. On the other hand, the customs delay reduction with geography and income mean is relatively zero or small. This indicates that most countries are above or near to their geography and income mean. Moreover, for low-income countries with large customs efficiency, there is large reduction in customs delay.

The CGE result indicates that there is large growth in both export, import, and GDP of middle and low-income regions. For high-income countries, there is no shock to trade facilitation, but they still benefit from their export to other regions. Comparing the three scenarios, there is more export, import and GDP growth with best practice due to large TF shock. Furthermore, the impact on import inclusive of iceberg cost is higher than import

valued at a c.i.f price, which shows the amount of amount of spoilage or loss no longer occurs due to trade facilitation.

The welfare result for all scenario shows that most middle and low-income regions report large welfare gain attributed to technological efficiency (iceberg effect) and allocative efficiency effect. Also, all regions with TF shock reported overall welfare gain, but for some regions with no TFA shock, there is welfare loss. The world welfare improves by around $55 billion, $3 billion, and $6 billion for best practice, geography, and income mean respectively.

Our analysis on trade facilitation policies provides specific trade facilitation areas that middle and low-income regions should focus to benefit more in terms of the reduction of customs delay. To benefit more from the reduction of customs delay, we recommend an improvement in the area of advance rulings, formality-documents, and fees and charges.

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Chapter 4

4. Analysis of the African Free Trade Area: A Trade Facilitation and Non-Tariff Measures Perspective

Chapter summary

On March 2018, 44 African countries signed a framework to establish a Continental Free Trade Area (CFTA). Currently, 49 out of 55 countries signed the agreement, and ten countries ratified the CFTA. The main objective of this chapter is to evaluate the impact of continental free trade area and customs union on the economies of African countries by focusing on trade facilitation policies and non-tariff measures. The result indicates that the reduction of customs delay has large welfare and GDP gain for most African countries. Similarly, reduction of NTMs by 50% results in large welfare and trade gain, but significant GDP loss across African countries.

Most African countries gain regarding welfare and GDP with continental free trade area while Benin, Guinea, Mauritius, and Zimbabwe lose in both welfare and GDP. Benin, Tunisia, Zambia, Botswana, and Namibia are the winning African countries in terms of GDP and welfare when CFTA is combined with trade facilitation and 50% reduction of NTMs. Whereas, Senegal, Ethiopia, and Kenya are losing countries in terms of both welfare and GDP. Further, comparing continental customs union with CFTA, for some countries, both are welfare improving (e.g., Senegal, Togo, Nigeria, Mozambique, Ruanda, Tanzania, Zambia, Egypt, Morocco, and Tunisia) while for others only CFTA result in welfare gain (e.g., Cote d Ivoire, Ghana, Burkina Faso, Guinea, Ethiopia, Kenya, Madagascar, Malawi, Uganda, Botswana, Namibia, and South Africa).

4.1. Introduction

Regional integration in Africa is characterized by “spaghetti bowl” type of regional trade arrangements. This crisscrossing of many Free trade Area (FTA) would allow countries to adopt discriminative trade policies, which in turn reduces trade and welfare. Most of the regional trade agreements in Africa are in the form of FTA, with eventual movement to customs unions. Besides, the continent is benefiting from preferential trade agreement provided by developed countries such as the Generalised System of Preference (GSP), Everything But Arms (EBA), and European Partnership Agreement (EPA). However, the intra-Africa trade is still at a low level, and most countries are not benefiting from international trade.

Trade facilitation has emerged as an important issue in current multilateral, bilateral, and regional trade agreements across the world. Both tariff and non-tariff barriers reduce through past rounds of multilateral, bilateral and regional trade negotiations. Thus there is an increasing focus on the relative costs of inefficient trade procedures (Persson, 2008). Further, trade constraints such as tariffs, subsidies, and quotas limit access to the market, but time and cost to trade are much more barriers to trade than tariff barriers (Hummels and Schaur 2013; Hummels (2007)). Moreover, regulations and procedures such as customs administration, inspections, trade financing, security issues, and infrastructure are now main trade barriers to goods trade (Minor, 2013). Hence, insufficient Trade Facilitation (TF) poses a barrier to trade, increasing Trade Transaction Costs (TTCs) while improving TF minimizes TTC regarding the trans-border movements of imports and exports (Perera et al., (2017); Milner, Morrissey, and Zgovu (2005)).

There is a relatively large trade cost in Africa in terms of tariff, non-tariff barriers, poor border management policies (Bouët, Cosnard, and Laborde 2017). Therefore, reduction of trade cost through the regional dimension of infrastructure development and trade facilitation would help Africa integration with the rest of the world through the global value chain (Shepherd 2016). Moreover, with reduction of trade cost, there would be more gain to African countries in terms of welfare, export, and increase in intra-Africa trade ((Jensen and Sandrey 2015); Mevel and Karingi (2012); Akinkugbe (2009)).

The analysis in this chapter differs from existing studies on African free trade area by Mevel and Karingi (2012) and Jensen and Sandrey (2015) in two ways. First, there is a difference in the trade facilitation data; we use our econometric estimates of reductions of customs delay in chapter 3. Besides, the trade facilitation is modeled using three scenarios; moving to best practice, geography and income mean. However, Jensen and Sandrey (2015) include a 25% reduction of NTMs as trade facilitation while Mevel and Karingi (2012) uses Minor and Tsigas (2008) database and assume that African countries would be twice efficient when they form CFTA. Second, there is a difference in model experiments. The Mevel and Karingi (2012) analysis uses the MIRAGE model and evaluates the impact of CFTA and CCU with and without trade facilitation. Whereas, Jensen and Sandrey (2015) uses the GTAP model and examine CFTA with reduction of NTMs. In this chapter, 11 different experiments are conducted. First, trade facilitation policies and NTM are evaluated separately without any tariff reduction. Then, CFTA is combined with trade facilitation and reduction of NTMs. Finally, CCU is evaluated with and without trade facilitation policies.

The main purpose of the study is to evaluate the impact of three broad trade liberalization policies on boosting intra-Africa trade. First, we assess the effect of removing import tariff among African countries through the Continental Free Trade Area (CFTA). Second, besides removing tariff, African countries are allowed to facilitating trade through the reduction of import time to clear border-related compliance. Third, we evaluate the impact of a 50% reduction of non-tariff measures by African countries. The three trade liberalization policies are evaluated based on their impact on trade and welfare of the continent. We use the GTAP CGE model version 9 database to assess the trade liberalization policies.

The rest of the paper is organized as follows: Section 4.2 reviews the trend and pattern of African economies on the three broad trade liberalization policies. Empirical literature reviews, which analyze tariff, non-tariff measures, and trade facilitation policies on the economies of Africa are explained in Section 4.3. Section 4.4 explains the GTAP CGE model; methodologies use to estimate ad valorem equivalent of trade facilitation policies

and non-tariff measures. We present the Model estimation result and discussion in section 4.5. Finally, Section 4.6 concludes.

4.2. Trade cost in Africa

Trade costs can be defined broadly as all costs incurred in getting a good to a final user other than the marginal cost of producing the good itself. They include transportation costs (freight costs and time costs), policy costs (tariffs and non-tariff barriers), information costs, contract enforcement costs, costs associated with the use of different currencies, legal and regulatory costs, and local distribution cost (Anderson and Wincoop 2004).

According to OECD (2002), Trade Transaction Costs (TTC) cover the preparation, and presentation of all prescribed documentation or electronic equivalents and the provisions of any required explanations, authentification and supporting supplementary information to service commercial and official procedures at all stages of the physical movement of the goods from consignor to consignee and the movement of related means of payment in the opposite direction. TTC are classified into direct and indirect costs. The direct cost includes compliance cost (e.g., costs required to collect, produce, transmit and process required information and documents) and charges of trade-related services such as; cross-border banking, international transportation, trade insurance, cargo handling, measurement, port-management, etc. Indirect cost includes costs generated through procedural delays, lost business opportunity costs (due to both direct and indirect TTC), and costs related to unpredictability (e.g., a lack of transparency or of uniformity in the interpretation of regulations and contracts). Costs generated through procedural delays result from exogenous factors (e.g., under-staffing, lack of automation, and low productivity of officials) or endogenous factors (e.g., deliberate stoppage, the low incentive in officials).

Trade cost can also distinguish between border-related costs and Behind The-Border (BTB) measures to identify those trade costs that are not a direct result of trade policies, but that can be reduced through other channels, notably via trade facilitation resulting from cooperation, often in the context of a regional trade agreement

- Border Related Costs includes Trade Policy including Product Standards and Technical regulations, Customs Administration.
- Behind-the-Border Related Costs includes Quality of Institutions, Information and Communication Costs.

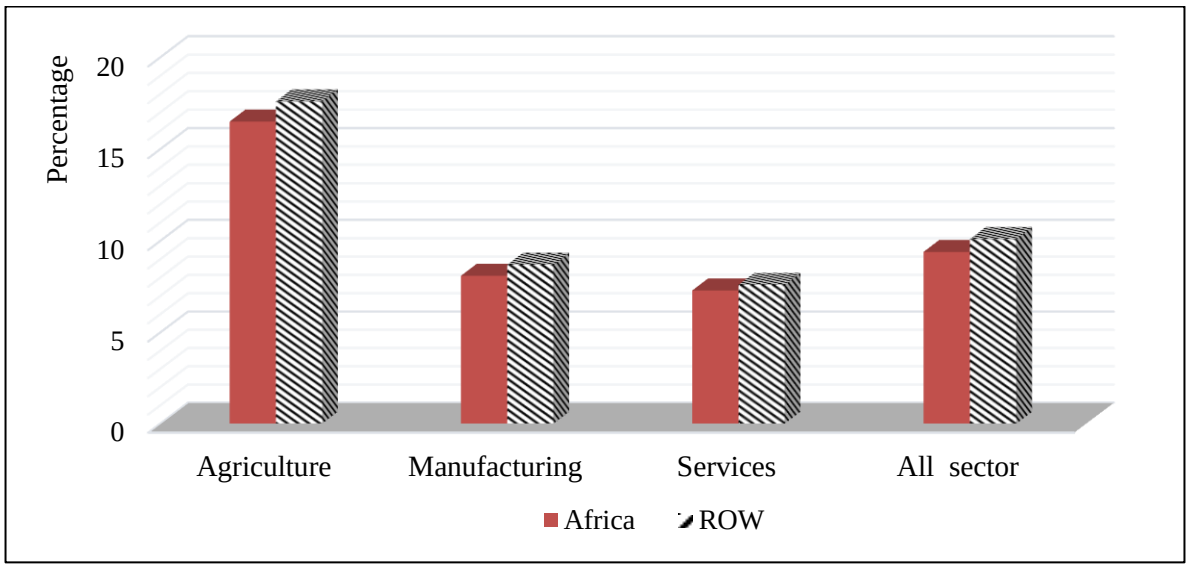
Trade costs are the most important element of overall transaction costs, and that trade costs depend largely on transport costs. Transport costs, though, are determined by many factors along the supply chain. Efficiency along the supply chain is closely linked both to the "hard" infrastructure (dock facilities, connections to railroads and trucking lines, harbor characteristics) and to the "soft" infrastructure, as reflected in the border and behind-the-border measures.

In the following section, we discuss the performance of African regions based on policy related trade costs (tariff and NTM), and time cost (time to export and import for border and documentary related compliance). Then, African countries effort in facilitating trade are evaluated using OECD trade facilitation indicator.

4.2.1. Tariff barriers in Africa

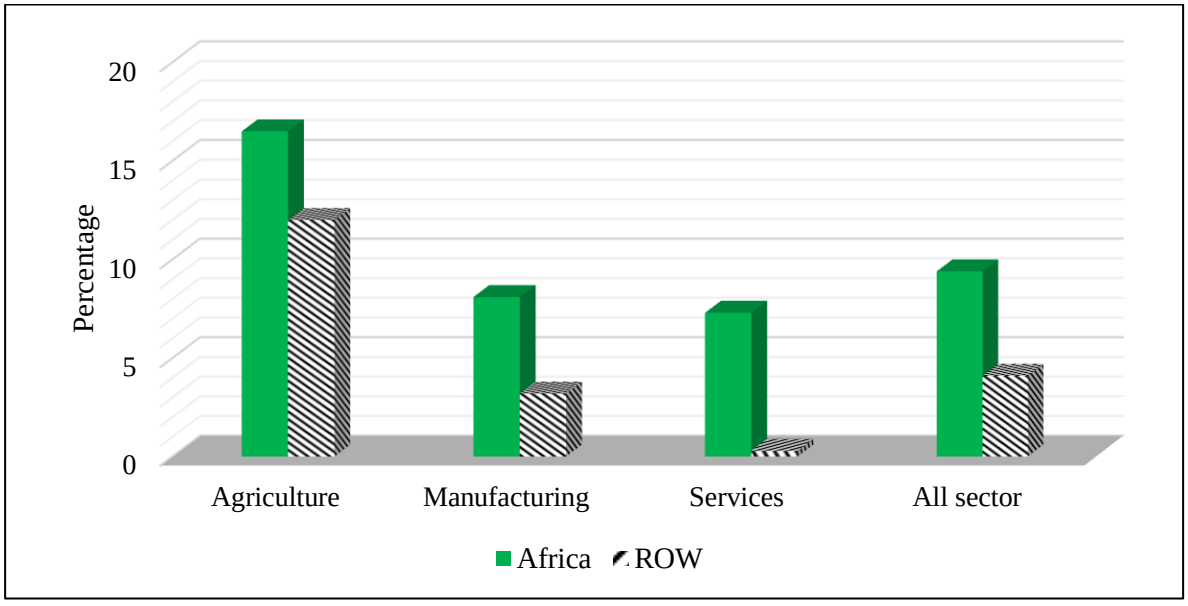
Although world tariff barrier reduced through time due to the different rounds of WTO and proliferation of regional and preferential trade agreements, import of goods by African regions is still facing relatively high tariff than other regions. Figure 4-1 below shows that import of agriculture by African regions is highly protected compared to manufacturing and service sector whatever the source is. On average, African regions impose 16.5% tariff on their import from other African regions for the agriculture sector while manufacturing and service sector faces 8% and 7% import tariff respectively. On the export side, African regions benefited from different preferential trade agreement provided by developed countries such as GSP, EBA, and EPA. As shown in figure 4-2 below, the export of agriculture, manufacturing and service sectors by African regions to ROW face relatively small tariff of 12%, 3%, and 0.3% respectively. However, Africa's export to other African region faces a relatively large tariff.

Figure 4-1. A tariff imposed by Africa on their import from Africa vs. ROW



Source: Authors calculation based on TASTE for GTAP 9.

Figure 4-2. Tariff faced by Africa on its export to Africa vs. ROW, by sector



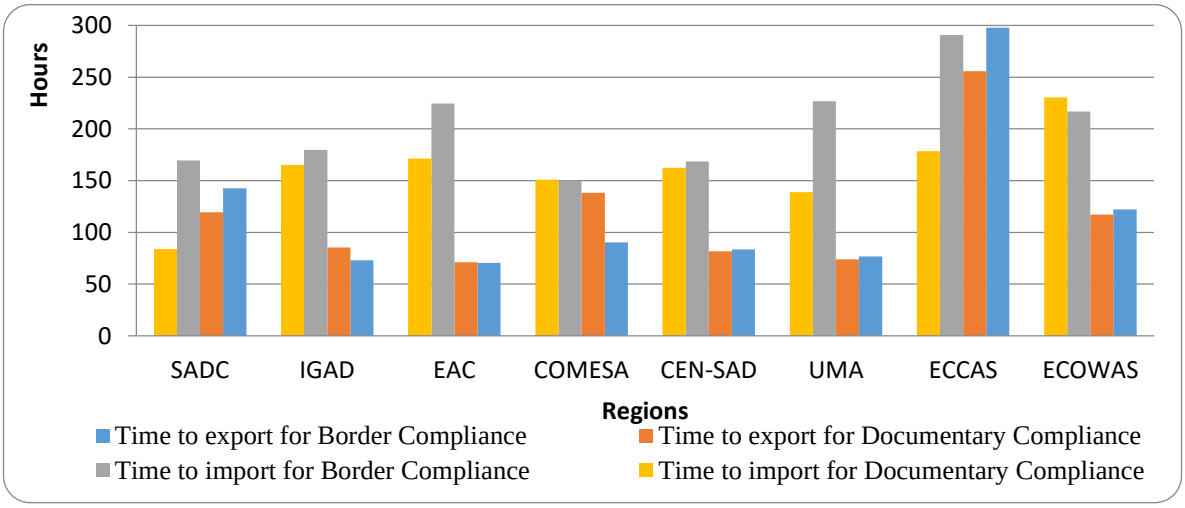
Source: Authors calculation based on TASTE for GTAP 9.

4.2.2. Customs delay in Africa

Figure 4-3 shows the performance of regional trade agreements in Africa based on the time to export and import for both types of compliance. For all regions imports of goods takes more time than exports for both type of compliance; an exception to this trend is SADC and ECCAS region that report small import time for border compliance than documentary compliance. Comparing the two type of compliance, it takes more import time for border compliance than documentary across all regions except ECOWAS. This is obvious since imports face more inspections as well as more procedures while export procedures are relatively simple with less special documents required. Besides, border compliance takes more import compliance time than export. For an export time, both types of compliance take almost similar time except SADC, and ECCAS regions that report slight divergence.

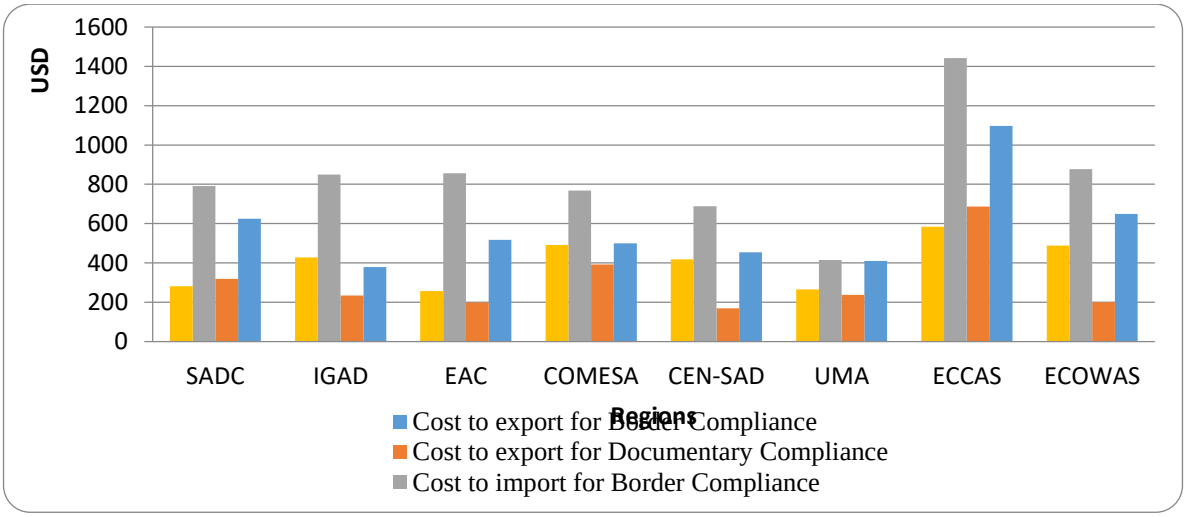
Out of eight building block regional trade agreements in Africa, IGAD, EAC, ECCAS, and ECOWAS are costly regions reporting on average more than $800 import cost for border-related compliance while it costs less for UMA regions. Figure 4-4 further shows that cost to export and import for documentary compliance is relatively lower than border compliance; EAC and UMA regions reported the lowest cost to export and import for documentary compliance while the cost is higher for COMESA and ECCAS regions.

Figure 4-3. Time to export and import for African regions, 2015



Source: Authors calculation using World bank doing business data (2015)

Figure 4-4. The cost to export and import for African regions, 2015



Note: Time to export and import are weighted average by export and import for 2015.

Source: Authors calculation using World bank doing business data(2015)

4.2.3. Non-Tariff measures in Africa

"Non-tariff measures are generally defined as policy measures other than ordinary customs tariffs that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both."UNCTAD(2012)

Although the categorization of NTMs is debatable, it is important to note that the identification of a policy measure as an NTMs depends on the type of regulations as defined by the legal, regulatory text. As shown in table 4-1, UNCTAD developed a detail classification of policy measures that can be grouped as NTMs. Based on the scope and design of NTMs, NTMs are classified as technical measures (standards and pre-shipment inspections), and non-technical measures. Table 4-1 below summarizes the internationally accepted classifications of NTMs. The classification has 16 chapters depending on their scope and design, and each chapter is further divided into groupings.

NTMs can also be classified according to whether they are applied at customs (border measures) or elsewhere (behind-the-borders). Border measures include import measures (e.g., quotas, import licensing, customs fees, and anti-dumping actions), and export measures such as export subsidies, export taxes, voluntary export restraints. Moreover,

behind-the-border measures are imposed internally in the domestic economy. They include most technical measures resulting from domestic legislation covering products standards concerning health, environmental, technical and other concerns, as well as internal taxes and domestic subsidies.

Furthermore, NTMs can also be categorized into four categories of regulations based on their impact on different prices: customs, process, product, and consumer (Melo and Nicita 2018). According to Melo and Nicita (2018), customs regulations include inspection fees, import and export taxes, which drive a wedge between the world and domestic prices. Whereas, product regulations such as safety standards in cars or toys or Maximum Residue limits (MRLs) for pesticides are related to the characteristics of products. Consumers' regulations which include excise taxes on fuels are primarily consumption taxes, but they also include other regulations such as minimum import prices, which directly affect the final prices paid by consumers. Finally, process regulations (e.g., labor and environmental standards) affect producer prices as they regulate methods of production when applied to not only domestic but also foreign producers.

Table 4-1. International classification of Non-tariff Measures

Technical Measures	A	**Sanitary and phytosanitary measures (SPS):** restriction for substances and ensuring food safety, and those for preventing dissemination of disease or pests. It also includes all conformity-assessment measures related to food safety, such as certification, testing and inspection, and quarantine.
	B	**Technical barriers to trade (TBT):** It refers to measures such as labeling, standards on technical specifications and quality requirements, and other measures protecting the environment. It also includes conformity-assessment measures related to technical requirements, such as certification, testing and inspection
Non-Technical Measures	C	**Pre-shipment inspection and other formalities (INSP):** requirements and formalities to be performed in the exporting country prior to shipment.
	D	**Contingent trade-protective measures (CTPM):** it is a measure implemented to counteract particular adverse effects of imports in the market of the importing country, including antidumping, countervailing, and safeguard measures.
	E	**Non-automatic licensing and quantity-control measures (QC):** licensing, quotas and other quantity control measures, import prohibitions that are not related to SPS or TBT measures.
	F	**Price-control measures, including additional taxes and charges (PC)**: includes measures implemented to control or affect the prices of imported goods, to support the domestic price of certain products, to increase or preserve tax revenue, and para-tariff measures.
	G	**Finance measures (FM):** measures restricting the payments for imports, including regulation of access and cost of foreign exchange and terms of payment.
	H	**Measures affecting competition (COM):** measures that grant exclusive or special preferences or privileges to one or more limited group of economic operators. It includes state trading monopolies, sole importing agencies and compulsory use of national insurance or transport.
	I	**Trade-related investment measures (INV):** measures that restrict investment by requiring local content or conditioning investment on balancing of exports and imports.
	J	**Distribution restrictions (DR):** restriction on distribution of imported goods within the country.
	K	**Restrictions on post-sales services (RPS):** deals with restrictions on post-sales services, for example, restrictions on the provision of accessory services.
	L	**Subsidies (SUB):** measures that relate to the subsidies that affect trade.
	M	**Government procurement restrictions (GPR):** restrictions on foreign bidders for public projects and contracts.
	N	**Intellectual property (IP):** intellectual property measures and intellectual property rights.
	O	**Rules of origin (RoO):** measures that restrict the origin of products or its inputs.
Export Measures	P	**Export-related measures (EXP)**: export taxes, export quotas, and export prohibitions.

Source: UNCTAD (2012)

4.2.3.1. Non-tariff measures incident Variables

There are various approaches used to identify the importance of trade measures and analyze their impact on international trade. The main approaches used are a simple inventory measure, computation of price gap and ad valorem equivalents. The incident of a measure is the basic statistical analysis based on NTMs data. It counts the number of measures to study their proliferation. They are based on the intensity of the policy instruments and measure the degree of regulation without considering its impact on trade or the economy. Using inventory measure, three commonly used incidence indicators are identified; the Coverage Ratio (CR), the Frequency Index (FI) and the Prevalence Score (PS). These indicators are based upon inventory listings of observed NTMs (Gourdon, 2014).

The frequency index indicates the percentage of products to which NTMs apply. It accounts only for the presence or absence of NTMs. Note that frequency indices do not reflect the relative value of the affected products and thus cannot give any indication of the importance of the NTMs on overall imports. The frequency index of NTMs imposed by country *i* is calculated as:

$$FI_i = \frac{\sum_{K=1}^{hs} NTM_{ik} D_{ik}}{\sum_{k=1}^{hs} D_{ik}} 100 \text{----------Equation 4-1}$$

Where subscript *k* denotes product and *i* country imposing the NTMs, and where NTM_{ik} is a dummy variable denoting the presence of an NTM (or type of NTMs) in the selected HS aggregation level (typically HS6 or HS4), *D* is also a dummy variable taking the value 1 when country *i* imports any quantity of product *k*, and zero otherwise.

Coverage ratio which measures the percentage of trade subject to NTMs for the importing country i is a good indicator to measure the importance of NTMs on overall imports. It is similar to the frequency ratio, but instead of the dummy for each product, the trade value for each product is used (more commonly, imports). As shown in equation 2, the numerator of CR captures the sum of the (import) value of those traded products that are affected by an NTMs. It is then divided by the total sum of imports, in the case the import measures are studied (export NTMs measures can be compared to export values). The coverage ratio is given as;

$$CR_i = \frac{\sum_{K=1}^{hs} NTM_{ik} x_{ik}}{\sum_{k=1}^{hs} x_{ik}} \ 100\text{----------Equation 4-2}$$

Where NTM_{ik} is defined as before, and X_{ik} is the value of imports in product k.

Both frequency and coverage ratios approach explained above do not consider whether more than one type of NTM is applied to the same product. However, in practice, more than one NTM are applied to most of the products. For example, a product could be subject to a sanitary standard and a technical measure on quality, and finally to some licensing. Doubtfully, the greater the number of NTMs applied to the same product, the more regulated the commerce of that product is, especially if measures are from different NTMs chapters (Gourdon 2014).

The prevalence score indicator captures the average number of NTMs which applied to products. It can be used, for example, to tell what product is affected by the largest number of NTMs or how many NTMs on average apply to a group of product. These indicators are mostly calculated on overall trade, considering all types of NTMs, but they are also suited to illustrate the incidence of particular NTMs on specific groups of products (e.g., average number of SPS measures applied on agricultural products) (Melo and Nicita 2018).

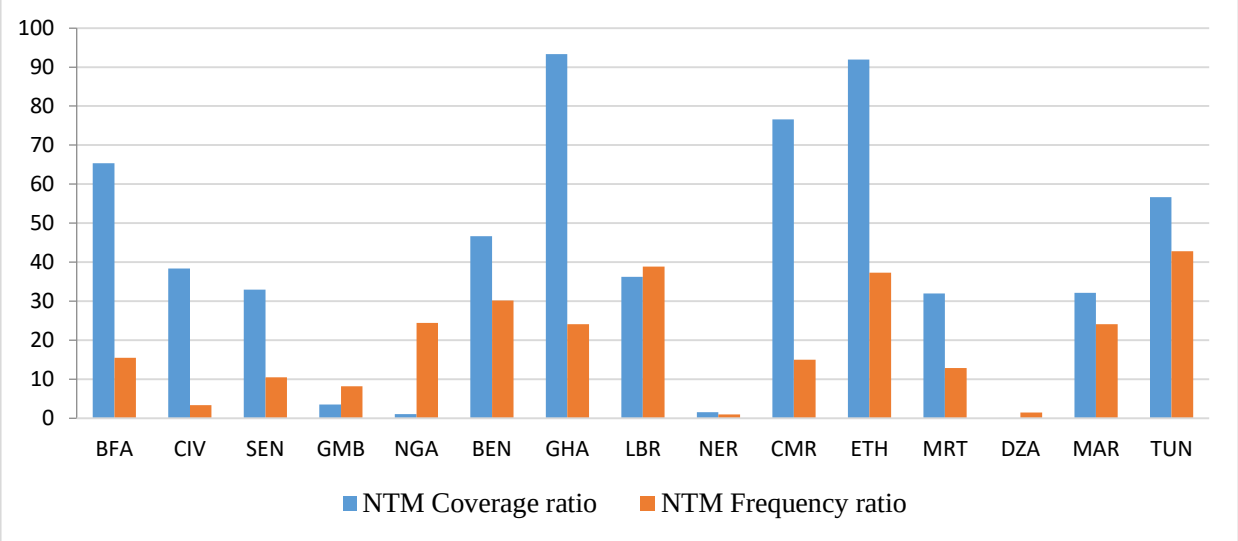
$$PS_i = \frac{\sum_{K=1}^{hs} \#NTM_{ik} D_{ik}}{\sum_{k=1}^{hs} D_{ik}} \ 100\text{----------Equation 4-3}$$

Where, $\#NTM_{ik}$ is the average number of NTM applied, and D_{ik} is imported product k in country.

We provide a descriptive analysis for the incidence of a various type of NTMs for the 15 African countries using WITS NTM database. The descriptive analysis is for coverage ratio and frequency ratio for each country for all NTMs as a whole.

Figure 4-5 and 4-6 show that the use of NTM varies across the 15 African regions for both export and import. The frequency ratio in table 4-5 indicates that more than 20% of the exported product is affected by an NTM for Nigeria, Benen, Ghana, Liberia, Ethiopia, Morocco, and Tunisia while the frequency ratio for other region is relatively small. The large differences suggest that the use of NTMs greatly varies across countries, even within the same geographic areas. This may be due to variation in the data collection method (Gourdon 2014). Similarly, as shown in table 4-6, for Burkina Faso, Senegal, Nigeria, Benin, Ghana, Liberia, Ethiopia, Algeria, Morocco and Tunisia, more than 20% of their imported product are affected by NTMs. This shows that more imported product is affected by NTM than exported products.

Figure 4-5. Frequency and coverage ratio for export, for selected African countries

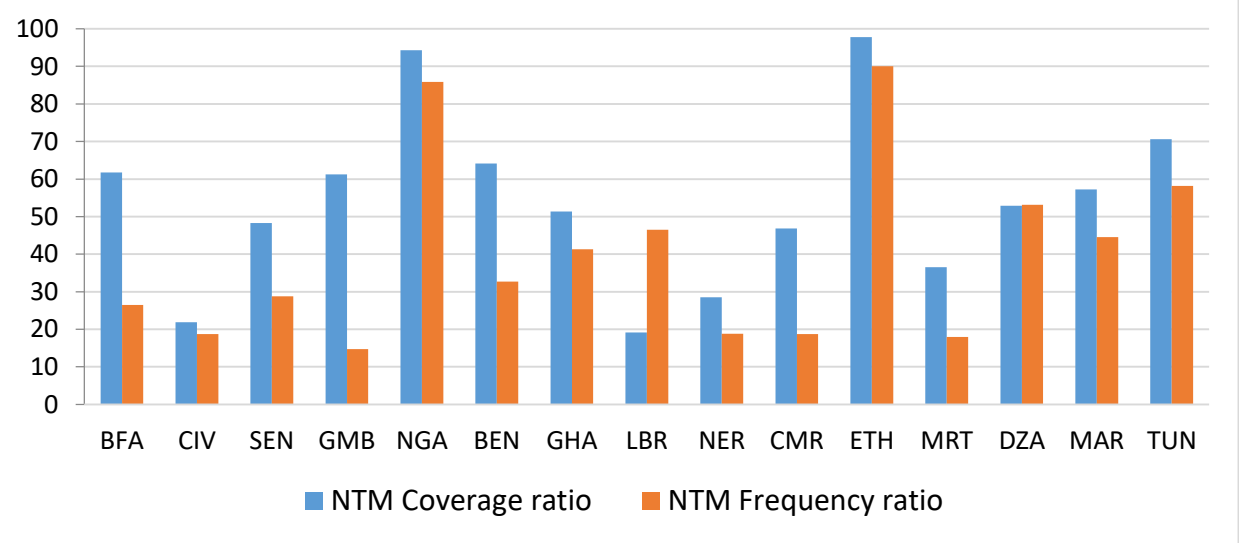


Source: WITS TRAINS database

Note: Burkina Faso (BFA), Cote de Ivore (CIV), Senegal (SEN), Gambia (GMB), Nigeria (NGA), Benen (BEN), Ghana (GHA), Liberia (LBR), Niger (NER), Cameroon (CMR), Ethiopia (ETH), Mauritania (MRT), Algeria (DZA), Morocco (MAR), Tunisia (TUN).

Moreover, figure 4-5 illustrates that Burkina Faso, Ghana, Cameroon, and Ethiopia have an export coverage ratio of more than 60%. Similarly, Burkina Faso, Gambia, Nigeria, Benen, Ethiopia, and Tunisia have an import coverage ratio of more than 60% (Table 4-6). This means that more than 60% of their trade is subject to NTMs. For Gambia, Nigeria, Niger, and Algeria the percentage of export covered by NTMs is less than 10 %. The coverage ratio is highly correlated with frequency ratio, and for most African countries coverage ratio is higher than the frequency ratio except Liberia. Furthermore, a higher coverage ratio results from two main factors. First, import composition. Most low-income countries, often import larger volumes of products where NTMs are more extensively used (agriculture) resulting in large coverage ratio for most African countries. Second, a larger use of NTMs policies on most traded products (e.g., for consumer protection) that also leads to large coverage ratio (Gourdon 2014).

Figure 4-6. Frequency and coverage ratio for import, for selected African countries



Source: WITS TRAINS database

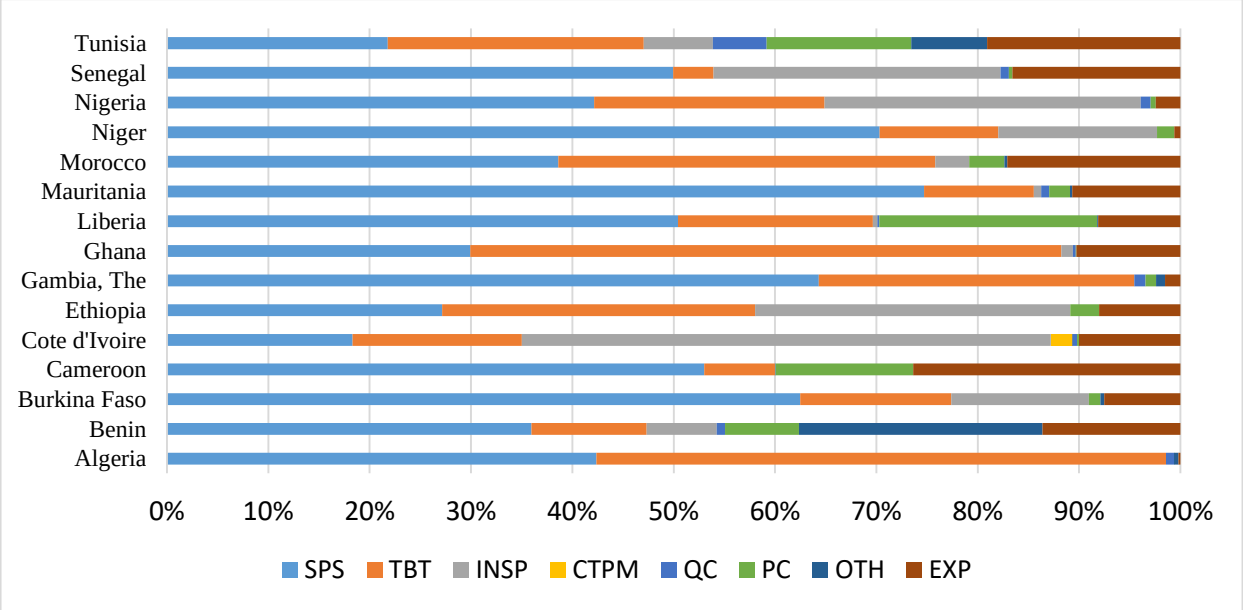
Most products in international trade face more than one regulatory measure applied to them, which may be from the same chapter or across different chapter. A large number of measures within a chapter could imply an even stricter regulatory framework. Besides, the greater the number of NTMs applied to the same product, the more regulated the trade in that product is. This is due to the similarity in nature of the measures within the same

chapter than measure from a different chapter (Gourdon, 2014). Figure 4-7 shows the distribution of NTMs for African countries using 8 NTMs[29]. For most countries, the share of SPS measure is largely followed by TBT and EXP measure. An exception to this trend is for Cote de Ivoire, Ethiopia, Niger, Nigeria and Senegal that have relatively large INSP measure. For Angola and Gambia, the share of SPS and TBT measure is more than 95%, which shows a strict regulatory measure in both chapters.

Although most countries NTMs distribution is concentrated in a few chapters, most of the products are subject to more than one type of NTMs. Figure 4-8 shows the prevalence rate of NTMs measured by the average number of NTMs applied to all product. It shows the number of the product (percentage) affected by 1 type, 2 types, more than three types, and no NTM, where types are differentiated by chapters. The share of products that are not affected by NTMs is large for all countries except Ethiopia, Nigeria, and Tunisia. For Burkina Faso, Cote d Ivoire, Algeria, Ethiopia, Mauritania, Morocco, Nigeria, and Senegal, the majority of import are affected by NTMs from one type. Although the import frequency and coverage ratio of Ethiopia and Nigeria are higher than that of Tunisia, Ethiopia's and Nigeria import can be considered relatively less regulated since as most of Tunisia's import is affected by NTMs from more than three chapters.

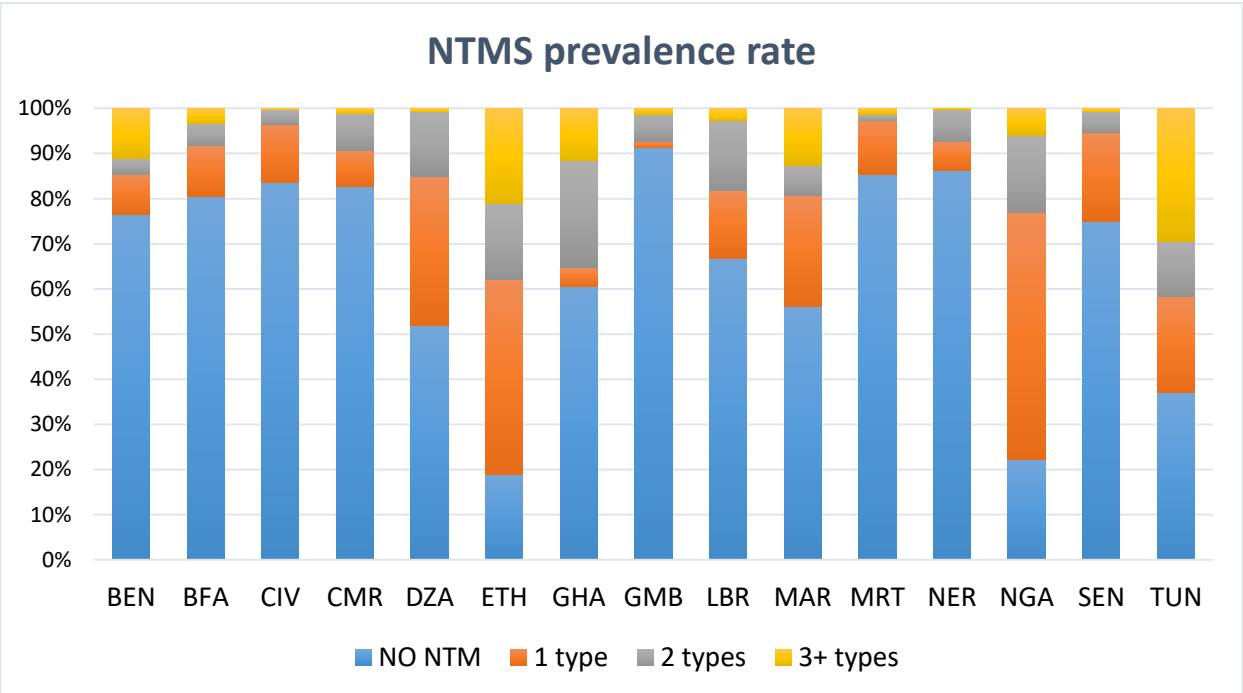
[29] The description of each measure is explained in table 4-1. Besides, other measures (OTH) includes (G, H, I, J, K, L, M, N, O) chapters of NTM.

Figure 4-7. NTM measure distributions by selected NTM chapters, percentage.



Source: WITS TRAINS database

Figure 4-8. Number of NTMs from different chapters affecting all products.



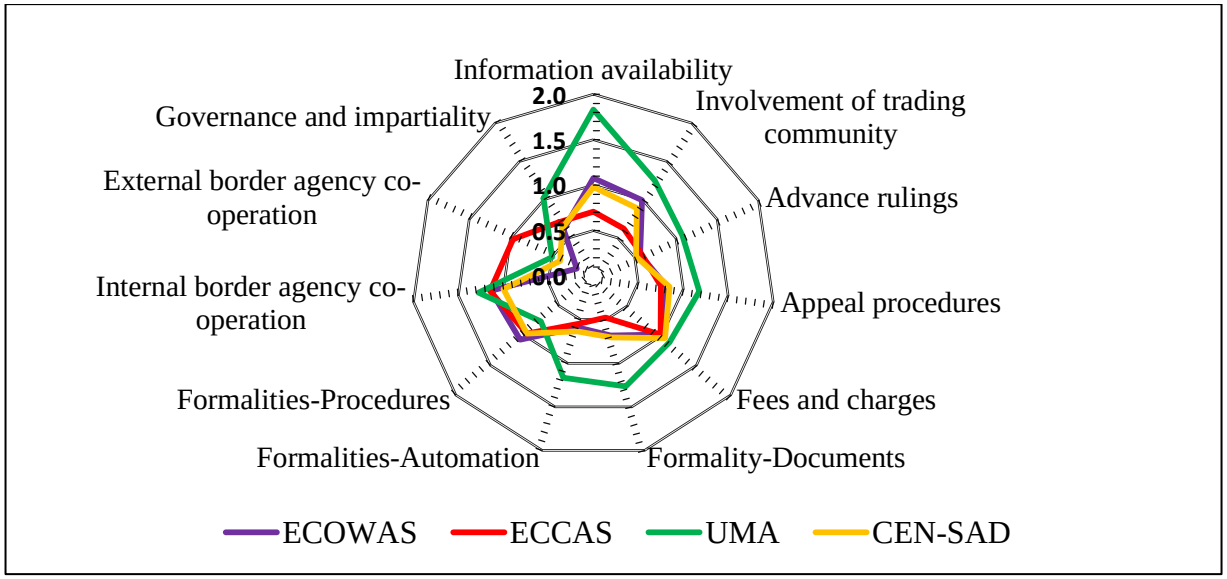
Source: WITS TRAINS database

4.2.4. Trade facilitation in Africa

In chapter 3, we explain in detail the 11 OECD trade facilitation indicates. In this section, we use the OECD TFIs and evaluate the performance of eight African regions across each indicator. Figure 4-9 shows that UMA regions have better performance in almost all TFIs except formality-procedures and external border cooperation. Moreover, ECOWAS, ECCAS, and CENSAD regions have similar performance in the area of advance ruling, appeal procedure, fees and charges, formality-automation, and formality-procedure while the is significant variation across other TFIs. Out of all west and central African regions, the ECCAS region has the worst performance on information availability, the involvement of the trading community, and formality-documents. The econometric estimation results in chapter 2 show that out of 11 TFIs formality-documents, fees and charges and advance rulings have a significant impact on reducing custom delay. For some regions with better performance in the significant TFIs, we expect relatively small welfare gain while for another region that has relatively poor performance in most TFIs, there get large welfare and trade gain. For example, ECCAS region benefits more regarding welfare by moving to best practice, geography or income mean in formality-document while the benefit to UMA region will be small as they are near to the best practice.

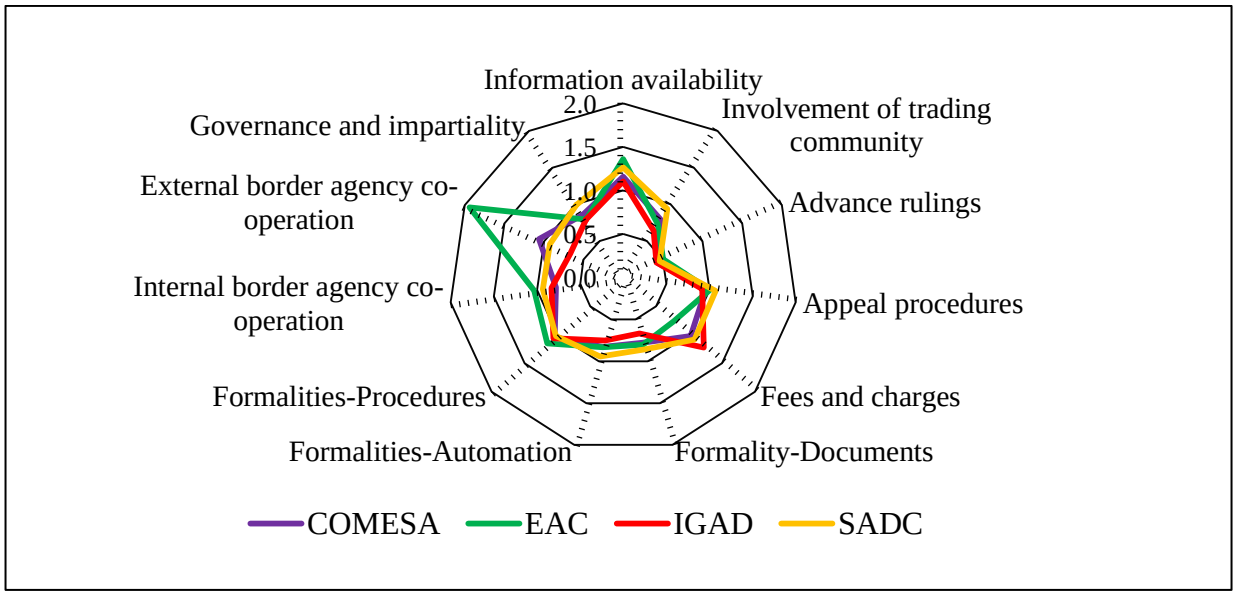
As shown in figure 4-10 below, east and southern Africa regions have similar performance in most TFIs, but there is some divergence in the area of internal and external border agency co-operation, and fees and charges. EAC have relatively better performance in most TFIs compared to other regions, especially in external border agency co-operation. The performance of all east and southern African region in the area of formality-document is relatively poor, and we expect a large gain in welfare by moving to best practice, geography and income mean.

Figure 4-9. Trade facilitation in Central and West African countries



Source: OECD Trade facilitation indicators (2015)

Figure 4-10. Trade facilitation in East and Southern Africa countries



Source: OECD Trade facilitation indicators database

4.3. Literature Review

Trade policy analysts use both partial equilibrium and Computable General Equilibrium (CGE) modeling approach to measure the impacts of the tariff, non-tariff measures, and trade facilitation policies on macroeconomic and welfare across regions/countries. Several studies have been done in Africa using both methods. In this chapter, we review the trade papers in Africa, particularly on African integration.

Harmonizations of product Standards can increase and expand trade opportunities in certain products, but it can also reduce export flow (the intensive margin of trade) by increasing the marginal cost of exporting. Besides, there may be an extra payment by exporters to harmonize their products with international standards, which also reduces the probability that a country will export at all (the extensive margin). Czubala, Shepherd, and Wilson (2009) using gravity model finds that non-harmonised standards reduce African exports and policies targeted at expanding African export should be complemented by measures to reduce the cost impact of international harmonization. Moreover, using a price-based approach, Cadot and Gourdon (2014) find that on average, SPS measures raise the domestic prices of foodstuffs by 13% in SSA.

Using gravity model, Njinkeu, Wilson, and Powo Fosso (2008) find that port efficiency and services infrastructure have a positive impact on African trade, while customs and regulatory environments are the main factors that lower intra-African trade. Furthermore, improvement in trade logistics to reduce trade cost by less developed African countries to the level comparable to advanced countries is essential to expand trade than tariff reduction (Portugal-Perez and Wilson 2009). A similar analysis on trade facilitation indicators such as corruption perception index, roads network, number of start-up procedures to register a business, taxes on exports, indicates that policy improvement aimed at removing all form of trade obstacles to the free flow of goods has a significant impact on Africa's export (Akinkugbe 2009). Seck (2017) examines the impact of trade facilitation measures such as border efficiency, physical infrastructure, regulatory environment, information and communication technology, and Logistics Performance Index (LPI) on bilateral trade flow for SSA. The estimation result shows that facilitating trade promote SSA export, and

improving the trade environment to the level of world average is equivalent to reducing the average distance to the typical trading partner by 1.7 to 10.1 percent, or cutting ad valorem bilateral tariff by 1.4 to 10.2 percent.

The gravity model papers are partial equilibrium analysis and focus on the trade impact of reducing non-tariff measures. Several studies extend the gravity model estimation and calculate the AVEs of NTMs, which can be introduced into CGE model (e.g., Kee, Nicita, and Olarreaga (2009); Zaki (2014)). Allen Dennis (2006) analyze the impact trade facilitation on regional integration among MENA regions using a survey data by Zarrouk (2003), which suggest that inefficiencies in trade facilitation amount to some 10.6% of the value of traded goods. The GTAP model simulation result indicates that regional integration among MENA region through FTA improve the welfare of the countries, but there is more welfare gain when tariff reduction is combined with trade facilitation. Similarly, using the ad valorem time cost estimate by Hummels et al. (2007), Minor and Tsigas (2008) examine the impacts of a 50 % reduction in total time to export and import on low-income SSA regions. The result indicates that there is more impact on GDP from import time reduction (4.2%) than from export time reduction (2.2.%). Further, the study highlights that the gap between exporting or importing time is an important factor in determining the gain from customs delay reduction.

A recent study on MENA region by Zaki (2014) uses a gravity model to estimate AVEs of time to export and import on several aspects of trade facilitation such as bureaucracy, internet coverage as a proxy for customs computerization, corruption, and geographical barriers on the time to trade. Then, using the MIRAGE model and AVEs estimate, the study finds that there is more gain regarding welfare and trade for MENA regions than developed ones with reduction of trade cost. Besides, trade facilitation helps increase both intra-regional and inter-regional trade.

Balistreri, Tarr, and Yonezawa (2014) made a comprehensive study in East Africa by dividing trade cost into three category, trade facilitation, non-tariff barriers, and the costs of business service. The trade facilitation analysis uses Minor (2013) database, while AVEs of NTM data from Kee, Nicita, and Olarreaga (2009) are used for non-tariff measure analysis.

For services barriers, the authors developed a new database of AVEs of barriers in eleven business services sectors in 103 countries. The result indicates that deep integration in the East African Customs Union that lowers these trade costs results in significant gains for the member countries, especially from improved trade facilitation. Moreover, the reduction of non-tariff barriers and services liberalization multilaterally would increase the gains between two and seven times, depending on the country. Similarly, Balistreri et al. (2016) examined poverty and shared prosperity implications of reducing trade costs on tripartite free trade area between COMESA, EAC, and SADC. The result indicates that there are significant reductions in the poverty headcount from deep integration in the Tripartite FTA. Besides, trade facilitation tends to increase the share of income captured by the poorest 40 percent of the population, while services reform decreases the share.

Few studies have been done on African free trade area focusing on trade facilitation and non-tariff measures (e.g., Mevel and Karingi (2012); Jensen and Sandrey (2015)). Mevel and Karingi (2012) evaluate the establishment of a continental free trade area followed by a continental customs union using dynamic MERAGE model. The result in 2022 indicates that the creation of CFTA would stimulate Africa export by 4%. Besides, the formation of CFTA by 2017 would enhance intra-African trade by 52.3% (or $34.6 billion). In their study, trade facilitation policies are introduced based on two assumptions. First, a reduction by half of the time spent at African ports by merchandise. Second, customs procedures in African countries are assumed to become twice more efficient than they are today. The model simulation result shows that when CFTA are combined with trade facilitation policies, intra-African trade increase by 128.4% (or $85.0 billion), as compared to the baseline in 2022.

Similarly, Jensen and Sandrey (2015) use the GTAP model to analyze the impact of CFTA using three liberalization policies, i.e., tariff, non-tariff barrier, and trade facilitation policies. The result shows that global welfare improves with CFTA, but some countries report large revenue loss. Further, a 50% reduction in non-tariff barriers results in large gained in terms of welfare, export and import growth than full tariff elimination.

Our study differs from Mevel and Karingi (2012) in several ways. First, we develop a new database on trade facilitation policies based on econometric estimates of customs delay. However, Mevel and Karingi (2012) uses Minor and Tsigas (2008) estimates of AVEs of time database and assume that African countries would be twice efficient when they form CFTA. Second, Mevel and Karingi (2012) do not analyze the impact of NTMs on continental free trade area while my study includes NTMs besides to tariff and trade facilitation policy. Third, besides the difference between GTAP and MIRAGE model, there is a difference in model experiments. Similarly, Jensen and Sandrey (2015) use a recursive GTAP model while we use static GTAP model. Besides, there is a significant difference in the approaches used to estimate trade facilitation policies and the model experiments. In Jensen and Sandrey (2015) paper, 25% reduction of NTMs is introduced using the iceberg approach while the rest 50% of NTMs are introduced as import tariff equivalent. However, in this study, NTMs are introduced in the GTAP model as import tariff equivalent and estimated customs delay reduction is introduced using the iceberg approach as a productivity shock.

4.4. Methodology of the study

4.4.1. Modeling NTMs in CGE model

Following the reduction of both tariff and traditional non-tariff barriers, the importance of NTMs have become more visible and their relative importance in boosting the benefit of international trade has considerably grown. Both the econometric and CGE modeling technique have been used to analyze the impact of NTMs. NTMs create an artificial scarcity and result in an artificially high price. The degree of restrictiveness of an NTMs is measured by the price differential that it drives between the price of imported goods and the price of the domestic substitutes. Therefore, the economic effects of the removal of a given NTMs are measured by the "wedge" between the distorted and the non-distorted price (Andriamananjara, Ferrantino, and Tsigas 2003). The econometric estimates of NTMs restrictiveness are then converted into their ad valorem or tariff equivalent for CGE model analysis.

Three basic techniques are used in CGE model analysis to analyze the impact of NTMs, depending on the extent to which they are implemented through shifts of the supply or demand curves or as transaction costs (Walmsley and Minor 2016). However, the choice of supply and demand side techniques in analyzing the full range of NTMs in the CGE model is complex. First, the incorporation of supply shift effects in the existing CGE model requires to develop appropriate functional forms to model supply functions. Second, demand shifts effect of NTMs can be modeled as gains or losses in the willingness to pay for imports or changes in the elasticity of substitution between imported goods, but its implementation in CGE model is limited due to the difficulty in finding relevant empirical information for plausible parametrization (Fugazza and Maur 2008).[30] Moreover, most NTMs involve a combination of supply shifts, transaction cost, and willingness-to-pay impacts. Hence, it is difficult to assign them into one of the three categories (Walmsley and Minor 2016).

In a most CGE model analysis of NTMs like GTAP model, the supply side techniques are implemented using export tax or import tax. Alternatively, NTMs are also introduced by changing the Armington import equation or iceberg approach. The import tax method is appropriate if the intended NTM policy is implemented to directly affect the domestic price of the imported commodity. The removal of NTMs in this approach are expected to deteriorate the terms of trade, but it improves resource allocation. Alternatively, in some instances, exporters are directly affected by the presence of NTMs. In this case, the NTMs effect can be introduced as an export tax equivalent that constrains the shipment of exports. In this case, the liberalizing country is expected to experience an improvement in its terms of trade as well as a better allocation of resources. Finally, NTMs can be modeled as institutional frictions or "sand in the wheels" of trade. In this approach, the reduction of burdensome custom and administrative procedures, technical regulations and SPS regulations result in efficiency gains. The liberalizing country, in this case, is expected experience deterioration in its terms of trade combined with improved resource allocation (Andriamananjara, Ferrantino, and Tsigas 2003).

[30] Walmsley and Minor 2016 are the first to impliment the demad side effect of NTMs.

Most studies use Hertel et al. (2001) approach, which is now referenced as the AMS or iceberg approach, for modeling trade facilitation into GTAP model (for example, Fox et al. (2003) and Francois et al.,.(2005)). The iceberg approach represents changes in importer costs deriving from reductions of NTMs. However, there is a recent development in the modeling of trade facilitation policies using the Willingness To Pay (WTP) approach (Walmsley and Minor 2016). Under the WTP approach, the reduction in customs delays is modeled as a demand shock that increases a consumer's willingness to pay for faster delivery. Comparing both methods, Walmsley finds that the iceberg method leads to a significantly larger increase in real GDP in contrast to the WTP method, due to productivity gains. In contrast, the WTP method has a more expansionary effect on trade volumes and causes the terms of trade to improve.

In this chapter, the trade facilitation policies are introduced into GTAP model using the iceberg approach. We use AVEs of customs delay reduced from chapter two as trade facilitation (productivity shock) for all African countries. For NTMs analysis, AVEs of NTMs estimated by Kee.et.al (2009) is used. The NTMs are incorporated into GTAP model as import tariff. Then, the impact of reducing NTMs is evaluated by reducing AVEs of NTMs by 50% for all African countries that have NTMs data. For some African countries, there is no NTMs data, but there is some gain from a reduction of NTMs by other regions.

4.4.2. GTAP model and Database

The study uses the static GTAP model with unemployment closure in the unskilled labor force to evaluate the impact of reducing tariff, NTMS, and customs delay in the economies of African countries/regions. The standard features of the GTAP model are perfect competition, constant return to scale, Armington assumption in trade flows, disaggregated import usage by activity, non-homothetic consumer demands and explicit modeling of international trade and investment (Hertel, 1997). GTAP model has the advantage of overcoming the effects of policy changes, at national, bilateral or multilateral levels, on production levels, input factors, volumes of trade and other induced influences on welfare. Furthermore, GTAP model is centered on the reallocation of resources between the sectors of the economy; it is an appropriate instrument for identifying the sectors and countries,

which gain or which lose with the change of policy-induced by trade liberalization policy. The data used in this study is version 9 of the GTAP database (Aguiar, Narayanan, and McDougall, 2016). The reference year for the database is 2011.

- **Regional and sectoral Aggregation**

The GTAP-9 database features 140 countries/regions and 57 tradeable commodities. In this study, the 140 countries/regions are mapped into 39 regions, and the 57 sectors are mapped into 20 sectors (Table 4-2). The GTAP 9 database identifies only 26 of the 55 African Union (AU) member countries as a separate region while the other 29 African countries are aggregated into six composite regions; Rest of North Africa (RNA), Rest of West Africa (RWA), Central Africa (CA), Rest of South Central Africa (RSCA), Rest of Eastern and Southern Africa (REA), and Rest of Southern African Customs (RSAC). Furthermore, the regional aggregation includes seven non-African regions; EU-27, UK, USA, China, India, Japan, and ROW. The detailed mapping of sectoral aggregation is available in appendix C.4.

Table 4-2. Regional and sectoral aggregation

No.	New Code	No.	New Code	No.	Aggregated GTAP Sectors
1	Egypt	21	Mauritius	1	Grains and Crops
2	Morocco	22	Mozambique	2	Vegetable
3	Tunisia	23	Rwanda	3	Oilseeds
4	Rest of NA	24	Tanzania	4	Sugarcane and Sugar beat
5	Benin	25	Uganda	5	other crops
6	Burkina Faso	26	Zambia	6	Live Animal
7	Cameroon	27	Zimbabwe	7	Livestock and Meat Products
8	Cote d'Ivoire	28	Rest of EA	8	Forestry
9	Ghana	29	Botswana	9	Fishery
10	Guinea	30	Namibia	10	Coal, Oil, and Gas
11	Nigeria	31	South Africa	11	Mining and Extraction
12	Senegal	32	Rest of SAC	12	Processed Food
13	Togo	33	China	13	Sugar
14	Rest of WA	34	Japan	14	Beverage and Tobacco
15	Central Africa	35	India	15	Textile
16	Rest of SCA	36	USA	16	Wearing Apparel
17	Ethiopia	37	UK	17	leather
18	Kenya	38	EU-27	18	Light Manufacturing
19	Madagascar	39	ROW	19	Heavy Manufacturing
20	Malawi			20	Services

Source: GTAP 9 database

- **Model experiments**

This study begins with the GTAP 9 database with the base year 2011, aggregated to the sets of regions and sectors specified in table 4-2 above. As shown in table 4-3, this chapter has eleven experiments, which differ depending on the type of trade liberalization policies taken by African regions/countries. The first three experiments consider the impact of trade facilitation policies on the economies of African countries. The three experiments explain the impact of reducing border-related customs delay when African countries/regions move to best practice, geography or income mean in formality documents. Experiment 4 analyses the impact of reducing NTMs by 50% on the economies of African regions/countries. The NTMs data is taken from (Kee, Nicita, and Olarreaga 2009), which provide AVEs of NTMs at HS-6 code level. Of 32 African aggregated regions 23 countries have NTMs data, while other countries/regions do not have data. The NTMs data is aggregated into 20 GTAP sectors using import weight for the 23 countries. For all experiments that include NTMs reduction, a new base data is created by adding AVEs of NTM with the GTAP 9 database. Hence, in experiment 4, we reduce only AVEs of NTMs by 50%[31]. Moreover, the first four experiments analyze the impact of reducing NTMs and customs delay without reducing import tariff and subsidy among African countries.

In experiment 5, we remove import tariff among all African countries to analyze the impact of CFTA among African countries without any reduction of NTMs and customs delay. Then, in experiment 6 and 7, we extend our analysis of experiment 5 by including customs delay and NTMs respectively. For experiment 6, the impact of trade facilitation policies on CFTA is introduced by reducing custom delay when countries move to geography mean[32] . Similarly, in experiment 7, African countries with NTMs data are allowed to reduce 50% of AVEs of NTMs besides removing tariff among themselves. Experiment 8 includes the three trade liberalization policies; tariff, trade facilitation, and

[31]The 50% of AVEs of NTM s are reduced on all imports originating from all over the world. So, we expect some benefit to non-African regions.

[32] Similar analysis is done with best practice and income mean, but the results are not included in the paper.

NTMs together. Hence, African form a free trade area, facilitate trade by reducing customs delay, and further reduce NTMs by 50%. Finally, experiment 9-11, deals with the continental customs union. In experiment 9, African countries form FTA first; then they set CET on imports from the non-African origin. Then, experiment 10, extends the analysis by removing 2% of sensitive products from CET calculation. In experiment 11, evaluates continental customs union combined with the reduction of customs delay.

Table 4-3. Experiment design for chapter 4.

No.	Experiment	Trade Liberalization policy
1	TFABM	Trade facilitation (reduction of customs delay) by African countries with best practice scenario.
2	TFAGM	Trade facilitation (reduction of customs delay) by African countries with geography mean scenario.
3	TFAIM	Trade facilitation (reduction of customs delay) by African countries with income mean scenario.
4	NTM	The reduction of non-tariff measures by 50%.
5	CFTA	Full free trade area among all African countries.
6	CFTA+TFAGM	As in experiment 5, but with trade facilitation policy for geography mean.
7	[CFTA+NTM]	As in experiment 5, but with reduction of NTMs by 50%.
8	[CFTA+NTM]+TFAGM	As in Experiment 7, but with trade facilitation policy for geography mean.
9	[CFTA]+CU	All African countries form CFTA first; then common external Tariff is imposed on Non-African regions.
10	[CFTA]+CU-2%	All African countries form CFTA first; then common external Tariff is imposed on Non-African regions excluding 2% of the sensitive product.
11	[CFTA]+CU-2%+TFAGM	As in experiment 9, but with trade facilitation policy for geography mean.

Source: Authors Simulation Design

4.5. Result and Discussion

4.5.1. Analysis of Trade facilitation and Non-Tariff Measures

In chapter 3, we calculate the number of customs delay reduced for border-related compliance when countries move to best practice, geography, and income mean in formality documents. In this chapter, we use the result from chapter three and evaluate the welfare and macroeconomic impact of reducing customs delay for border-related compliance by African countries. Besides, we examine the impact of reducing NTMs by 50% in Africa using ad valorem equivalent of NTMs estimates by (Kee, Nicita, and Olarreaga 2009). The NTMs data is available for 23 African countries, but for some countries such as Burkina Faso, Cameroon, Madagascar, Ethiopia, Gabon, Rwanda, and Uganda, there are many missing values. Thus, for NTMs analysis, we expect large macroeconomic and welfare effect for regions with full NTMs data[33].

We introduce the impact of trade facilitation (reduction of customs delay) in the GTAP CGE model using the iceberg approach (Hertel et al. 2001). In this approach, the impact of reducing customs delay or facilitating trade is simulated by imposing positive productivity shock (AMS) on goods crossing the border[34]. A positive shock to AMS has two effects. First, AMS reduces the importer's price causing substitution towards that good and an increase in quantity demanded. Second, AMS reduces the amount that needs to be imported to satisfy a given level of demand. These two effects work in opposite directions, but in practice, the first effect outweighs the second effect due to the fact that the price effects are multiplied by an elasticity which is frequently greater than one in GTAP model (Walmsley and Minor 2016).

The analysis of NTMs in this chapter is introduced in the GTAP model as import tax. First, we use Alter tax utility to add surcharges to import tariff that represent AVEs of NTMs by African countries as estimated by kee.et.al. (2009). After running Alter tax experiment, we save the results as a new base model that include both tariff and NTM data.

[33]For African regions/countries that doesn't have NTMs data, there is no reduction of NTMs. So, the NTMs result is only for countries with NTMs data.
[34]The technical shifting parameter in GTAP model is referred to as AMS (i, r, s).

Then, using the updated tariff and subsidy data, the NTMs are reduced by 50% to analyze the impact of NTMs in the economies of African countries.

The result in table 4-4 shows that there is large welfare gain with best practice experiment than with income and geography mean for all African regions /countries. This shows that African countries are far from best practice but near or above to the geographic and income mean in formality documents. Hence, a reduction of customs delay under best practice is expected to result in large productivity shock, and hence welfare gain. The difference in welfare across countries/regions results from the difference in the size of trade facilitation shock, which in turn depends on the difference in either the amount of time to import for border compliance or the performance of countries in formality documents indicator.

Egypt, South Africa, Morocco, and Tunisia, Tanzania gain regarding welfare and GDP with best practice scenario; Nigeria has a similar result, but they are different in that they lose regarding GDP. The large welfare gain across all trade facilitation scenarios goes to Egypt, which is around $4297 million. This is mainly due to the poor performance of Egypt in formality document indicator. Hence, the reduction of import time for Egypt is large and result in large productivity shock. For Morocco, Tunisia, Nigeria, Tanzania, South Africa, Ethiopia, and Kenya, there is small welfare gain with geography and income mean experiments. These countries are far from best practice in formality documents, but near to both geography and income mean. Table 4-4 also shows that Madagascar, Malawi, Mauritius, Rwanda, Zimbabwe, Botswana, and Namibia reports small welfare gain across the three trade facilitation experiment. This is due to the relatively small time to import for border-related compliance or better performance in formality documents. Overall, the world as whole gains in terms of welfare and GDP, but non-African regions experience welfare and GDP loss under all trade facilitation scenarios.

Table 4-4. Changes in Gross Domestic Product and Welfare Effects

Region	Welfare in Equivalent Variation				Gross Domestic Product			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	TFABM	TFAGM	TFAIM	NTM	TFABM	TFAGM	TFAIM	NTM
Egypt	4297.63	2562.68	2599.48	5049.51	5879.03	3451.94	3503.1	-3696.66
Morocco	2090.51	7.11	8.6	1139.5	1995.84	9.02	12.15	-1315.44
Tunisia	1132.11	4.73	14.01	905.29	1353.48	7.82	27.14	256.93
Benin	-584.51	-27.01	-1.8	-27.02	-901.98	-44.61	-2.7	-35.49
Burkina Faso	110.03	53.88	40.83	56.56	51.75	25.82	19.55	-38.81
Cameroon	565.29	33.86	6.26	57.93	336.64	33.9	16.66	-178.13
Cote d ivore	257.08	16.08	3.04	1074.19	207.42	21.08	10.89	-128.58
Ghana	290.93	1.76	1.93	105.93	224.74	3.53	2.61	-273.9
Guinea	230.56	228.04	228.01	25.31	196.77	190.53	190.33	19.3
Nigeria	3455.36	3.68	7.56	7171.99	-177.54	-4	3.66	-25063.6
Senegal	140.88	10.12	8.25	-752.07	204.87	19.42	15.67	-4198.51
Togo	843.14	46.35	3.29	11.62	958.47	52.59	4.31	9.33
Ethiopia	671.76	34.15	0.97	-0.28	690.54	35.03	0.65	-125.23
Kenya	809.17	6.97	3.8	158.1	1111.15	13.54	6.32	312.04
Madagascar	72.4	0.14	0.16	4.83	79.55	-0.18	-0.12	-4.11
Malawi	72.34	4.32	0.59	48.65	122.83	7.57	1.4	-13.47
Mauritius	62.19	0.02	-0.04	100.69	50.15	-0.35	-0.45	-108.16
Mozambique	41.17	15.97	11.99	8.35	32.16	11.11	8.26	8.95
Rwanda	8.09	0.34	0.31	11.44	9.29	0.91	0.7	-57.28
Tanzania	1498.98	77.03	4.93	930.56	1090.82	60.66	8.07	-3045.2
Uganda	143.39	1.7	1.23	4.79	167.94	5.9	4	3.23
Zambia	151.68	8.12	7.43	46.57	222.09	16.76	15.75	36.54
Zimbabwe	68.72	0.16	0.11	9.7	47.2	0.29	0.08	10.17
Botswana	5.31	0.2	0.14	1.77	0.39	-0.01	0.06	-2.27
Namibia	23.75	2.9	3.08	3.17	49.54	8.46	9.02	6.85
South Africa	2323.7	13.21	12.25	237.41	1632.33	12.97	11.13	-32.26
Other Africa	13450.21	1574.74	2297.86	336.3	6820.87	655.34	1045.11	88.35
Africa Total	32231.87	4681.25	5264.27	16720.84	22456.34	4595.04	4913.35	-37565.41
World total	31388.90	4251	4768.64	21311.91	6957.79	293.01	497.43	-18199.2

Source: Model Simulation result

Table 4-5 column 1-4, investigates in detail the welfare result for African countries by decomposing total welfare into five components[35]. The welfare result is decomposed into

[35]We discuss the welfare decomposition for experiment 2 (TFAGM) since the CFTA and CCU experiments include trade facilitation by geography mean scenario. All the CFTA and CCU analysis can be done for best practice and income mean scenario, but to summarize the discussion we choose to present the result for geography mean.

allocative efficiency, endowment effect, terms of trade effect, and investment-saving balance effect. The allocative efficiency, which measures the ability to efficiently allocate resource across sectors in the economy, show that all African countries/regions with productivity shock gain in terms of allocative efficiency. An exception to this trend is Benin that reports negative allocative efficiency. The endowment effect, which measures the change in wage bill caused by the change in employment, also shows that there is more employment of unskilled labor due to the reduction of customs delay and hence welfare gain[36].

The technical efficiency effect measures the gain in welfare due to an improvement in the technical efficiency of production. This effect is mainly due to the reductions of customs delay. Table 4-5 column 3 show that, for some countries such as Morocco, Tunisia, Ghana, Nigeria, Senegal, Kenya, Madagascar, Mauritius, Rwanda, Uganda, Zambia, Zimbabwe, Botswana, Namibia, and South Africa, the technical efficiency effect is zero. This shows that the performance of these countries is above their geography mean and moving to geography mean does not reduce time to import. Hence, the productivity shock (AMS) is zero. However, for other countries, there is positive productivity shock and result in large welfare gain. The productivity gain from the reduction of customs delay transmit from imports to domestic products, and hence to exports when the product is exported through changes in the price of the domestic commodity. This result in a change in the price of export relative to import, which is captured by the terms of trade effect. The terms of trade effect show that most countries welfare benefited owning to lower export prices than import prices. An exception to this trend is Benin, Burkina Faso, Mozambique, and Zimbabwe. The difference between investment and saving adjusts to equate the real trade balance.

Table 4-6 column 1-5 further investigates the reason for the decline or gain in GDP for experiment 3 by decomposing GDP into different component. For Nigeria, Madagascar, and Mauritius, the reduction in GDP comes from a decline in consumption of domestically

[36] In this study we change the unemployment closure of unskilled labor force. So, the welfare gain from endowment effect are associated with employment of unskilled labor.

produced goods, investment, although there is a trade surplus. The main reason for the decline in domestic consumption is an increase in export due to productivity gain. Therefore, there is a potential for a change in production structure; more of production is exported than the base year. For other African countries, there is a trade deficit, but the increase in domestic consumption, government consumption, and investment dominates the deficit.

Table 4-5. Welfare decomposition for TFAGM and NTM experiment (US$ million)

Region	Welfare Decomposition for TFAGM					Welfare Decomposition for NTM			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All.Eff	End.Eff	Tech.Eff	TOT	IS	All.Eff	End.Eff	TOT	IS
Egypt	72.08	480.4	1786.64	108.57	114.98	5305.3	2093.87	-1831.59	-518.02
Morocco	0.36	2.08	0	4.17	0.5	980.33	929.49	-497.99	-272.32
Tunisia	0.64	1.08	0	2.81	0.21	667.06	460.64	-180.24	-42.16
Benin	-13.84	-1.53	13.46	-4.24	-20.86	-10.79	-1.53	4.02	-18.72
Burkina Faso	9.2	8.23	34.07	-2.23	4.62	39.6	8.98	1.85	6.12
Cameroon	7.61	9.41	16.27	1.33	-0.75	53.57	37.53	-24.33	-8.83
Cote d ivore	3.48	2.35	7.17	3.27	-0.18	703.01	458.53	-180.24	92.9
Ghana	0.32	0.65	0	0.43	0.35	99.2	76.91	-34.82	-35.35
Guinea	81.83	16.56	141.05	6.48	-17.88	9.6	1.96	14.68	-0.92
Nigeria	0.55	1.28	0	4.07	-2.22	4380.38	1394.45	-706.06	2103.22
Senegal	1.94	2.11	0	3.09	2.97	396.4	257.9	-340.76	-1065.6
Togo	16.33	6.33	14.65	6.86	2.18	3.58	1.71	6.27	0.06
Ethiopia	6.26	8.89	18.93	1.74	-1.67	17.97	22.42	-8.49	-32.18
Kenya	0.95	1.23	0	2.73	2.05	7.68	46.49	66.61	37.32
Madagascar	0	0.06	0	0.08	0	1.01	4.82	-0.67	-0.33
Malawi	0.38	0.72	2.06	0.78	0.39	43.34	6.96	-1.32	-0.32
Mauritius	-0.02	0.01	0	0.02	0.01	54.48	111.32	-42.63	-22.47
Mozambique	0.97	4.39	12.19	-0.43	-1.15	-0.94	3.26	5.85	0.17
Rwanda	0.11	0.11	0	0.13	0	4.74	10.48	-1.89	-1.89
Tanzania	13.67	24.34	41.71	2.45	-5.15	1181.29	1033.28	-350.39	-933.61
Uganda	0.51	0.15	0	0.95	0.09	0.21	2.51	1.82	0.25
Zambia	-2.16	4.31	0	7.59	-1.61	5.81	31.44	10.84	-1.52
Zimbabwe	0.11	-0.01	0	-0.08	0.13	1.25	2.47	5.65	0.33
Botswana	0.03	0.3	0	0.05	-0.17	-0.03	1.55	-0.46	0.71
Namibia	0.41	0.53	0	2.7	-0.74	-0.3	0.51	3.19	-0.23
South Africa	1.16	2.36	0	10.5	-0.81	145.17	181.83	-86.58	-3.01

Source: Model Simulation result

For trade facilitation experiments, the main source of welfare gain is an increase in technical efficiency of production while for NTMs experiment (experiment 4) welfare gain results from the reduction of tariff equivalent of non-tariff measures. For most African countries with relatively large NTMs such as Egypt, Morocco, Côte d'Ivoire, Nigeria, Tanzania, and South Africa, a reduction of NTMs by 50% result in large welfare gain, but lose in terms of GDP. Table 4-4 column 4 shows that Egypt and Nigeria report a large welfare gain of around $5049 million and $7171 million respectively.

The welfare decomposition for experiment 4 in table 4-5 indicates that the main source of welfare gains are allocative efficiency and endowment effect, although there is a loss of welfare from terms of trade and investment-saving effect. For Senegal and Ethiopia, the loss from terms of trade and investment-saving effect outweighs the gain in allocative efficiency and endowment effect, and result in net welfare loss of $752 million and $0.28 million respectively. Burkina Faso, Guinea, Togo, Mozambique, Zimbabwe, Botswana, Namibia, and other aggregated African regions did not have NTMs data but benefited from the reduction of NTMs by other African countries. However, the reverse is true for Benin.

Table 4-6 column 6 indicates that the large decline in GDP for Egypt, Morocco, Nigeria, and Tanzania result mainly from a decline in consumption of domestic commodity and trade deficit. The major factor for the decline in local consumption of domestic production is an increase in both export and import due to the reduction of NTMs. Thus, for these regions, more of production is exported than in the base year, and more of consumption is imported

Table 4-6. GDP decomposition for TFAGM and NTM experiment (US$ million)

Region	GDP by Component for TFAGM					GDP by Component for NTM				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Cons.	Invt.	Gov.	Export	-(Import)	Cons.	Invt.	Gov.	Export	-(Import)
Egypt	2871.2	871.82	491.89	-165.2	617.7	-3150.97	2059.83	-187.37	10374.78	12792.9
Morocco	6.65	4.78	2.23	1.81	6.46	-960.04	629.44	-115.21	2492.01	3361.64
Tunisia	5.85	3.22	1.75	0.83	3.83	165.13	1132.07	156.69	1281.86	2478.81
Benin	-67.2	-32.39	-10.92	16.45	-49.46	-53.16	-25.76	-8.67	14.29	-37.82
Burkina Faso	16.9	11.23	6.6	9.39	18.31	-23.97	3.29	-4.92	54.83	68.05
Cameroon	26.56	12.75	6.51	9.96	21.89	-128.18	-15.66	-22.61	101.39	113.07
Cote d ivore	14.87	5.82	3.47	12.41	15.49	-98.56	249.87	18.76	921.75	1220.4
Ghana	2.64	0.44	0.73	0.57	0.84	-201.96	6.76	-45.61	252.48	285.56
Guinea	217.55	59.27	27.63	-14.89	99.05	21.75	5.36	2.76	1.36	11.93
Nigeria	-2.32	-4.24	-0.28	1.49	-1.34	-17217.7	-3201.1	-2039.8	3471.85	6076.79
Senegal	18.05	8.45	4.03	-0.86	10.25	-3876.06	-189.95	-808.86	1404.25	727.9
Togo	76.91	54.13	8.65	-23.65	63.46	13.94	11.23	1.62	-4.23	13.25
Ethiopia	30.93	11.72	3.85	-3.46	8.03	-93.05	-20.18	-9.29	42.88	45.57
Kenya	11.57	3.69	2.81	1.58	6.1	267.03	95.36	64.85	41.42	156.62
Madagascar	-0.12	-0.15	-0.01	0.06	-0.05	-2.07	8.55	-0.22	10.37	20.75
Malawi	5.68	3.67	2.08	-2.24	1.63	-11.15	26.05	-3.37	37.41	62.4
Mauritius	-0.24	-0.21	-0.05	0.01	-0.16	-88.97	63.13	-6.58	198.07	273.82
Mozambique	8.48	1.81	1.53	1.77	2.48	6.6	0.89	1.12	4.43	4.08
Rwanda	0.68	0.15	0.07	0.24	0.23	-42.43	-7.88	-3.99	17.66	20.63
Tanzania	43.91	21.56	13.21	1.11	19.11	-2047.32	-329.57	-443.99	1398.09	1622.41
Uganda	4.32	1.69	0.56	2.09	2.76	2.11	1.29	0.45	6.32	6.93
Zambia	8.05	6.7	2.93	-0.93	-0.01	16.04	18.92	7.3	63.36	69.07
Zimbabwe	0.29	-0.05	0.05	-0.01	-0.02	9.63	0.26	2.1	6.44	8.28
Botswana	0.02	-0.42	0.01	0.35	-0.02	-0.92	-4.28	-0.3	2.17	-1.05
Namibia	4.39	2.15	1.5	3.47	3.05	3.77	-0.23	1.18	2.65	0.5
South Africa	9.44	1.47	3.6	14.48	16.02	-16.81	197.25	15.25	784	1011.95

Source: Model Simulation result

The trade effect of trade facilitation and NTMs experiments are reported in table 4-6 column 4 & 5 for experiment 2, and column 9 & 10 for experiment 5. All African countries witness a flood of imports with reductions of customs delay. However, for some countries with no productivity shock, there is a reduction in the value of imports. Moreover, due to the reduction of import price, domestic production becomes cheap in these countries, and in turn, result in increased export. Therefore, under both trade facilitation and NTMs experiment, we observe large increase in export for most countries. An exception to this trend is Egypt, Guinea, Senegal, Togo, and Zambia under all trade facilitation scenario.

Table 4-7 indicates that facilitation of trade and the reduction of NTMs result in the trade deficit for most African countries. However, Benin, Nigeria, Central Africa, Rwanda, REA, Botswana, Namibia, reports trade surplus under all trade facilitation experiments. Similarly, Benin, Senegal, Mozambique, Botswana, and Namibia report trade surplus with a 50% reduction of NTMs. On the other hand, all non-African regions report trade surplus across all scenarios. An exception to this trend is India that reports trade deficit under the NTMs experiment.

Table 4-7. Aggregate Trade Balance Changes (US$ million)

Region	TFABM	TFAGM	TFAIM	NTM
Egypt	-1304.67	-782.97	-794.49	-2418.17
Morocco	-1465.26	-4.63	-6.22	-869.64
Tunisia	-820.96	-3	-9.58	-1196.95
Benin	1394.32	65.91	4.28	52.11
Burkina Faso	-17.33	-8.91	-6.74	-13.22
Cameroon	-174.77	-11.92	-2.93	-11.68
Cote d ivore	-52.49	-3.09	-0.27	-298.65
Ghana	-116.76	-0.28	-0.18	-33.08
Guinea	-115.92	-113.93	-113.85	-10.57
Nigeria	125.02	2.81	3.24	-2604.94
Senegal	-142.29	-11.11	-8.99	676.35
Togo	-1381.93	-87.1	-6.76	-17.48
Ethiopia	-228.92	-11.48	0.3	-2.7
Kenya	-388.18	-4.53	-2.26	-115.2
Madagascar	-33.37	0.1	0.09	-10.38
Malawi	-68.8	-3.87	-0.24	-25
Mauritius	-31.08	0.16	0.19	-75.75
Mozambique	-1.7	-0.7	-0.48	0.36
Rwanda	0.06	0	0.01	-2.98
Tanzania	-306.48	-18.01	-1.92	-224.31
Uganda	-18.21	-0.66	-0.47	-0.61
Zambia	-11.63	-0.92	-0.69	-5.72
Zimbabwe	-2.28	0.01	0.06	-1.83
Botswana	1.1	0.38	0.31	3.23
Namibia	0.56	0.42	0.4	2.14
South Africa	-762.28	-1.54	-1.43	-227.93

Source: Model Simulation result

4.5.2. Continental Free Trade Area with Trade Facilitation and Non-tariff Measures

In section 4.5.1, we discuss the impact of reducing only non-tariff measures and customs delay. In this section, we extend our analysis by combining the free trade area among African countries with a reduction of customs delay and non-tariff measures. The discussion focuses entirely on experiment 5, 6, and 7. For experiment 5 and 6, the baseline data is GTAP 9 version 2011. However, for experiment 7- a new base data is created by adding AVEs of NTM with the GTAP 9 database. Then, original import tariff and 50% of the AVEs of NTMs are removed by African countries, leaving 50% of the AVEs of NTMs.[37]

4.5.2.1. Continental Free Trade Area with Trade Facilitation

Table 4-8 column 1 reports that most African countries gain in terms of welfare and GDP with continental free trade area while Benin, Guinea, Mauritius, and Zimbabwe lose in both welfare and GDP. Overall, the world and Africa welfare improve by $3502 million, and $5591 million respectively, although world GDP reduce by $2775 million due to the large reduction from the non-African region.

Combining free trade area with a reduction of customs delay result in large welfare gain than tariff removal only. Table 4-8 column 2 shows that Zimbabwe and Mauritius continue to lose in welfare when CFTA is combined with trade facilitation policies. The performance of these countries is above the geography mean and reduction of customs delay does not affect their welfare. The result for Benin is surprising as the country reports relatively large welfare loss in both experiment 6, although there is some benefit from the reduction of customs delay. For Guinea, CFTA is not welfare improving, but when a reduction of customs delay is combined with CFTA there is a welfare gain of around $205 million.

Table 4-8 column 2 indicates that Egypt and South Africa enjoys the highest welfare gain when African free trade area is formed, and customs delay is reduced by moving to

[37] The 50% reduction of NTMs is also reduced on imports from non-African regions.

geography mean. For Egypt, the welfare gain is a combination of both tariff removal and trade facilitation while for South Africa the welfare gain is associated with tariff removal only as the country performance is above the geography mean. Overall, most African countries gain in welfare and GDP by forming free trade area and facilitate trade through reduction of customs delay; Cameroon and Tanzania have a similar result, but they are exceptions in that they lose in terms of GDP. All non-African regions lose in terms of welfare, but the world enjoys a welfare gain of $7758 million when CFTA is formed with trade facilitation, although world GDP reduces by $2509 million.

Table 4-8. Changes in Gross Domestic Product and Welfare Effects (US$ Million)

	Changes in Welfare			Changes in Gross Domestic Product		
	(1)	(2)	(3)	(4)	(5)	(6)
	CFTA	CFTA+TFAGM	CFTA+NTM	CFTA	CFTA+TFAGM	CFTA+NTM
Egypt	58.66	2632.15	8641.98	634.99	4128.41	-8578.63
Morocco	87.13	95.92	2710.79	194.06	206.81	-2677.67
Tunisia	136.37	142.62	2188.4	267.11	278.21	223.14
Benin	-56.63	-89.49	1358.05	-85.54	-137.34	1017.89
Burkina Faso	18.36	72.14	195.77	-19.41	6.06	-164.52
Cameroon	70.01	102.25	283.45	-32.65	-3.42	-1359.25
Cotedivore	203.65	221.83	1599.17	508	535.11	-315.38
Ghana	203.69	206.14	557.74	278.91	283.88	-1543.05
Guinea	-16.08	205.09	-34.76	-77.33	98.05	-479.08
Nigeria	223.9	228.14	10807.25	441.77	438.57	-40353.95
Senegal	346.26	359.53	-848.75	683.59	709.83	-5881.23
Togo	276.27	321.69	32.02	361.42	414.32	-277.44
Ethiopia	112.91	146.86	-75.8	156.66	191.17	-1925.78
Kenya	163.94	174.82	-183.02	251.03	273.4	-2086.21
Madagascar	19.04	19.19	38.75	54.55	54.41	-150.72
Malawi	44.95	49.27	83.44	111.83	119.41	-169.01
Mauritius	-1.58	-1.53	7.10	-0.58	-0.87	-329.99
Mozambique	19.15	35.19	70.44	21.84	33.09	-262.96
Rwanda	17.69	18.04	112.58	37.15	38.10	-154.06
Tanzania	135.69	216.61	1669.32	-76.32	-9.83	-5029.97
Uganda	105.27	107.93	81.65	231.01	241.43	-522.59
Zambia	158.08	160.88	349.14	603.03	609.06	281.46
Zimbabwe	-384.6	-384.38	12.71	-1525.3	-1524.87	-1438.05
Botswana	4.52	5.16	188.12	22.25	23.07	94.62
Namibia	74.76	78.51	135.89	231.45	243.07	65.07
South Africa	1902.91	1921.89	1203.78	5625.34	5657.58	-7944.72
Other Africa	1667.29	3241.85	4977.42	1523.47	2180.32	-18510.02
Total Africa	5591.61	10288.3	36160.86	10422.33	15087.03	-98472.1
World total	3502.47	7758.03	51430.91	-2775.26	-2509.07	-55372

Source: Model Simulation result

Table 4-9 column 1-5 inspects the main source of welfare gain for African countries when CFTA is combined with a reduction of customs delay. The result shows that for Egypt the main source of welfare gain is from technical efficiency ($1790 million) and endowment effect ($572 million). Besides, for Egypt, Morocco, Benin, Mauritius, Zambia, and Botswana, there is welfare loss from negative allocative efficiency. The negative allocative efficiency effect shows that trade is diverted from this region to another region due to tariff reduction. On the other hand, the large gain from endowment effect for most African countries shows that more unskilled labor is employed following the formation of free trade area and reduction of customs delay. An exception to this trend is Benin, which reports welfare loss from the endowment effect. For Zimbabwe, the welfare loss from terms of trade ($282 million) and investment saving balance ($254 million) outweighs the gain in welfare from allocative efficiency (96 million) and endowment effect (56 million) resulting in a net welfare loss. The result for Benin is surprising since the welfare gain is only from technical efficiency.

Table 4-10 column 1-5 investigates the reasons for changes in GDP using the expenditure approach. Most regions report an improvement in all component of GDP while there is a slight reduction in consumption of domestic commodities for Benin, Cameron, Mauritius, Tanzania, and Zimbabwe. For Benin, Mauritius, and Zimbabwe, the decline in GDP is mainly from a decline in consumption of a domestic commodity, although there is a trade surplus. Thus, there is potential for the change in production and consumption structure for these countries; more of production is exported than the base case, and more of consumption is imported following the reduction of import tariff and facilitation of trade. Whereas for Cameroon, and Tanzania, the trade deficit contributes to the decline in GDP. Moreover, table 4-10 column 4 and 5 shows that when CFTA is combined with customs delay reduction, there is an increase in both export and import for most African countries resulting in the trade deficit. An exception to this are Benin, Mauritius, Zimbabwe, Botswana, and Namibia, which report trade surplus.

Table 4-9. Welfare decomposition for CFTA with trade facilitation and NTMs (US$ million)

Region	Welfare Decomposition for CFTA+TFAGM					Welfare Decomposition for CFTA+NTM			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All.Eff	End.Eff	Tech.Eff	TOT	IS	All.Eff	End.Eff	TOT	IS
Egypt	-149.14	572.71	1790.17	236.87	181.54	8910.01	4207.64	-3217.94	-1257.72
Morocco	-185.75	164.55	0.00	85.70	31.42	2161.52	2135.77	-1055.75	-530.97
Tunisia	18.32	44.02	0.00	71.96	8.31	1780.62	1026.88	-516.34	-102.77
Benin	-35.4	-1.91	13.49	-13.64	-52.04	679.19	311.95	91.80	275.11
Burkina Faso	17.61	23.44	34.43	-14.86	11.51	117.09	51.39	-13.75	41.03
Cameroon	47.55	77.12	16.42	-34.69	-4.15	322.22	321.08	-253.97	-105.88
Cotedivore	65.26	31.53	7.33	146.53	-28.82	1015.32	705.45	-280.96	159.36
Ghana	41.66	95.78	0.00	39.93	28.77	411.66	626.52	-204.54	-275.90
Guinea	77.17	21.57	142.14	-6.18	-29.62	96.59	22.15	-41.36	-112.14
Nigeria	47.37	115.96	000	74.98	-10.17	6344.25	2288.31	-1147.38	3322.05
Senegal	57.41	88.20	0.00	106.71	107.21	707.99	505.97	-527.18	-1535.52
Togo	124.77	43.38	15.26	72.10	66.18	115.16	121.25	-39.37	-165.02
Ethiopia	33.64	80.39	18.98	16.49	-2.65	251.67	187.51	-189.11	-325.87
Kenya	59.42	64.60	0.00	21.13	29.67	349.14	334.16	-464.18	-402.14
Madagascar	0.95	10.18	0.00	7.23	0.83	25.13	62.12	-43.98	-4.51
Malawi	8.36	22.41	2.05	4.51	11.94	68.61	37.37	-13.55	-8.99
Mauritius	-0.14	0.48	0.00	-2.30	0.43	49.62	94.42	-89.56	-47.37
Mozambique	5.53	22.65	12.23	-6.53	1.31	30.51	106.76	-24.29	-42.54
Rwanda	6.47	9.59	0.00	1.54	0.44	57.02	61.98	-0.56	-5.87
Tanzania	52.99	157.50	42.06	-12.22	-23.72	1830.86	1782.57	-553.08	-1391.03
Uganda	30.30	46.42	0.00	26.94	4.27	44.96	100.7	-44.53	-19.48
Zambia	-16.42	245.62	0.00	5.11	-73.44	69.99	247.76	27.19	4.20
Zimbabwe	96.37	56.76	0.00	-282.86	-254.66	580.6	237.77	-299.21	-507.91
Botswana	-0.85	3.95	0.00	4.93	-2.87	18.32	133.20	22.49	14.09
Namibia	8.82	10.42	0.00	76.5	-17.23	32.11	73.81	20.46	9.52
South Africa	470.99	397.63	0.00	998.49	54.78	1968.73	1358.36	-1927.07	-196.3

Source: Model Simulation result

4.5.2.2. Continental Free Trade Area with Non-Tariff Measures

Table 4-8 column 3 and 6 show that when African countries establish CFTA and 50% of AVEs of NTMs are removed most African regions gain in terms of welfare and GDP (e.g., Tunisia, Benin, Zambia, Botswana, and Namibia) while others lose in both GDP and welfare (e.g., Guinea, Senegal, Ethiopia, and Kenya). As shown in appendix C.1, some countries have large NTMs. Hence, a 50% reduction of NTMs combined with free trade

area results in large welfare gain for countries with large non-tariff barriers (e.g., Egypt, Nigeria, Morocco, Tunisia, Cote de Ivoire, Tanzania, and South Africa). Overall, world welfare improves by $51430 million, but world GDP shrink by $55372 million. Comparing the three experiments, there is relatively large welfare gain when CFTA is combined with reductions of NTMs than with trade facilitation. An exception to this trend is Togo, and Uganda, which report large welfare gain with experiment 5 and six than experiment 7.

Table 4-10. GDP decomposition for CFTA with trade facilitation and NTMs (US$ million)

Region	GDP by component for CFTA+TFAGM					GDP by component for CFTA+ NTM				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Cons.	Invt.	Gov.	Export	Import	Cons.	Invt.	Gov.	Export	Import
Egypt	3408	1107	578	537	1502	-7107	2962	-634	15061	18861
Morocco	120	338	52	575	878	-2010	1258	-209	5573	7289
Tunisia	196	149	62	132	262	38	2171	326	2868	5179
Benin	-206	-26	-33	82	-45	1739	1973	322	-276	2739
Burkina Faso	7	30	5	70	106	-93	51	-19	208	313
Cameroon	-1	64	4	320	391	-926	41	-179	947	1242
Cotedivore	366	118	83	498	530	-227	398	12	1426	1925
Ghana	196	206	63	355	536	-1094	431	-268	1471	2083
Guinea	120	59	16	49	145	-488	17	-57	245	196
Nigeria	296	137	46	707	747	-27785	-4985	-3299	5979	10264
Senegal	657	369	148	87	551	-5429	-113	-1113	2412	1638
Togo	596	375	67	-41	582	-355	428	-36	231	545
Ethiopia	166	78	20	101	174	-1516	-323	-164	611	534
Kenya	234	148	59	199	366	-1750	-145	-390	1301	1102
Madagascar	45	12	5	17	25	-117	85	-13	191	296
Malawi	80	154	30	-25	119	-132	100	-36	60	160
Mauritius	-1	-1	0	6	5	-270	2	-41	178	199
Mozambique	23	12	4	54	59	-178	-1	-27	232	288
Rwanda	29	10	3	24	28	-114	-15	-10	84	99
Tanzania	-7	115	6	206	330	-3422	-549	-758	2240	2541
Uganda	176	74	24	123	155	-389	-37	-40	142	198
Zambia	280	371	103	366	511	136	245	56	148	304
Zimbabwe	-1452	-152	-268	967	620	-1368	-254	-239	1181	758
Botswana	10	6	4	12	9	40	91	25	126	187
Namibia	127	61	43	85	73	34	62	17	207	255
South Africa	3550	1439	1345	2197	2874	-4914	780	-1507	9874	12178

Source: Model Simulation result

Table 4-9 column 6-9 reports welfare effect by different component for experiment 7. The result shows that for countries with overall welfare gain, the gain in allocative efficiency and endowment effect dominates the welfare loss from terms of trade and investment saving balance. An exception to this trend is Benin, Zambia, Botswana, Namibia, and RSAC, which report welfare gain across all component of welfare decomposition. For Guinea, Senegal, Ethiopia, and Kenya, the welfare loss derives from the terms of trade effect and investment saving balance. The negative terms of trade effect for these countries result from lower import price (than export price), as the tariff is reduced from both from free trade area and NTMs. The negative investment-saving balance for Guinea, Senegal, Ethiopia, and Kenya, moves in line with the trade balance.

As shown in Table 4-10 column 6-10, the main source of loss in GDP for Senegal, Ethiopia, Kenya, and Zimbabwe are the decline in consumptions of the domestic commodity, investment, and government expenditure, although there is trade surplus. However, for another region, the trade deficit contributes to GDP loss besides the decline in consumption of the domestic commodity. The large decline in consumption of domestic commodity results from an increase in both export and import. Hence, more consumer goods are imported than a base year and more of production good is exported.

4.5.2.3. Continental Free Trade Area with both Trade Facilitation and Non-tariff Measures

In section 4.5.2.1 and 4.5.2.2, we evaluate the separate impact of reducing NTMs and customs delay with continental free trade area independently. However, in this section, a continental free trade area is combined with a 50% reduction of NTMs and a reduction of customs delay.

The result in table 4-11 indicates that most African countries welfare improves from combining trade facilitation and NTMs policy with the continental free trade area agenda. An exception to this trend is Senegal, Ethiopia, and Kenya, which report welfare and GDP loss. Egypt and Nigeria enjoy a relatively large welfare gain of $12499 million and $10817

million respectively. For Egypt, the welfare gain results from tariff removal, NTMs reduction, and trade facilitation while for Nigeria the gain is associated with both tariff and NTMs. Overall, combining trade facilitation and NTMs with continental free trade area improves African and world welfare by $42193 million and $56956 million respectively, although there is large reduction in world GDP by around $55203 million.

Table 4-11. Changes in Gross Domestic Product, Welfare, and Trade balance (US$ million)

Region	Changes in Welfare	Changes in GDP	Trade Balance
Egypt	12499.87	-3338.94	-4856.68
Morocco	2717.94	-2672.88	-1717.51
Tunisia	2194.45	231.77	-2314.9
Benin	1326.78	966.42	-2944.74
Burkina Faso	254.01	-137.63	-113.07
Cameroon	316.01	-1337.12	-305.29
Cotedivore	1623.02	-288.78	-501.5
Ghana	559.8	-1541.38	-611.52
Guinea	177.02	-334.73	-43.71
Nigeria	10817.52	-40354.7	-4281.96
Senegal	-825.49	-5843.23	756.05
Togo	62.19	-248.55	-359.29
Ethiopia	-41.24	-1895.79	67.09
Kenya	-175.11	-2072.33	193.97
Madagascar	38.95	-151.00	-105.49
Malawi	88.41	-161.01	-104.43
Mauritius	7.11	-330.64	-21.09
Mozambique	86.55	-252.35	-57.24
Rwanda	113.01	-153.13	-14.94
Tanzania	1836.06	-4914.70	-316.7
Uganda	83.39	-516.41	-57.61
Zambia	352.32	287.08	-156.79
Zimbabwe	12.89	-1438.12	422.63
Botswana	188.73	95.11	-60.42
Namibia	138.91	73.59	-47.97
South Africa	1217.61	-7942	-2309.64
Other Africa	6524.21	-17925.57	-6047.02
Africa Total	42193.14	-92197.00	-25909.77
World Total	56956.24	-55203.00	0.80

Source: Model Simulation result

Table 4-12 indicates that the main source of welfare loss for Senegal, Ethiopia, and Kenya are investment-saving balance and terms of trade effect, although there is gain from allocative efficiency and endowment effect. However, for other African countries, the gain in allocative efficiency, endowment effect, and technical efficiency outweighs the loss of welfare from terms of trade and investment-saving balance, resulting in a net welfare gain.

Table 4-12. Welfare and GDP decomposition for experiment 8 (US$ million)

Region	Welfare Decomposition					GDP Decomposition				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All.Eff	End.Eff	Tech.Eff	TOT	IS	Cons.	Invt.	Gov.	Export	Import
Egypt	9090.11	4949.54	2587.84	-3074.78	-1052.83	-2756	4157	117	14831	19688
Morocco	2162.43	2137.78	0.00	-1051.68	-530.81	-2006	1260	-208	5574	7293
Tunisia	1781.74	1028.26	0.00	-513.11	-102.45	44	2174	328	2868	5182
Benin	667.19	308.51	14.60	88.72	247.75	1659	1943	309	-263	2681
Burkina Faso	127.88	60.19	35.85	-15.47	45.56	-75	62	-12	217	330
Cameroon	328.89	330.84	17.95	-253.98	-107.68	-908	51	-174	956	1261
Cote d ivore	1022.48	709.34	9.42	-277.26	159.03	-208	404	17	1440	1941
Ghana	411.86	627.32	0.00	-203.65	-275.73	-1093	431	-267	1471	2083
Guinea	167.92	38.01	144.28	-35.94	-137.24	-321	66	-36	237	281
Nigeria	6346.81	2290.53	0.00	-1138.76	3318.9	-27785	-4989	-3298	5982	10264
Senegal	715.97	510.73	0.00	-523.57	-1528.63	-5392	-102	-1105	2412	1656
Togo	123.63	126.62	15.38	-35.66	-167.77	-312	454	-31	220	580
Ethiopia	257.73	196.82	20.06	-187.46	-328.4	-1489	-313	-161	608	541
Kenya	350.17	335.65	0.00	-461.07	-399.85	-1738	-141	-387	1303	1109
Madagascar	25.13	62.18	0.00	-43.85	-4.51	-117	85	-13	191	296
Malawi	69.14	38.22	2.22	-12.62	-8.55	-126	103	-33	57	162
Mauritius	49.60	94.42	0.00	-89.54	-47.37	-271	2	-41	178	199
Mozambique	31.41	111.25	12.33	-24.66	-43.78	-170	1	-26	233	290
Rwanda	57.12	62.16	0.00	-0.39	-5.88	-113	-15	-10	85	100
Tanzania	1864.38	1835.44	90.46	-549.73	-1404.49	-3340	-525	-733	2248	2565
Uganda	45.43	100.75	0.00	-43.42	-19.37	-384	-35	-39	144	202
Zambia	67.09	250.14	0.00	31.56	3.53	139	248	57	144	301
Zimbabwe	580.67	237.77	0.00	-299.2	-507.81	-1368	-254	-239	1181	758
Botswana	18.36	133.81	0.00	22.7	13.84	40	91	25	127	187
Namibia	32.47	74.29	0.00	23.38	8.78	39	64	19	210	258
South Africa	1969.93	1360.52	0.00	-1915.55	-197.33	-4911	779	-1505	9885	12190

Source: Model Simulation result

Although many countries benefited from liberalization in terms of welfare gain, there is large GDP loss. This is mainly due to large trade deficit resulting from the flood of imports following tariff reduction and facilitation of trade. Besides to trade deficit, the decline in consumption of domestic commodities also contributes to GDP loss. Hence, there is a change in the production and consumption pattern among African countries following trade liberalization. Table 4-12 column 6-10 indicates that the GDP loss for Egypt, Morocco, Nigeria, Senegal, Tanzania, and South Africa owes to large decrease in consumption of domestic commodities. Overall, Benin, Tunisia, Zambia, Botswana, and Namibia are the winning African countries in terms of gain in both GDP and welfare. Whereas, Senegal, Ethiopia, and Kenya are losing countries in terms of both welfare and GDP following the reduction of trade barriers.

4.5.3. Continental Customs Union

In CFTA experiments, we evaluate the full elimination of import tariff and subsidies among all African regions. However, the roadmap for the regional integration process in Africa, which came into effect in the Abuja Treaty,1994 specifies that a Continental Customs Union (CCU) will be established in 2 years after CFTA is agreed. Therefore, besides the formation of a free trade area among African countries, we assume that African countries harmonize their external tariff and set common external tariff (CET) on import from non-African regions. The CET is set at detail HS-6 level and differs across product level. As shown in table 4-13, we choose the two CET structures for CCU analysis; ECOWAS CET and COMESA CET. Then, countries under ECOWAS, UMA, ECCAS, and CEN-SAD regional trade group are assumed to adopt ECOWAS CET rate while countries under COMESA, SADC, EAC, and IGAD are assumed to adopt COMESA CET. [38]

The analysis of CCU has three main experiments. In experiment 9 (CCU), all African countries form a free trade area first; then common external tariff is imposed on imports from non-African regions. In experiment 10 (CCU-SEN), all African countries form free trade area, then common external tariff is imposed on imports from non-African regions, but 2% of sensitive products are excluded from CET rate calculation based on revenue loss

[38] The classification of countries under each group is provided in appendices C.5.

criteria. Most regional trade agreements in Africa moved from free trade area to customs union and signed the CET, but there is a challenge in implementing the rates due to significant revenue loss, and issues related to selecting sensitive products. Hence, around 101(2%) HS-6 code sectors with large revenue loss are excluded from the CET rate calculation. In experiment 11(CCU+TFGM), all African countries form free trade area first, then common external tariff is imposed on import from non-African regions plus customs delay is reduced by moving to geography mean in trade facilitation policies.

Table 4-13. Continental customs union CET rate classification

Regional Economic Integration	CET rate	Type of goods	Duty rate	No. of HS-6 code	Percentage
▪ ECOWAS ▪ UMA ▪ ECCAS ▪ CEN-SAD	ECOWAS CET	Essential Social Goods	0	125	2.47%
		Goods of primary necessity, raw materials, and specific inputs.	5	1884	37.32%
		Intermediate good	10	1081	21.41%
		Final consumption good	20	1840	36.45%
		Specific Goods for Economic Development	35	117	2.31%
		Total		5047	100%
▪ COMESA ▪ SADC ▪ EAC ▪ IGAD	COMESA CET	Raw materials as well as for capital goods[39]	0	2018	40.01%
			5	152	3.01%
		Intermediate goods	10	1496	29.66%
		Final goods	25	1377	27.30%
		Total		5043	100%

Source. Authors calculation using data from COMESA and ECOWAS.

The result in table 4-14 shows that some African countries gain in both welfare and GDP (e.g., Tunisia, Benin, Senegal, Togo, and Zambia) while Ethiopia, Kenya, Uganda, and Madagascar loses in terms of welfare and GDP across all experiments. For Morocco, Mozambique, Rwanda, Tanzania, and RSAC, there is welfare gain with the customs union, and when CCU is combined with trade facilitation policy, but the reduction of a sensitive product result in welfare losses. Further, Cote de Ivoire, Ghana, Nigeria, and Mauritius

[39] Some HS-6 code sectors have 5% of CET rate.

loses in terms of welfare, but gain in GDP across all experiments while the reverse is true for Cameroon.

Table 4-14. Changes in GDP and welfare for continental customs union (US$ million)

Region	Changes in Welfare			Changes in Gross Domestic Product		
	CCU	CCU-SEN	CCU+TFGM	CCU	CCU-SEN	CCU+TFGM
Egypt	1536.69	566.34	4125.53	-576.50	2336.02	2899.91
Morocco	16.26	-345.85	26.68	-814.70	834.08	-799.65
Tunisia	297.34	168.5	303.05	9.60	523.15	19.55
Benin	52.89	46.2	26.91	157.96	157.35	114.25
Burkina Faso	-38.86	-44.63	14.46	6.40	11.12	31.66
Cameroon	14.24	3.28	46.32	-290.39	-102.44	-261.13
Cotedivore	-125.53	-104.54	-106.46	78.67	165.87	108.72
Ghana	-34.53	-53.57	-32.06	178.04	376.38	183.09
Guinea	-23.47	-22.19	209.62	16.54	35.64	214.77
Nigeria	-422.97	-617.49	-421.42	987.53	2285.32	976.96
Senegal	3.18	43.59	20.84	65.32	158.61	99.78
Togo	33.36	52.41	82.73	62.20	100.68	119.26
Ethiopia	-140.61	-106.38	-107.40	-871.70	-669.31	-839.98
Kenya	-224.78	-190.86	-215.19	-983.65	-561.13	-964.78
Madagascar	-22.99	-20.35	-22.86	-160.22	-110.68	-160.42
Malawi	-2.08	11.90	2.34	-36.14	38.21	-28.46
Mauritius	-149.09	-133.30	-149.04	235.09	269.72	234.8
Mozambique	11.41	-5.59	27.35	11.18	52.78	22.32
Rwanda	11.66	-4.96	12.01	-47.31	-30.36	-46.37
Tanzania	37.16	-59.54	117.02	-471.43	-258.07	-408.18
Uganda	-17.04	-13.57	-14.56	-281.49	-149.26	-271.95
Zambia	74.44	46.10	77.14	89.87	115.16	95.13
Zimbabwe	62.59	33.76	63.35	-4.07	60.86	-2.38
Botswana	-12.51	-32.08	-11.96	-5.00	4.96	-4.43
Namibia	-0.64	-15.36	3.36	19.76	47.30	32.01
South Africa	-136.29	146.76	-115.27	544.86	3544.8	581.24
Other Africa	-747.86	-1010.92	811.32	-4437.91	-2377.44	-3836.02
Africa Total	51.97	-1662.34	4773.81	-6517.00	6859.32	-1890.00
China	155.78	-477.29	62.7	1986.82	326.88	1521.94
Japan	181.09	201.62	141.54	1450.18	1662.06	959.00
India	338.47	128.09	323.39	1501.46	955.83	1404.35
USA	795.61	531.25	677.12	4997.75	3611.00	3642.63
UK	-52.57	-156.54	-66.15	-547.32	-679.69	-697.88
EU27	-2632.62	-3238.7	-2794.33	-11162.5	-11380.00	-12277.00
ROW	575.24	-527.47	585.67	4272.75	1287.50	3563.25
World Total	-587.03	-5201.38	3703.61	-4018.00	2642.88	-3774.00

Source: Model Simulation result

Comparing CCU with CFTA, for some countries, both are welfare improving (e.g., Senegal, Togo, Nigeria, Mozambique, Ruanda, Tanzania, Zambia, Egypt, Morocco, and Tunisia) while for others only CFTA result in welfare gain (e.g., Cote de Ivoire, Ghana, Burkina Faso, Guinea, Ethiopia, Kenya, Madagascar, Malawi, Uganda, Botswana, Namibia, and South Africa). For Zimbabwe and Benin, CFTA is not welfare improving, but moving to customs union result in welfare gain. Mauritius is the only country that loses in both CFTA and CCU experiments.

Table 4-14 indicates that most non-African regions benefit in terms of both welfare and GDP from customs union (e.g., Japan, India, and the USA) while UK and EU-27 lose in terms of both welfare and GDP across all customs union experiments. This is due to trade diversion from EU member countries towards other non-African regions. China and ROW also gain in terms of welfare and GDP, but they are exceptional in that their welfare reduces when sensitive products are removed from the CCU experiment. Overall, moving from CFTA to CCU reduces world welfare with /without sensitive products, but when CCU is combined with trade facilitation policy both African and world welfare improves by $4773 million, and $3703 million respectively. The large decrease in world welfare comes from EU-27 across all experiments.

Table 4-15 and 4-16 show the decomposition of welfare and GDP by different component for CCU and CCU+TFGM experiments. The result indicates that, for Benin, Burkina Faso, Cote de Ivoire, Ghana, Nigeria, Senegal, Mauritius, and South Africa, there is a loss in welfare due to allocative efficiency and endowment effect in both experiments. The loss from allocative efficiency for these region implies that there is trade diversion from these regions to others, which can be seen from table 4-16 as both export and import reduces in both experiments. Moreover, the loss from the endowment effect also reveals that there is unemployment in the unskilled labor force following tariff reduction, which may result from the trade diversion effect. For Morocco and Tunisia, there is welfare loss from endowment effect, but the gain in welfare from allocative efficiency, terms of trade and investment-saving balance outweighs the loss; Botswana and Namibia have similar result, but they are exceptional in that the former has loss from both terms of trade and

investment-saving balance while the latter has loss from investment-saving balance. Overall, allocative efficiency of the world, as well as Africa, improves by $487.08 million, and $100 million for CCU+TFGM and CCU experiments respectively, which shows that CCU has an overall trade creating the effect, although significant trade is diverted from EU-27 to other regions.

Table 4-15. Welfare decomposition for continental customs union experiments (US$ million)

Region	Welfare Decomposition for CCU+TFGM					Welfare Decomposition for CCU			
	All.Eff	End.Eff	Tech.Eff	TOT	IS	All.Eff	End.Eff	TOT	IS
Egypt	1174.07	1351.55	1802.70	-176.76	-26.03	1105.42	859.40	-284.36	-143.77
Morocco	169.68	-362.87	0.00	12.98	206.89	170.16	-366.49	6.56	206.03
Tunisia	273.59	-109.88	0.00	95.10	44.19	272.92	-111.28	91.76	43.93
Benin	-55.9	-18.30	13.47	3.50	84.14	-42.43	-16.97	7.73	104.56
Burkina Faso	-12.64	-2.72	34.57	-0.33	-4.41	-20.88	-11.06	2.16	-9.09
Cameroon	44.28	55.00	16.63	-47.33	-22.26	37.64	45.84	-48.02	-21.23
Cotedivore	-65.92	-71.61	7.57	47.83	-24.33	-70.51	-73.76	42.38	-23.64
Ghana	-29.56	-106.94	0.00	29.55	74.89	-30.41	-107.76	29.15	74.48
Guinea	44.92	12.85	141.24	11.48	-0.87	-43.13	-3.95	7.80	15.8
Nigeria	-164.38	-140.35	0.00	18.61	-135.30	-162.97	-141.81	15.20	-133.39
Senegal	-10.75	-15.24	0.00	17.98	28.85	-13.92	-18.80	12.58	23.32
Togo	10.67	-0.74	15.99	20.51	36.30	-5.73	-7.72	13.85	32.96
Ethiopia	1.71	85.36	19.06	-82.94	-130.58	-3.97	76.49	-84.66	-128.48
Kenya	97.08	68.59	0.00	-191.66	-189.20	95.79	66.91	-195.4	-192.08
Madagascar	-20.72	34.62	0.00	-33.85	-2.91	-20.72	34.55	-33.92	-2.91
Malawi	5.13	1.91	2.04	-4.92	-1.84	4.78	1.13	-5.69	-2.31
Mauritius	-78.68	-207.10	0.00	91.41	45.34	-78.68	-207.11	91.38	45.32
Mozambique	4.50	18.45	12.25	-4.99	-2.85	3.58	14.01	-4.47	-1.70
Rwanda	7.56	6.05	0.00	-0.33	-1.28	7.55	5.90	-0.51	-1.28
Tanzania	108.55	129.59	42.35	-88.08	-75.40	94.99	103.72	-91.38	-70.16
Uganda	7.24	19.51	0.00	-33.48	-7.83	6.37	19.50	-34.88	-8.03
Zambia	22.34	61.87	0.00	-2.27	-4.80	29.06	58.53	-8.95	-4.20
Zimbabwe	84.44	24.67	0.00	-26.54	-19.15	84.14	24.71	-26.72	-19.47
Botswana	0.38	-3.90	0.00	-3.71	-4.73	0.31	-4.49	-3.81	-4.51
Namibia	1.39	-10.01	0.00	16.30	-4.33	0.87	-10.48	12.30	-3.33
South Africa	-62.55	-352.62	0.00	261.33	38.57	-61.09	-357.59	243.17	39.22
Africa Total	798.14	109.9	3106.52	-389.50	1148.76	346.23	-682.76	-524.29	912.84
World Total	487.08	109.9	3106.52	-19.19	19.31	100.85	-682.76	-19.10	13.99

Source: Model Simulation result

The result in table 4-16 shows that the gain in GDP attributes to trade surplus and an increase in consumption of domestic commodity for Benin, Senegal, Namibia, South Africa,

and Burkina Faso while for Togo and zamia there are large trade deficit but the increase in consumption of domestic commodity outweighs the deficit across all experiments. Egypt, Cameron, and Togo enjoy large welfare gain, but there is a trade deficit across all experiments. However, Tunisia, Benin, Senegal enjoys the large gain in terms of welfare, GDP, and trade surplus. Cote di Ivoire, Ghana, Nigeria, Ethiopia, Kenya, and Botswana lose in terms of welfare, but they report trade surplus across all experiments. The loss in GDP for Ethiopia and Kenya attributes to a large decrease in consumption of a domestic commodity, and some extent to a decrease in investment and government expenditure

Table 4-16. GDP decomposition for continental customs union experiments (US$ million)

Region	GDP decomposition for CFTA+TFAGM					GDP decomposition for CFTA+ NTM				
	Cons.	Invt.	Gov.	Export	Import	Cons.	Invt.	Gov.C	Export	Import
Egypt	-453	483	-8	1452	-2051	2437	1350	488	1323	-2698
Morocco	-879	-2379	-121	-440	3004	-868	-2369	-117	-436	2991
Tunisia	-142	-781	45	-408	1295	-134	-776	47	-407	1290
Benin	219	-157	32	-48	112	154	-189	22	-31	160
Burkina Faso	1	-12	-1	-29	47	18	-1	5	-19	28
Cameroon	-191	12	-42	138	-208	-168	24	-37	148	-228
Cotedivore	52	-40	6	-177	238	73	-32	11	-160	217
Ghana	98	-169	34	-145	360	101	-168	35	-145	360
Guinea	12	-16	1	-61	80	238	46	30	-35	-64
Nigeria	649	153	79	-319	426	642	148	78	-318	427
Senegal	54	-39	11	-14	54	85	-23	18	-15	35
Togo	84	-10	9	-21	0	167	40	19	-43	-64
Ethiopia	-692	-118	-77	224	-209	-664	-108	-73	221	-216
Kenya	-818	-141	-192	486	-318	-802	-135	-188	489	-328
Madagascar	-129	33	-16	111	-159	-129	33	-16	111	-159
Malawi	-27	9	-9	-1	-8	-21	12	-7	-3	-10
Mauritius	182	-148	27	-466	640	182	-149	27	-466	640
Mozambique	9	11	1	11	-21	18	12	3	13	-24
Rwanda	-35	-5	-4	18	-21	-34	-5	-4	18	-21
Tanzania	-315	-4	-81	267	-339	-269	19	-67	272	-362
Uganda	-207	-46	-25	79	-83	-200	-43	-24	83	-88
Zambia	43	72	17	-11	-31	46	76	18	-16	-29
Zimbabwe	-4	-8	1	73	-66	-2	-8	1	72	-66
Botswana	-6	-21	-1	-4	27	-6	-21	-1	-4	27
Namibia	10	-14	3	2	19	17	-11	5	7	14
South Africa	219	-656	69	-2219	3132	245	-647	78	-2191	3096

Source: Model Simulation result

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4.6. Conclusion

In this chapter, we evaluate the impact of African free trade area on the economies of African countries using GTAP CGE model. Three trade liberalization policies namely tariff, non-tariff measures and trade facilitation policies are evaluated in terms of their impact on welfare and macroeconomic of the member countries. For trade facilitation analysis, I use an econometric estimated customs clearance time on trade facilitation policies. The nobility in using the econometric estimation is that they tell us which specific trade facilitation policy is responsible for the reduction of customs delay. Unlike previous studies, this study provides an additional two trade facilitation scenarios; geography means and income means. Moreover, the analysis on NTMs is based on econometric estimates of AVEs of NTMs by kee.et.al (2009).

Trade facilitation has large welfare and trade gain for most African countries. The gain in trade facilitation is higher when countries move to best practice than geography and income mean. The main source of welfare gain for trade facilitation experiment is an increase in technical efficiency of production. The estimation result signifies that countries with poor trade facilitation policy would benefit more from the reduction of customs delay and report large welfare and trade gain. Moreover, the gap between countries exporting and importing time is also an important factor in determining the impacts of reducing customs delay across countries. Similarly, reduction of NTMs by 50% results in large welfare and trade gain, but significant GDP loss across African countries. Besides, welfare gain from the reduction of NTMs is higher for countries with relatively large NTMs. Both trade facilitation and reduction of NTMs improve welfare and intra-Africa trade. However, the analysis does not take in to account the cost of trade facilitation and costs associated with harmonization of international standards. Therefore, this analysis provides only the benefits of trade facilitation and reduction of NTMs.

Most African countries gain in terms of welfare and GDP with continental free trade area while Benin, Guinea, Mauritius, and Zimbabwe lose in both welfare and GDP. However, combining free trade area with a reduction of customs delay and NTMs result in

large welfare and GDP gain than tariff removal only. Egypt and South Africa enjoy the highest welfare gain when African free trade area is formed, and customs delay is reduced by moving to geography mean. Similarly, when CFTA is complimented with 50% reduction of NTMs, Tunisia, Benin, Zambia, Botswana, and Namibia gain in terms of welfare and GDP while some lose in both GDP and welfare (e.g., Guinea, Senegal, Ethiopia, and Kenya). Finally, combining trade facilitation and NTMs policy together with continental free trade result in large welfare and GDP gain for most African countries. An exception to this trend is Senegal, Ethiopia, and Kenya, which report welfare and GDP loss. Egypt and Nigeria enjoy a relatively large welfare gain of $12499 million and $10817 million respectively.

This chapter also evaluates the impact of the continental customs union as African countries are planning to move to customs union once CFTA is finalized. The result shows that some African countries gain in both welfare and GDP (e.g., Tunisia, Benin, Senegal, Togo, and Zambia) while Ethiopia, Kenya, Uganda, and Madagascar loses in terms of welfare and GDP across all experiments. Comparing CCU with CFTA, for some countries, both are welfare improving (e.g., Senegal, Togo, Nigeria, Mozambique, Ruanda, Tanzania, Zambia, Egypt, Morocco, and Tunisia) while for others only CFTA result in welfare gain (e.g., Cote de Ivoire, Ghana, Burkina Faso, Guinea, Ethiopia, Kenya, Madagascar, Malawi, Uganda, Botswana, Namibia, and South Africa). For Zimbabwe and Benin, CFTA is not welfare improving, but moving to customs union result in welfare gain. Mauritius is the only country that loses in both CFTA and CCU experiments.

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Chapter 5

5. Conclusion

5.1. Main finding and Policy Implication

The Abuja treaty in 1991 identifies eight regional trade communities as a building block regional trade for the establishment of African Economic Commission (AEC); ECOWAS, CEN-SAD, ECCAS, UMA, COMESA, SADC, EAC, and IGAD. The roadmap of regional economic integration highlights that the eight regional economic communities should first liberalize their trade by reducing tariff and non-tariff barriers then determine the timetable for the gradual liberalization of regional and intra-community trade, and harmonizing customs duties visà-vis other states.

COMESA as one of building block regional trade community is a free trade area and customs union and Ethiopia is currently negotiating to join the COMESA free trade area. Hence, chapter two lays entirely on trade liberalization among COMESA countries using three alternative regional trade arrangements; Ethiopia-COMESA FTA, COMESA customs union and the EPA. The simulation results indicated that most COMESA regions win in terms of GDP and welfare with full FTA among all COMESA regions. Ethiopia's welfare improves by $22 million by joining the COMESA free trade area but loses with a customs union, and EPA. The result further shows that, for the customs union and EPA experiments, there is a mixed result; some regions lose and some gain depending on the scope of tariff reduction and the initial tariff rate. Rwanda, Zambia, and RSCA emerge as the biggest winners in terms of welfare in all experiments. Overall, the world as a whole enjoys welfare gains under the COMESA FTA and EPA scenarios, even though world GDP declined slightly. Another impressive result from our analysis concerns its implications for trade patterns in the regional bloc. The results indicate that there is more trade in a full free trade area among all COMESA member states and that there is a significant improvement in their

exports and imports. Similarly, in the customs union and EPA experiments, we observe significant improvements in the exports and imports of most COMESA regions, but some regions, such as Egypt, Mauritius, RNA, and RSAC, report a substantial reduction in their exports and imports. We also examine the sectoral level effect of alternative trade liberalization policies for Ethiopia. The overall result shows that grains, oilseeds, forestry and fishery, and leather are the winning sectors, reporting trade surpluses across all experiments, while beverages and tobacco, textiles and apparel, and fabricated metal equipment are losing sectors, having trade deficits across all experiments. The aggregate trade balance improves more for Ethiopia under a customs union and the EPA than under an FTA, but there is significant revenue loss under a customs union and the EPA. Also, there is a substantial loss in terms of welfare and GDP under the customs union and the EPA. The analysis in chapter 2 focuses on the reduction of tariff barriers, but regional trade agreements agendas are beyond tariff barriers and include reductions of both non-tariff measures and customs delay. Hence, in chapter three, we estimate the impact of trade facilitation policies on time to trade.

Chapter 3 analyses the impact of trade facilitation policies on customs clearance time. We use an econometric model to estimate the impact of trade facilitation policies on customs clearance time. The simulation results are then used to calculate a counterfactual analysis when the countries move to best practice, geography, and income mean in trade facilitation policies. Further, we use the GTAP CGE model to analyze the welfare and macroeconomic impact of trade facilitation policies. The estimated result indicates that Fees & Charges, formality-document and advance rulings have statistically significant coefficients with the expected sign while other policy variables are insignificant, and they often carried the wrong sign, indicating they were a poor fit in our model. The estimation result suggests that both formality documents, and fees and charges have a significant impact on export and import clearance time for documentary compliance, while only formality document significantly reduces border-related compliance. Besides, advance rulings have also a significant effect on export clearance time for documentary compliance. The counterfactual analysis shows that there is a significant reduction in customs delay

with best practice than with geography and income mean. Moreover, comparing across income group, low-income countries with large customs efficiency reports a large reduction in customs delay. The CGE result indicates that there is a large gain regarding welfare and GDP of middle and low-income regions following the reduction of customs delay. For high-income countries, there is no reduction of customs delay, but they still benefit from their export to other regions. Overall, the world welfare improves by around $55 billion, $3 billion, and $6 billion for best practice, geography, and income mean scenarios respectively.

Chapter 4 combines three trade liberalization policies; tariff, non-tariff measures, and trade facilitation policies. In this chapter, African countries establish a continental free trade area and customs union. Moreover, customs delay is reduced using trade facilitation policy, and 50% of AVEs of non-tariff measures are reduced through harmonization of standards across countries. The result indicates that African countries enjoy large welfare gain following reduction of customs delay through facilitating trade. The gain in trade facilitation is higher when countries move to best practice than geography and income mean. Besides, there is also a large benefit for African countries with poor trade facilitation policy as they move to best practice, geography or income mean in the area of formality-documents. Moreover, the gap between countries exporting and importing time is an essential factor in determining the impacts of reducing customs delay across countries. Similarly, reduction of NTMs by 50% results in large welfare and trade gain, but significant GDP loss across African countries. Both trade facilitation and reduction of NTMs improve welfare and intra-Africa trade. However, the analysis does not take in to account the cost of trade facilitation and costs associated with harmonization of international standards. Therefore, this analysis provides only the benefits of trade facilitation and reduction of NTMs.

Most African countries benefit from continental free trade area, but Benin, Guinea, Mauritius, and Zimbabwe lose in both welfare and GDP. Moreover, combining a free trade area with a reduction of customs delay and NTMs result in significant welfare and GDP gain than tariff removal only. Egypt and South Africa enjoy the highest welfare gain when African free trade area is formed, and customs delay is reduced by moving to geography

mean. Similarly, when continental free trade area is combined with 50% reduction of NTMs, Tunisia, Benin, Zambia, Botswana, and Namibia gain in terms of welfare and GDP while some lose in both GDP and welfare (e.g., Guinea, Senegal, Ethiopia, and Kenya). Again, combining both trade facilitation and NTMs policy with continental free trade result in large welfare and GDP gain for most African countries. An exception to this trend is Senegal, Ethiopia, and Kenya, which report welfare and GDP loss. Finally, the analysis on continental customs union shows that some African countries gain in both welfare and GDP (e.g., Tunisia, Benin, Senegal, Togo, and Zambia) while Ethiopia, Kenya, Uganda, and Madagascar loses in terms of welfare and GDP across all customs union experiments. Comparing CCU with CFTA, for some countries, both are welfare improving (e.g., Senegal, Togo, Nigeria, Mozambique, Ruanda, Tanzania, Zambia, Egypt, Morocco, and Tunisia) while for others only CFTA result in welfare gain (e.g., Cote de Ivoire, Ghana, Burkina Faso, Guinea, Ethiopia, Kenya, Madagascar, Malawi, Uganda, Botswana, Namibia, and South Africa). For Zimbabwe and Benin, CFTA is not welfare improving, but moving to customs union result in welfare gain; Mauritius is exceptional in that it loses in both CFTA and CCU experiments.

A central policy implication arises from the analysis: tariff reduction only does not give the desired benefit from trade liberalization. Hence, to benefit from international trade and boost intra-Africa trade, African countries should reduce their customs delay through adopting trade facilitation policies, and remove non-tariff measures through harmonization of standards on TBT and SPS. There are several trade facilitation policies designed to eliminate border frictions, but more focus should on the area of formality-documents (simplification and harmonization of documents), fees and charges, and advance rulings.

The position of African countries across the three trade facilitation policies in comparison with best practice, geography mean and income mean differ one another. However, based on our observation from the descriptive statistics, we recommend the following specific area for action. For advance rulings, improving the availability of information on advance rulings, publishing the average issuance time for advance rulings, and publically availability of advance rulings of general interest should get more focus. For

formalities-documents, the focus should be on expanding the acceptance of copies of documents and comply with international standards of documents. For fees and charges, the focus should be on improving the availability of information on their website related to fees and charges, reducing the number and diversity of fees and charges collected, and reducing service fee charge during regular working hours.

5.2. Direction for future research

The overall goal of this dissertation is to provide an in-depth analysis of topical aspects related to the regional economic integration in Africa. All our findings are based on the GTAP CGE model and econometric model for trade facilitation policies. The GTAP CGE model is an appropriate tool to provide answers to the different research questions mentioned in this thesis. Building upon this analysis, several aspects of trade liberalization policies could be explored further. First, the trade negotiation agenda in Africa includes issues beyond tariff and non-tariff measures such as free movement of people and factors of production; creation of a single domestic market and Pan-African Economic and Monetary Union. Therefore, further empirical research focusing on deep regional economic integration would facilitate trade negotiation among African countries. Second, due to data limitation, most African countries do not have an estimate of NTMs. For this thesis, we use econometric estimates of AVEs of NTMs by Kee.et.al (2009) that include 23 African countries. Further research covering more African countries and many aspects of NTMs would help to analyze many countries. Similarly, the econometric estimation in chapter 3 includes 104 countries, but most of them do not have full data on trade facilitation indicators. Therefore, further research using more updated data in terms of country and data coverage would help to provide a result for many other policies.

Appendixes

A. Appendix Chapter 2

Appendix A.1. Regional aggregation

No.	Aggregated Region	GTAP Regions
1	Ethiopia	Ethiopia
2	Egypt	Egypt
3	Kenya	Kenya
4	Malawi	Malawi
5	Madagascar	Madagascar
6	Mauritius	Mauritius
7	Rwanda	Rwanda
8	Uganda	Uganda
9	Zambia	Zambia
10	Zimbabwe	Zimbabwe
11	Libya, Algeria, Western Sahara	Rest of North Africa
12	Swaziland, Lesotho	Rest of South African Customs Union.
13	Eritrea, Seychelles, Burundi, Comoros, Djibouti, Sudan, Somalia, Mayotte	Rest of Eastern Africa
14	D.R. Congo, Angola	South Central Africa
15	European Union	Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Bulgaria, Croatia, Romania.
16	USA	United States
17	Rest of Africa	All African regions outside COMESA
18	ROW	All other regions

(Source) GTAP 9 Database

Appendix A.2. Sectoral Aggregation

No.	New Codes	Sector Description	GTAP sectors
1	Grains	Grains	pdr, wht, gro.
2	VegetablFrut	Vegetable and Fruit	v_f
3	Oilseed	Oilseed	osd
4	Othcrops	Other crops	c_b, pfb, ocr
5	Livestock	Livestock	ctl, oap, rmk, wol
6	ForestFisher	Forestry & Fishery	frs, fsh.
7	CoalOilGas	Coal, Oil, and Gas	coa, oil, gas, omn
8	FoodMnfcs	Food manufacturing	cmt, omt, vol, mil, pcr, sgr, ofd
9	BeverTobaco	Beverage and Tobacco	b_t
10	TextileAppar	Textile & wearing Apparel	tex, wap
11	Leather	Leather	lea
12	WoodPaper	Wood Paper	lum, ppp
13	PetroChemica	Petroleum & Chemical	p_c, crp, nmm
14	BasicMetals	Basic metals	i_s, nfm
15	FabMetalEqu	Fabric metal Equipment	fmp, otn, ele, ome
16	MotorVehpar	Motor vehicle part	mvh
17	OtherMnfcs	Other manufacturing	omf
18	Services	Services	ely, gdt, wtr, cns, trd, otp, wtp, atp, cmn, ofi, isr, obs, ros, osg, dwe.

(Source) GTAP 9 Data Base

B. Appendix Chapter 3

Appendix B.1. Econometric model result with all TFI variables.

Variable	logTEDC	logTEBC	logTIDC	logTIBC
logsqkm	0.345***	0.266***	0.405***	0.311***
	(-0.0715)	(-0.0789)	(-0.0977)	(-0.0911)
landlocked		-0.418		-0.43
		(-0.259)		(-0.279)
Information	0.00753	0.0215	0.383	0.638
	(-0.315)	(-0.334)	(-0.455)	(-0.446)
Involvement	0.379	0.0311	0.0633	0.0917
	(-0.389)	(-0.317)	(-0.443)	(-0.317)
Advance rulings	-0.361*	-0.305	0.0684	-0.111
	(-0.209)	(-0.237)	(-0.357)	(-0.311)
Appeal procedures	-0.466	-0.43	-0.668	-0.413
	(-0.346)	(-0.282)	(-0.455)	(-0.376)
Fees and charges	-0.866**	0.15	-0.928*	-0.228
	(-0.388)	(-0.38)	(-0.521)	(-0.45)
Formality documents	-0.835***	-0.491*	-0.694*	-0.899***
	(-0.289)	(-0.264)	(-0.36)	(-0.266)
Formality-automation	-0.407	-0.0427	-0.00328	0.303
	(-0.364)	(-0.357)	(-0.447)	(-0.331)
Formality-procedures	0.357	0.16	0.285	0.724
	(-0.658)	(-0.574)	(-0.696)	(-0.64)
Cooperation-internal	-0.0372	0.0206	0.127	0.104
	(-0.218)	(-0.218)	(-0.244)	(-0.211)
Cooperation-external	-0.00803	0.0351	-0.126	-0.105
	(-0.172)	(-0.151)	(-0.226)	(-0.237)
Governance and impartiality	-0.0452	-0.307	-0.526	-0.937**
	(-0.407)	(-0.361)	(-0.479)	(-0.363)
_cons	1.963*	1.96	1	1.008
	(-1.004)	(-1.291)	(-1.51)	(-1.568)
N	71	71	71	71
r2	0.529	0.359	0.401	0.365
F	7.147	2.769	5.023	3.228

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Source: Model estimation

Appendix B.2. Regional aggregation mappings

Short code	Long description	Mapping to GTAP Regions
HIEU	High income European Union	Austria; Belgium; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Poland; Portugal; Slovakia; Slovenia; Spain; Sweden; United Kingdom; Croatia.
HICA	High income Central Asia	Switzerland; Norway; Turkey.
HIAP	High-income Asia Pacific	Australia; New Zealand; Hong Kong; Japan; Korea; Taiwan; Singapore.
HILA	High income Latin America	Canada; United States of America; Mexico; Chile; Uruguay.
HIMENA	High income MENA	Bahrain; Israel; Kuwait; Oman; Qatar; Saudi Arabia; United Arab Emirates.
UMIEU	Upper middle income European Union	Bulgaria; Romania.
UMICA	Upper middle income Central Asia	Albania; Belarus; Russian Federation; Rest of Europe; Kazakhstan; Azerbaijan; Georgia.
UMIAP	Upper middle income Asia pacific	China; Malaysia; Thailand.
UMILA	Upper middle income Latin America	Argentina; Brazil; Colombia; Ecuador; Paraguay; Peru; Venezuela; Rest of South America; Costa Rica; Panama; Rest of Central America; Caribbean.
UMIMENA	Upper-middle-income MENA	Iran Islamic Republic of; Rest of Western Asia; Rest of North Africa.
UMISSA	Upper middle income Sub Saharan Africa	Mauritius; Botswana; Namibia; South Africa.
LMICA	Lower middle income Central Asia	Ukraine; Rest of Eastern Europe; Kyrgyzstan; Rest of Former Soviet Union; Armenia.
LMIAP	Lower-middle-income Asia Pacific	Rest of Oceania; Mongolia; Cambodia; Indonesia; Lao People's Democratic Republic; Philippines; Viet Nam; Rest of Southeast Asia; Bangladesh; India; Pakistan; Sri Lanka; Rest of South Asia.
LMILA	Lower middle income Latin America	Bolivia; Guatemala; Honduras; Nicaragua; El Salvador.
LMIMENA	Lower middle income MENA	Egypt; Morocco; Tunisia.
LMISSA	Lower middle income Sub Saharan Africa	Cameroon; Cote d'Ivoire; Ghana; Nigeria; Kenya; Zambia; Rest of South African Customs.
LIAP	Low-income Asia Pacific	Nepal.
LISSA	Low Income Sub Saharan Africa	Benin; Burkina Faso; Guinea; Senegal; Togo; Rest of Western Africa; Central Africa; South Central Africa; Ethiopia; Madagascar; Malawi; Mozambique; Rwanda; Tanzania; Uganda; Zimbabwe; Rest of Eastern Africa.
ROW	ROW	Rest of East Asia; Rest of North America; Rest of EFTA; Rest of the World.

Source: Authors aggregation using GTAP 8.1 database.

Appendix B.3. Sectoral Aggregation Mappings

Code	Long name	Mapping to GTAP Sectors
Agriculture	Agriculture	Paddy rice; Wheat; Cereal grains nec; Vegetables, fruit, nuts; Oil seeds; Sugar cane, sugar beet; Plant-based fibers; Crops nec; Raw milk; Wool, silk-worm cocoons; Forestry; Fishing.
LiveAnimal	Live Animal	Cattle, sheep, goats, horses; Animal products nec.
MinExtract	Mining and Extraction	Minerals nec; Petroleum, coal products; Mineral products nec.
CoalOilGas	Coal, Oil and Gas	Coal; Oil; Gas.
Procfood	Processed Food	Meat: cattle ,sheep, goats, horse; Meat products nec; Vegetable oils and fats; Dairy products; Processed rice; Sugar; Food products nec; Beverages and tobacco products; Textiles; Wearing apparel.
LightMnfc	Light Manufacturing	Leather products; Wood products; Paper products, publishing; Transport equipment nec; Manufactures nec.
HeavyMnfc	Heavy Manufacturing	Chemical, rubber, plastic prods; Ferrous metals; Metals nec; Metal products; Motor vehicles and parts; Electronic equipment; Machinery and equipment nec.
Service	Services	Electricity; Gas manufacture, distribution; Water; Construction; Trade; Transport nec; Sea transport; Air transport; Communication; Financial services nec; Insurance; Business services nec; Recreation and other services; PubAdmin/Defence/Health/Educat; Dwellings.

Source: Authors aggregation using GTAP 8.1 database

C. Appendix Chapter 4

Appendix C.1. Ad valorem equivalent of NTMs (Percentage)

Regions	Agriculture	Manufacturing	Service
Burkina Faso	19.04	1	0
Cotedivore	66.47	17.47	10.7
Cameroon	11.67	2.01	0
Algeria	51.49	30.43	
Egypt	44.66	29.51	0
Ethiopia	0	2.45	0
Gabon	0	0.09	
Ghana	15.38	1.23	0
Kenya	0.77	0.33	0
Morocco	40.82	5.38	0
Madagascar	0	1.45	
Mali	16.01	1.93	
Mauritius	27.64	4.22	
Malawi	31.08	0.47	0
Nigeria	60.04	33.22	5.57
Rwanda	0	6.58	0
Sudan	41.43	38.37	0
Senegal	34.21	35.29	10.68
Tunisia	38.6	10.04	
Tanzania	30.98	50.32	10.35
Uganda	0.74	0	0
South Africa	3.28	0.96	0
Zambia	12.58	0	0

Source: Authors aggregation using Kee.et.al (2009) data

Appendix C.2. Reported and simulated time to export and import for border and documentary compliance (days)

		Reported time to export		Reported time to import		Estimated time to export with best practice		Estimated time to import with best practice	
No.	Regions	DC	BC	DC	BC	DC	BC	DC	BC
1	Egypt	3.67	2	8	5	0.42	0.84	1.34	1.43
2	Morocco	1.13	0.79	1.21	5.5	0.21	0.51	0.36	2.94
3	Tunisia	0.13	4.08	1.13	5.33	0.04	2.65	0.51	2.85
4	RNA	6.21	4.92	10.38	13.63	1.36	3.19	2.55	7.28
5	Benin	4.5	5.75	5.46	6.42	0.75	3.73	1.65	3.43
6	Burkina Faso	3.5	3.13	4	4.25	0.51	1.63	1.05	1.66
7	Cameroon	2.75	8.42	6.79	11.29	0.65	5.46	2.05	6.03
8	Cotedivore	5	4.58	6.71	5.21	0.85	2.98	1.65	2.78
9	Ghana	3.71	4.5	22.75	3.71	0.66	3.63	7.49	2.71
10	Guinea	5.79	3	6.5	3.79	0	0	0	0
11	Nigeria	5.47	5.64	7.2	11.82	1.02	4.55	2.49	8.64
12	Senegal	1.08	2.54	3	2.21	0.5	2.05	1.65	1.61
13	Togo	0.63	3.13	8.46	11.13	0.1	2.03	2.55	5.94
14	RWA	3.05	3.21	4.42	6	0.5	2.15	1.46	3.52
15	CentralAfri	5	11.5	7.06	10.5	1.67	6.02	2.06	4.24
16	RSCA	9.85	13.19	7.84	12.85	1.32	8.33	1.96	6.3
17	Ethiopia	3.79	2.38	8.71	8.46	0.83	1.54	3.22	4.52
18	Kenya	0.79	1.17	3.5	7.5	0.2	0.94	1.41	5.48
19	Madagascar	2.46	3.92	4.33	5.38	0.63	3.16	1.75	3.93
20	Malawi	3.46	3.54	2.63	2.67	0.51	2.3	0.79	1.42
21	Mauritius	0.38	2	0.38	2.13	0.13	1.61	0.19	1.55
22	Mozambique	2.92	3.25	1	0.58	0.41	1.7	0.28	0.23
23	Rwanda	1.75	4.04	2	0.92	0.38	3.26	0.81	0.67
24	Tanzania	5	4	11	16.75	0.72	2.6	2.44	8.95
25	Uganda	2.67	3.54	5.75	6.42	0.47	2.85	1.89	4.69
26	Zambia	3	3.25	3.17	3.38	0.52	2.62	1.04	2.47
27	Zimbabwe	4.13	3.08	3.38	2.5	1.35	2.48	1.67	1.83
28	REA	7.7	6.61	5.32	5.81	0.02	4.27	0.11	3.07
29	Botswana	1	0.33	0.13	0.17	0.3	0.27	0.08	0.12
30	Namibia	3.75	5	0.13	0.25	0.91	4.03	0.06	0.18
31	South Africa	2.83	4.17	1.5	6	1.26	3.36	0.71	4.39
32	RSAC	0.15	0.14	0.15	0.21	0.03	0.1	0.05	0.13

Note: BC= Border compliance, DC= documentary Compliance.

Source: Authors calculation from econometrics result.

Appendix C.3. Simulated time to export and import for border and documentary compliance (days)

		Estimated time to export with geography mean		Estimated time to import with geography mean		Estimated time to export with income mean		Estimated time to import with income mean	
No.	Regions	DC	BC	DC	BC	DC	BC	DC	BC
1	Egypt	2.13	1.35	4.68	2.82	2.07	1.34	4.41	2.79
2	Morocco	1.01	0.79	1.21	5.5	0.99	0.79	1.15	5.5
3	Tunisia	0.12	4.08	1.13	5.33	0.12	4.08	1.13	5.33
4	RNA	5.19	4.92	8.75	13.63	4.09	4.67	6.93	12.65
5	Benin	4.02	5.66	5.21	6.26	4.34	5.75	5.46	6.42
6	Burkina Faso	2.39	2.48	2.92	3.03	2.67	2.64	3.18	3.33
7	Cameroon	2.63	8.28	6.49	11.02	2.61	8.42	6.46	11.29
8	Cotedivore	3.85	4.51	5.22	5.08	3.82	4.58	5.2	5.21
9	Ghana	2.73	4.5	18.11	3.71	2.34	4.5	17.64	3.71
10	Guinea	0	0	0	0	0	0	0	0
11	Nigeria	4.25	5.64	6.03	11.82	3.65	5.64	5.87	11.82
12	Senegal	1.08	2.54	3	2.21	1.08	2.54	3	2.21
13	Togo	0.56	3.07	8.08	10.86	0.6	3.13	8.46	11.13
14	RWA	2.31	3	4.09	5.7	2.47	3.07	4.28	5.83
15	CentralAfri	3.71	9.11	5.18	7.75	3.94	9.55	5.37	8.24
16	RSCA	7.11	12.62	6.2	11.51	6.02	12.33	5.7	11.36
17	Ethiopia	3.69	2.34	8.51	8.26	3.79	2.38	8.71	8.46
18	Kenya	0.77	1.17	3.42	7.5	0.7	1.17	3.33	7.5
19	Madagascar	2.4	3.92	4.23	5.38	2.46	3.92	4.33	5.38
20	Malawi	2.75	3.48	2.51	2.6	2.96	3.54	2.63	2.67
21	Mauritius	0.38	2	0.38	2.13	0.36	2	0.38	2.13
22	Mozambique	1.8	2.58	0.73	0.42	2.01	2.74	0.8	0.46
23	Rwanda	1.6	4.04	1.95	0.92	1.69	4.04	2	0.92
24	Tanzania	3.45	3.93	7.73	16.35	3.66	4	8.19	16.75
25	Uganda	1.96	3.54	4.58	6.42	2.1	3.54	4.74	6.42
26	Zambia	2.17	3.25	2.52	3.38	1.86	3.25	2.46	3.38
27	Zimbabwe	4.13	3.08	3.38	2.5	4.13	3.08	3.38	2.5
28	REA	0.1	6.47	0.32	5.6	0.1	6.58	0.34	5.75
29	Botswana	0.83	0.33	0.13	0.17	0.66	0.33	0.13	0.17
30	Namibia	3.12	5	0.13	0.25	2.49	5	0.13	0.25
31	South Africa	2.83	4.17	1.5	6	2.83	4.17	1.5	6
32	RSAC	0.13	0.14	0.14	0.21	0.11	0.14	0.14	0.21

Source: Authors calculation from econometrics result.

Appendix C.4. Sectoral Aggregation mapping for CFTA

No.	New Code	Sector Description	GTAP code	Aggregated
1	Grains	Grains and Crops	pdr wht gro	Agriculture
2	Vegetable	Vegetable	v_f	Agriculture
3	Oilseeds	Oilseeds	osd	Agriculture
4	Sugcanebeat	Sugar cane and Sugar beat	c_b	Agriculture
5	Othercrops	other crops	pfb ocr	Agriculture
6	LiveAnimal	Live Animal	ctl oap	Agriculture
7	Livestock	Livestock and Meat Products	rmk wol	Agriculture
8	Forestry	Forestry	frs	Manufacturing
9	Fishery	Fishery	fsh	Manufacturing
10	CoalOilGas	Coal, Oil, and Gas	coa oil gas	Manufacturing
11	MinExtract	Mining and Extraction	omn p_c nmm	Manufacturing
12	Procfood	Processed Food	cmt omt vol mil pcr ofd	Agriculture
13	Sugar	Sugar	sgr	Agriculture
14	BevTobacco	Beverage and Tobacco	b_t	Agriculture
15	Textile	Textile	tex	Manufacturing
16	WearingAppar	Wearing Apparel	wap	Manufacturing
17	Leather	leather	lea	Manufacturing
18	LightMnfc	Light Manufacturing	lum ppp otn omf	Manufacturing
19	HeavyMnfc	Heavy Manufacturing	crp i_s nfm fmp mvh ele ome	Manufacturing
20	Services	Services	ely gdt wtr cns trd otp wtp atp cmn ofi isr obs ros osg dwe	Service

Source: Author aggregation using GTAP 9 database

Appendix C.5. List of overlapping regional trade agreements in Africa

No.	Regions	COMESA	EAC	SADC	IGAD	ECOWAS	CEN-SAD	ECCAS	UMA
1	Egypt	✓	✓				✓		
2	Morocco						✓		✓
3	Tunisia						✓		✓
4	Rest of North Africa	✓					✓		✓
5	Benin					✓	✓		
6	Burkina Faso					✓			
7	Cameroon							✓	
8	Cote d'Ivoire					✓	✓		
9	Ghana					✓	✓		
10	Guinea					✓	✓	✓	
11	Nigeria					✓	✓		
12	Senegal					✓	✓		
13	Togo					✓			
14	Rest of West Africa					✓	✓		✓
15	Central Africa						✓	✓	
16	South Central Africa			✓				✓	
17	Ethiopia	✓			✓				
18	Kenya	✓	✓		✓				
19	Madagascar	✓		✓					
20	Malawi	✓		✓					
21	Mauritius	✓		✓					
22	Mozambique			✓					
23	Rwanda	✓	✓					✓	
24	Tanzania		✓	✓					
25	Uganda	✓	✓		✓				
26	Zambia	✓		✓					
27	Zimbabwe	✓		✓					
28	Rest of East Africa	✓	✓	✓	✓		✓	✓	
29	Botswana			✓					
30	Namibia			✓					
31	South Africa			✓					
32	Rest of South African Customs	✓		✓					

Source: Author aggregation using WTO regional trade agreements database.

Appendix C.6. A simple Armington model with tariff and Non-tariff measures

1. Simple Armington model: Substitution between domestic and imported good.

A typical Armington model assumes a three-stage budgetary allocation procedure. Expenditure is first allocated among goods without regard to their origin. Expenditure on each good is then allocated between domestic and imported varieties. Finally, expenditure on imports is allocated among competing national suppliers. We will see three cases.

A. When the domestic country applies no tariff on import from its suppliers (frictionless trade).
B. When the domestic country applies uniform tariff on import from its suppliers.
C. When there is iceberg transport cost between domestic and supplier country.

A. Frictionless trade

The Utility function for good "i" at country "s".

$$\mathbf{U} = (\boldsymbol{\alpha}\, \boldsymbol{C_s}^{\boldsymbol{\rho}} + (\mathbf{1} - \boldsymbol{\alpha})\boldsymbol{C_{rs}}^{\boldsymbol{\rho}})^{\mathbf{1}/\boldsymbol{\rho}}$$

Subject to the budget constraint

$$\boldsymbol{P_T Q_T} = \boldsymbol{P_s C_s} + \boldsymbol{P_{rs} C_{rs}}$$

Where,

r = is source country, and "s" is destination country.

$C_s =$ Quantity of domestic good "i" at "s".

$C_{rs} =$ Quantity of export of good "i" from region "r" to region "s".

$\alpha =$ A parameter that weights the import good relative to the domestic good.

$\sigma = \frac{1}{1+\rho}$ = Constant elasticity of substitution between the domestic and the imported good.

$P_s =$ Price of domestic good.

$P_{rs} =$ Price of imported good "i" from region "r" to region "s".

$P_T =$ Price index

$Q_T =$ Quantity index

$$L = (\alpha\, C_s^{\rho} + (1-\alpha) C_{rs}^{\rho})^{1/\rho} + \lambda(P_T Q_T - P_s C_s - P_{rs} C_{rs})$$

$$\partial L/\partial C_s = 1/\rho\,(\alpha\, C_s^{\rho} + (1-\alpha) C_{rs}^{\rho})^{1/\rho - 1}\left(\alpha\,\rho C_s^{\rho-1}\right) = \Lambda P_s$$

$$\partial L/\partial C_{rs} = 1/\rho\,(\alpha\, C_s^{\rho} + (1-\alpha) C_{rs}^{\rho})^{1/\rho - 1}\left(1-\alpha\,\rho C_{rs}^{\rho-1}\right) = \Lambda P_{rs}$$

$$\frac{\left(\alpha\, C_s^{\rho-1}\right)}{\left(1-\alpha\, C_{rs}^{\rho-1}\right)} = \frac{P_s}{P_{rs}}$$

$$\frac{\left(C_s^{\rho-1}\right)}{\left(C_{rs}^{\rho-1}\right)} = \frac{1-\alpha}{\alpha}\frac{P_s}{P_{rs}}$$

$$\frac{C_s}{C_{rs}} = \left(\frac{1-\alpha}{\alpha}\right)^{1/\rho-1}\left(\frac{P_s}{P_{rs}}\right)^{1/\rho-1}$$

$$\frac{C_{rs}}{C_s} = \left(\frac{1-\alpha}{\alpha}\right)^{1/1-\rho}\left(\frac{P_s}{P_{rs}}\right)^{1/1-\rho}$$

As we know, $\rho = \frac{\sigma_i - 1}{\sigma_i}$

$$\frac{C_{rs}}{C_s} = \left(\frac{1-\alpha}{\alpha}\right)^{\sigma_i}\left(\frac{P_s}{P_{rs}}\right)^{\sigma_i}$$

Or

$$\frac{C_{rs}}{C_s} = \left(\frac{\alpha}{1-\alpha}\right)^{-\sigma_i}\left(\frac{P_{rs}}{P_s}\right)^{-\sigma_i}$$

The GTAP model notation is:

$$QXS_{i,r,s} = b_{ij}^{\delta_i} QIM_{i,s}\left(\frac{PMS_{i,r,s}}{PIM_{i,s}}\right)^{-ESUBM_i}$$

Alternatively, in percentage change:

$$qxs_{irs} = qim_{is} - \sigma^i(\alpha - (1-\alpha)) - \sigma^i(pms_{irs} - pim_{is})$$

B. Armington Model with import tariff

$$U_s = (\alpha\, C_s^{\rho} + (1-\alpha) C_{rs}^{\rho})^{1/\rho}$$

Subject to the budget constraint

$$P_T Q_T = P_s Q_s + \tau_{rs} P_{rs} Q_{rs}$$

Where

- ✓ τ_{rs} *is one plus the tariff rate applied on commodity* C_m.

✓ $\rho = \frac{\sigma-1}{\sigma}$, elasticity of substitution.

Step 1: calculate import demand function.

$$L = (\alpha\, {C_s}^{\rho} + (1-\alpha){C_{rs}}^{\rho})^{1/\rho} + \lambda(P_T Q_T - P_s C_s - \tau_{rs} P_{rs} C_{rs})$$

FOC.

$$\partial L/\partial C_s = 1/\rho\,(\alpha\, {C_s}^{\rho} + (1-\alpha){C_{rs}}^{\rho})^{1/\rho-1}\left(\alpha\,\rho {C_s}^{\rho-1}\right) = \lambda P_s --(1)$$

$$\partial L/\partial C_{rs} = 1/\rho\,(\alpha\, {C_s}^{\rho} + (1-\alpha){C_{rs}}^{\rho})^{1/\rho-1}\left(1-\alpha\,\rho {C_{rs}}^{\rho-1}\right) = \lambda \tau_{rs} P_{rs} --(2)$$

From equation 1 &2,

$$\frac{\left(\alpha\, {C_s}^{\rho-1}\right)}{\left(1-\alpha\, {C_{rs}}^{\rho-1}\right)} = \frac{P_s}{\tau_{rs} P_{rs}}$$

$$\frac{\left({C_s}^{\rho-1}\right)}{\left({C_{rs}}^{\rho-1}\right)} = \frac{1-\alpha}{\alpha}\frac{P_s}{\tau_{rs} P_{rs}}$$

$$\frac{C_s}{C_{rs}} = \left(\frac{1-\alpha}{\alpha}\right)^{1/\rho-1}\left(\frac{P_s}{\tau_{rs} P_{rs}}\right)^{1/\rho-1}$$

$$\frac{C_{rs}}{C_s} = \left(\frac{1-\alpha}{\alpha}\right)^{1/1-\rho}\left(\frac{P_s}{\tau_{rs} P_{rs}}\right)^{1/1-\rho} \text{---------- (3)}$$

As we know, $\rho = \frac{\sigma_i-1}{\sigma_i}$

$$\frac{C_{rs}}{C_s} = \left(\frac{1-\alpha}{\alpha}\right)^{\sigma_i}\left(\frac{P_s}{\tau_{rs} P_{rs}}\right)^{\sigma_i}$$

Or

$$\frac{C_{rs}}{C_s} = \left(\frac{\alpha}{1-\alpha}\right)^{-\sigma_i}\left(\frac{\tau_{rs} P_{rs}}{P_s}\right)^{-\sigma_i}$$

Taking logarithm

$$\ln\left(\frac{C_{rs}}{C_s}\right) = -\sigma_i ln(\frac{\alpha}{1-\alpha}) - \sigma_i \sigma ln(\frac{\tau_{rs} P_{rs}}{P_s})$$

$$\ln C_{rs} = lnC_s - \sigma_i \ln(\alpha - (1-\alpha)) - \sigma_i \ln(P_{rs}\tau_{rs} - lnP_s) \text{---------- (4)}$$

The GTAP model notation is

$$\mathrm{QXS_{i,r,s}} = \mathrm{b_{ij}}^{\delta_i}\mathrm{QIM_{i,s}}\left(\frac{\tau_{rs}\mathrm{PMS_{i,r,s}}}{\mathrm{PIM_{i,s}}}\right)^{-\mathrm{ESUBM_i}}$$

Or in percent change

$$qxs_{irs} = qim_{is} - ESUBM^{i}(\tau_{rs}pms_{irs} - pim_{is})$$

Where,

- ✓ $pms_{irs} = pcif_{irs} + tms_{irs}$
- ✓ tms_{irs} *is onr plus the tariff rate applied on commodity* i, *imported from region* r *by region* s.

C. Armington Model with Iceberg cost

$$\mathrm{U}_s = \left[\alpha\, {C_s}^{\rho} + (1-\alpha)\left(\frac{C_{rs}}{\tau_{rs}}\right)^{\rho}\right]^{1/\rho}$$

Subject to the budget constraint

$$P_T Q_T = P_s C_s + P_{rs}\tau_{rs}.\frac{C_{rs}}{\tau_{rs}}$$

Where

- ✓ τ *is iceberg transport cost.*
- ✓ $\rho = \frac{\sigma-1}{\sigma}$, elasticity of substitution.

Step 1: calculate demand for import.

$$L = \left[\alpha\, {C_s}^{\rho} + (1-\alpha)\left(\frac{C_{rs}}{\tau_{rs}}\right)^{\rho}\right]^{1/\rho} + \Lambda(P_T Q_T - P_s C_s - P_{rs} C_{rs})$$

FOC.

$$\partial L/\partial C_d = \frac{1}{\rho}\left[\alpha\, {C_s}^{\rho} + (1-\alpha)\left(\frac{C_{rs}}{\tau_{rs}}\right)^{\rho}\right]^{\frac{1}{\rho}-1}\left(\alpha\,\rho {C_d}^{\rho-1}\right) = \Lambda P_s --(1)$$

$$\partial L/\partial C_m = \frac{1}{\rho}\left[\alpha\, {C_d}^{\rho} + (1-\alpha)\left(\frac{C_{rs}}{\tau_{rs}}\right)^{\rho}\right]^{\frac{1}{\rho}-1}(1-\alpha)\rho\left(\frac{C_{rs}}{\tau_{rs}}\right)^{\rho-1}\frac{1}{\tau_{rs}} = \Lambda P_{rs} --(2)$$

From equation 1 &2,

$$\frac{\left(\alpha\, {C_s}^{\rho-1}\right)}{\left(\left(\frac{C_{rs}}{\tau_{rs}}\right)^{\rho-1}\frac{1-\alpha}{\tau_{rs}}\right)} = \frac{P_s}{P_{rs}}$$

$$\frac{\left({C_s}^{\rho-1}\right)}{\left(\frac{C_{rs}}{\tau_{rs}}\right)^{\rho-1}} = \frac{1-\alpha}{\alpha\tau_{rs}}\frac{P_s}{P_{rs}}$$

$$\left[\frac{\tau_{rs}C_s}{C_{rs}}\right]^{\rho-1} = \frac{1-\alpha}{\alpha\tau_{rs}}\frac{P_s}{P_{rs}}$$

$$\left[\frac{C_{rs}}{\tau_{rs}C_s}\right]^{1-\rho} = \frac{1-\alpha}{\alpha\tau_{rs}}\frac{P_s}{P_{rs}}$$

$$\frac{C_{rs}}{\tau_{rs}C_s} = \left(\frac{1-\alpha}{\alpha}\right)^{1/1-\rho}\left(\frac{P_s}{\tau P_{rs}}\right)^{1/1-\rho}$$

As we know, $\rho = \frac{1-\sigma_i}{\sigma_i}$, so $1/\rho + 1 = \sigma_i$

$$\frac{C_{rs}}{\tau_{rs}C_s} = \left(\frac{\alpha}{1-\alpha}\right)^{-\sigma_i}\left(\frac{\tau P_{rs}}{P_s}\right)^{-\sigma_i}$$

$$\frac{C_{rs}}{\tau_{rs}} = C_s\left(\frac{\alpha}{1-\alpha}\right)^{-\sigma_i}\left(\frac{\tau P_{rs}}{P_s}\right)^{-\sigma_i}$$

$$\frac{C_{rs}}{C_s} = \tau_{rs}\left(\frac{\alpha}{1-\alpha}\right)^{-\sigma_i}\left(\frac{\tau P_{rs}}{P_s}\right)^{-\sigma_i}$$

$$\ln\left(\frac{C_{rs}}{C_s}\right) = -\sigma_i ln\left(\frac{\alpha}{1-\alpha}\right) + ln\tau_{rs} - \sigma_i ln\left[\frac{\tau P_m}{P_d}\right]$$

$$\ln C_{rs} = lnC_s + ln\tau_{rs} - \sigma_i ln(P_{rs}\tau_{rs} - P_s) - \sigma_i(\alpha - (1-\alpha))$$

The GTAP model notation is

$$\frac{\mathrm{QXS_{i,r,s}}}{\tau_{rs}} = \mathrm{b_{ij}}^{\delta_i}\mathrm{QIM_{i,s}}\left(\frac{\tau_{rs}\mathrm{PMS_{i,r,s}}}{\mathrm{PIM_{i,s}}}\right)^{-\mathrm{ESUBM_i}}$$

Or in percent change

$$qxs_{irs} = qim_{is} + ams_{irs} - ESUBM^i(pms_{irs} - ams_{irs} - pim_{is})$$