



**ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**THE ECONOMY-WIDE IMPACT OF ETHIOPIA'S ACCESSION TO THE
WORLD TRADE ORGANIZATION: A RECURSIVE DYNAMIC
COMPUTABLE GENERAL EQUILIBRIUM MODEL**

By

SIRACK KASSAHUN

June 2017

Addis Ababa, Ethiopia

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LIST OF ACRONYMS

CES	Constant Elasticity of Substitution
CESD	Center for Economic and Social Development
CFTA	Continental Free Trade Area
CGE	Computable General Equilibrium
COMESA	Common Market for Eastern and Southern Africa
DCGE	Dynamic Computable General Equilibrium
EDRI	Ethiopian Development Research Institute
ERCA	Ethiopian Revenue and Customs Authority
ESDR	Economic and Social Development Research
GAMS	General Algebraic Modeling System
GATT	General Agreement on Tariffs and Trade
GATS	General Agreement on Trade in Services
HS	Harmonized System
ICTSD	International Center for Trade and Sustainable Development
IMF	International Monetary Fund
ITC	International Trade Center
LDCs	Least Developed Countries
MFN	Most Favored Nations
MFTR	Memorandum of Foreign Trade Regime
NTT	New Trade Theory
ODCs	Other Duties and Charges
SAM	Social Accounting Matrix
TFP	Total Factor Productivity
TRIPs	Trade Related Aspect of Intellectual Property Rights
WCO	World Customs Organization

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ABSTRACT

The study examined the impact of Ethiopia's accession to the World Trade Organization on the economy from the market access for trade in goods negotiation perspective by using the Recursive Dynamic Computable General Equilibrium model and identified the possible range of commitment on simple average bound tariffs on agricultural and non-agricultural sectors by using analysis on tariffs. According to the model result; real Gross Domestic Production at factor cost increased by 0.06%, as export and import increased by 0.25% and 0.2% which improves trade balance by 0.04% with the increase in private consumption by 0.04% and a decrease in fixed investment by 0.02%. Total activity production levels has the highest positive percentage change and households become better off because of reduced import price as their consumption expenditure increases but government revenue decreases as a result of import tariff reduction by greater percentage during 2027-2030 as compared to the base. In general, Import tariff reductions to some extent in the long run as part of World Trade Organization accession process and multilateral trade negotiation once become a member have a positive impact on the economy. Based on the commitment on simple average final bound tariffs of the six Least Developed Countries that acceded to the World Trade Organization through accession negotiation; the possible range of commitment on the bound tariff is identified as 28.5% to 44.7% for agriculture while 20.8% to 28.8% for non-agriculture. As the difference between the simple average bound tariff and the simple average applied tariff; the range gives a policy space from 6.4% to 22.6% for agriculture and 4.2% to 12.2% for non-agriculture since Ethiopia's simple average applied tariff is 22.1% for agriculture & 16.6% for non-agriculture. Therefore, Ethiopia should use a negotiation strategy that secures higher policy space for its development interests.

Keywords: WTO, Import Tariff, Accession Negotiation on Trade in Goods, Recursive DCGE Model, Ethiopia

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

The WTO is an organization for progressively liberalizing trade. Trade liberalization is the main approach that WTO members have adopted to promote economic growth and development. More than 160 governments and separate custom territories are members of the WTO. All the countries in the long-run will be a member of WTO, because, all the countries in the world have been globalized, it doesn't matter what kind of economic system they have or what foreign policy they follow (CESD, 2013).

As Evenett and Braga (2004) stated that throughout the process of accession to the WTO, the burden is on the applicant to satisfy the demands of existing WTO members. WTO accession process is very costly and complex because of the reasons that it is taking longer and longer time to complete; the price of joining the WTO now includes commitments that go beyond the Uruguay Round agreements; the price of joining the WTO is steadily rising; and the WTO accession process takes little account of the specific circumstances of applicant countries or their needs for special and differential treatment. The basic reason for the emergence of these perceptions is that the terms, rather than the procedures, of WTO accession are not well defined in legal terms.

According to the guidelines for LDC accessions text, acceding LDCs shall bind all agricultural tariff lines at an overall average rate of 50 percent. This level is about 28 percentage points lower than the average of the 30 LDCs which joined the organization in its early years, but 18 percentage points higher than the five recently acceded LDCs. With regard to non-agricultural products, the decision provides two options: acceding LDCs shall bind 95percent of their NAMA lines at an overall average rate of 35 percent, or they can undertake more comprehensive binding coverage. In the latter case, the acceding country shall be afforded proportionately higher overall average rates, to be agreed with WTO members. The text also specifies that "in such cases the acceding LDC shall be entitled to transition periods of up to 10 years for up to 10 percent of their tariff lines" (ICTSD, 2012, p. 4).

As Sauv  (2005) indicated that Both Nepal and Cambodia which are the first two LDCs that acceded the WTO through accession process, made important liberalization commitments

involving trade in goods. For Cambodia, the weighted bound tariff rate is about 20.4 per cent, higher than the applied rate of 13.4 per cent. However, when these figures are matched with actual trade flows, some interesting findings emerge. Calculations show a revenue loss of about US\$ 23million, representing 11 per cent of total revenues (estimated at US\$ 253 million).Most of these losses could be traced to tariff reductions on imports of intermediate materials used by garment factories, where the applied rate of 35 per cent would be reduced to levels between 10 and 17.5 per cent in most cases. Other areas where significant losses of customs revenue may occur are imports of automobiles and spirits. Expected trade creation would be equivalent to US\$ 34.1 million and would likely be generated in sectors where accession induced bound rates are lower than previously applied rates and where trade flows have been recorded.

According to Ministry of Trade (2015) Ethiopia had started the accession process to the WTO by submitting its application for observer status two years after the establishment of the WTO, on 25 September 1997. During 1997-2003 a number of impact assessment studies had been conducted. The outcome of the studies showed that the benefits of joining the WTO outweigh the cost the country will face in implementing the agreements and therefore recommends the country to join the organization.

On 13 January 2003 Ethiopia requested to accede to the WTO pursuant to Article XII. Virtually every WTO member warmly welcomed Ethiopia's request and a Working Party was established in February 2003 and Mr. Neil McMillan of UK was assigned as Chairperson of the Working Party.

Ethiopia submitted its Memorandum of Foreign Trade Regime (MFTR) in December 2006 which was distributed to WTO Members on 25 January 2007. Following the submission of this document it received more than 200 questions on the first round from Members (the Government of the United States of America and Canada) in February 2007.

The first working party meeting was held in May 2008 after the replies for the first round of questions have been submitted and circulated to all members in the three WTO languages which are English, French and Spanish. The second rounds of questions were received from USA, Canada and the European Commission in August 2008 and replies were prepared and submitted to the WTO in 2009. However, due to the retirement of the chairman of the working party and on mere procedural issue raised by some members, the replacement took quite some time. As a result the second Working Party Meeting was delayed and held in May 2011 after a

new working party chairman from Denmark (H.E. Dr. Steffen Smidts) was assigned as a new chairperson. Following the second working Party Meeting, Ethiopia received the third round of questions from members (USA, the European Union and Canada) in July 2011 and the responses have been prepared and submitted to the Secretariat in January 2012.

Preparation of initial offer in goods was finalized and submitted in January 2012 before the Third working party meeting took place in March 2012. The offer is served as a basis for the bilateral negotiations with the interested working party members. Canada has sent to Ethiopia its bilateral request on the goods offer which has kicked-off the bilateral negotiation on goods.

Ethiopia received the fourth round of questions in 2012 from working party members: U.S.A, the European Union, and Canada to which currently the replies have been prepared and are ready for submission to the WTO Secretariat.

As bilateral negotiations on tariff bindings with interested WTO working party members continue throughout the accession process; the outcome of the negotiation as a commitment would have a wider effect on the economy. Therefore, deep and series researches are needed in order to have a negotiation goal as well as strategy that secure a maximum benefit.

1.2. Statement of the Problem

Turning to the price of accession, it is important to distinguish between the two broad types of commitments made by acceding countries: those relating directly to market access and commitments on rules. With respect to market access for agricultural and non-agricultural (i.e., manufacturing) products, there is clear evidence that the price of accession expressed in terms of the concessions made by acceding countries has grown over time. For both agricultural and non-agricultural goods the average tariff binding allowed to acceding countries has fallen over time, standing now at levels well below those agreed by developing countries in the Uruguay Round. From a mercantile perspective, therefore, the relative price of WTO accession is high in comparison to Uruguay Round commitments made by peer nations and it is growing over time (Evenett and Braga, 2004).

In 2002, the WTO's General Council agreed on guidelines to facilitate the process of accession by LDCs. The impact of such guidelines is difficult to assess when examining the commitments undertaken by Cambodia and Nepal. There is little tangible evidence of any

specific effect of the guidelines on the results of the accession process, as reflected in the accession documents of the two countries (Sauvé, 2005).

LDCs have been required to undertake market access concessions higher than even what some advanced members have had to undertake. Along with their lack of human, institutional and financial resources, the excessive concession demands from the existing members made the notoriously complex accession process too onerous for the world's poorest countries (Henok, 2014).

Ethiopia's major import items are non-Agricultural products. The average applied NAMA tariff is at 16.6 percent, but all tariffs in the clothing sector are at 35 percent. Average applied tariffs on textiles are at 27.9 percent, with peaks at 35 percent. For other NAMA sectors, Ethiopia has tariff peaks at 35 percent for mineral and metal products, chemicals, wood, paper, leather, footwear, transport equipment, and manufactures (ICTSD, 2012).

There are a number of studies available on the impact of Ethiopia's accession to the WTO. For example, Wolde (2006) studied the impact of Ethiopia's accession to the WTO on export market access for which it would have little significance and Mussie et al. (2015) used the Recursive CGE Model to assess the economic Wide impact of WTO accession from the trade in goods negotiation point of view by using the 2005/06 SAM.

The studies conducted so far are tried to assess the impact of Ethiopia's accession to the WTO taking into account the different negotiation subjects like negotiation on trade in goods and trade in services by using different methodologies. But there is lack of sufficient researches as far as the use of economic models like Recursive DCGE model and simulating realistic scenarios to come up with tangible conclusion as well as policy implication are concerned to quantify the possible impact of accession on the economy. The study tried to fill the identified research gap by employing Recursive DCGE model with analysis on bound and applied tariffs of Ethiopia and selected recently acceded LDCs which are taken as best benchmarks.

1.3. Objectives of the Study

1.3.1. General Objective

The general objective of the study is to analyze the economy-wide impact of Ethiopia's accession to the World Trade Organization (WTO).

1.3.2. Specific Objectives

The study has the following specific objectives:

- To analyze the impact of Ethiopia's accession to the WTO from the perspective of trade in goods negotiation on the Ethiopian economy;
- To identify the range for the bound tariff rates in which it is considered to be best for Ethiopia and acceptable by WTO members in the agricultural and non-agricultural sectors;

1.4. Significance of the Study

As the negotiation to the WTO become very demanding from the acceding country perspective, it is very essential to analyze and evaluate different possible negotiations outcomes before as well as during the negotiation in order to give and indicate different options as well as recommendations based on different scenarios. One of the most important negotiation areas that have a profound consequence on Ethiopia's accession to the WTO is the negotiation on trade in goods which is conducted on the basis of the ceiling of the bound tariff rate after tabling the Initial offer by the acceding country to start bilateral negotiation with interested WTO working party members which decides the terms and condition of accession through negotiation.

The study gives well analyzed and evaluated recommendations for the accession of Ethiopia to the WTO regarding negotiations on trade in goods to have made an informed decision and designing overall negotiation strategy by the policy makers and negotiators in the process of Ethiopia's accession to the WTO.

1.5. Scope and Limitations of the Study

The scope of the study is concentrated on the impact of Ethiopia's WTO accession on its economy from the trade in goods negotiation perspective. Negotiation to accede to the WTO

have different aspects like negotiations to be conducted on trade in services which includes the terms and conditions for the liberalization of financial and telecommunication sectors; reforming various trade and related laws, regulations, rules and practices to be compatible with different WTO agreements in order to create a predictable trade regime, accepting and applying different WTO rules and principles like agreements on trade in goods (GATT), trade in services (GATS) and Trade Related Aspect of Intellectual Property Rights (TRIPs) without negotiation which is called unconditional obligation.

The first limitation of the study is lack of comprehensive analysis to show the impact of Ethiopia's accession to the WTO on its economy by taking into account other negotiation aspects besides the bound tariff negotiation such as subsidy and trade facilitation issues that have an impact on the economy. The second limitation is concerned with the nature of the recursive DCGE model itself as it has its own limitation including the assumption of perfect competition. The third limitation is the 2005/2006 Ethiopian SAM as a time limitation but It is tried to minimize the limitation by updating the SAM to give the 2015/16 economy which is used as the main data source for the model. There are also other limitations like unavailability of sufficient time.

1.6. Organization of the Study

The study is organized into five chapters. The first chapter dealt with the introduction part of the study which includes Background, Statement of the Problem, Objectives, Significance, Scope and Limitation. The second chapter reviews the Theoretical and Empirical literatures on the subject matter. The third chapter shows the Methodological procedures the study follows including the model and data analysis method. The fourth chapter presents the results and Discussion of the Study. The last chapter i.e. chapter five gives conclusions and recommendations based on what is analyzed and discussed in the previous chapter.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1. Theoretical Literature

2.1.1. Definition of Globalization

Globalization has different definitions in terms of economic, social and political context. But, the study selects the economic definitions of globalization from international trade point of view as presented as follows.

According to Todaro (2010) Globalization is one of the most frequently used words in discussions of development, trade, and international political economy. As the form of the word implies, globalization is a process by which the economies of the world become more integrated, leading to a global economy and, increasingly, global economic policymaking, for example, through international agencies such as the World Trade Organization (WTO).

On the other hand Salavatore (2013) defined Globalization as a revolution which in terms of scope and significance is comparable to the Industrial Revolution, but whereas the Industrial Revolution took place over a century, today's global revolution is taking place under our very eyes in a decade or two.

In general terms, globalization exhibits three overlapping but distinct dimensions which are often treated synonymously: a *policy dimension*, referring to the reduction of barriers to goods, services, people, capital and information flowing across national borders; an *economic dimension* which refers to the increasing scale of these flows and the extent to which countries are thereby integrated into an international division of labour; and an *institutional dimension* which refers to the nature, reach and influence of rules, norms and structures designed to manage the expanding network of international activity and transactions (UNCTAD, 2016).

2.1.2. International Trade Theories

International trade theory and policies are the microeconomic aspects of international economics because they deal with *individual* nations treated as single units and with the

(relative) price of *individual* commodities (Salavatore, 2013).

During the seventeenth and eighteenth centuries, the mercantilists believed that a nation could gain in international trade only at the expense of other nations. As a result, they advocated restrictions on imports, incentives for exports, and strict government regulation of all economic activities.

In 1776 Adam Smith emphasized that trade between two nations is based on absolute advantage as stated in his famous book *The Wealth of Nations*. When one nation is more efficient than (or has an absolute advantage over) another in the production of one commodity but is less efficient than (or has an absolute disadvantage with respect to) the other nation in producing a second commodity, then both nations can gain by each *specializing* in the production of the commodity of its absolute advantage and exchanging part of its output with the other nation for the commodity of its absolute disadvantage. By this process, resources are utilized in the most efficient way and the output of *both* commodities will rise. This increase in the output of both commodities measures the gains from specialization in production available to be divided between the two nations through trade.

In the early part of the nineteenth century, David Ricardo pioneered the law of comparative advantage which stated that even if one nation is less efficient than (has an absolute disadvantage with respect to) the other nation in the production of *both* commodities, there is still a basis for mutually beneficial trade. The first nation should specialize in the production and export of the commodity in which its absolute disadvantage is smaller (this is the commodity of its *comparative advantage*) and import the commodity in which its absolute disadvantage is greater (this is the commodity of its *comparative disadvantage*) (Ibid).

In 1920's The Heckscher–Ohlin (H-O) (or Factor Proportions) model emerged as the dominant model of comparative advantage in modern economics. It demonstrates that when countries move to free trade, they will experience an increase in aggregate efficiency. The change in prices will cause a shift in production of both goods in both countries. Each country will produce more of its export good and less of its import good. Unlike the Ricardian model, however, neither country will necessarily specialize in production of its export good. Nevertheless, the production shifts will improve productive efficiency in each country. Also, due to the changes in prices, consumers, in the aggregate, will experience an improvement in consumption efficiency. In other words, national welfare will rise for both countries when they move to free trade (Saylor Academy, 2016).

In the late 1970s and early 1980s the New Trade Theory emerged as to fill the gap that the H-O model leaves since a significant portion of today's international trade unexplained. These complementary theories are based on international trade on economies of scale, imperfect competition, and differences in technological changes among nations.

In Concluding, it appears that the evolution of trade theory, from old trade doctrines to the NTT, has impacted policy at two levels. The first relates to the continuing support of the free trade doctrine to determine policy for developing areas. As is expected, the push comes from the advanced nations, both at the intergovernmental level and at multilateral institutions like the IMF and the WTO. The second impact of trade theory relates to policies pursued by the advanced nations, which relies considerably on the NTT doctrines of strategic trade. The uneven power relation between the rich and poor nations of the world permits that a continuation of this asymmetrical combination of policies, to which trade theory unfortunately has contributed much. Much of the preoccupation of the policymakers with the micro-theoretic formulations of trade theory, both old and new, are related to a total neglect of the macroeconomic issues relating to the national as well as the world economy. One only expects that the new theories, which are yet to come up, will address some of these limitations (Sen, 2010).

2.1.3. Overview of Trade Liberalization

There are sound theoretical reasons how free trade in an ideal world can augment world output by guiding resources to their best possible usages at any given point of time. Free trade is also endowed with considerable dynamic energy, which can sustain this efficient usage of resources over a period of time for a given country or group of countries, resulting in higher growth rates. Such beneficial effects of free trade are unambiguously true at an aggregate level, in the sense of making *every* country better off, although to different extents. However, theory does not say that free trade makes every individual better off. In fact, quite to the contrary, any reasonable theory of trade predicts that free trade has differential impacts on various population groups within a country (Guha-Khasnobis, 2004).

Although economic theory suggests that free trade maximizes welfare, countries do set import tariffs, being ruled by several reasons. One of them, widely discussed by trade economists, is a

terms of trade argument. It states that large countries which can influence world prices can gain by setting an import tariff, thus lowering the price of imports. Although such policy also distorts production and consumption, benefits can outscore losses if an optimal import tariff is introduced (Eromenko, 2010).

When a small nation imposes an import tariff, the domestic price of the importable commodity rises by the full amount of the tariff for individuals in the nation. As a result, domestic production of the importable commodity expands while domestic consumption and imports fall. However, the nation as a whole faces the unchanged world price since the nation itself collects the tariff. These general equilibrium effects of a tariff can be analyzed with the trade models and by assuming that the nation redistributes the tariff revenue fully to its citizens in the form of subsidized public consumption and/or general income tax relief (Salavatore, 2013).

In contrary, through the price effects, trade liberalization would increase demand for both imported inputs and exports. This would realign incentives away from the non-tradable sectors and towards the tradable sector resulting in increased trade. Efficiency gains were expected because the tradable sector of the economy would be exposed to external competition especially in developing countries. Trade liberalization is also expected to result in increased investment and productivity gains as a result of technology transfers, economies of scale would result from increased production in the tradable sector. Increased productivity would lead to structural transformation as labor moved to the more productive sectors of the economy (UNECA, 2013).

There are different divergent views on the benefits of trade liberalization as the main source of divergence is the level of trade elasticities and the implementation of dynamic relations. There is no consensus yet on the magnitude of behavioral parameters. Moreover, the link between openness and factor productivity might be strong, but it is not fully understood or precisely estimated (Bouët, 2008).

As Hokeman and Olarreaga (2007) stated that some countries and many individuals will lose as a result of trade liberalization. In principle, aggregate gains will exceed aggregate losses and this implies that after a reform it is possible to redistribute incomes to compensate the losers while still generating net benefits for the gainers from the reform.

2.1.4. GATT and the WTO

According to the WTO eTraining course, the GATT is an international trade agreement concluded in 1947. It contains rules and obligations that governed trade in goods for almost fifty years between its "CONTRACTING PARTIES". From 1948 to 1994, before the WTO was created, the GATT provided the legal framework for the bulk of world trade.

The negotiation of the GATT dates back to the 1940's. It was part of the post-war project to reconstruct a multilateral system of world trade through the elimination of discrimination, the reduction of tariffs and the dismantlement of other trade barriers. The initial objective was to create an International Trade Organization (the ITO) to handle the trade side of international economic cooperation, which was meant to join the two "Bretton Woods" institutions, the World Bank and the International Monetary Fund (IMF).

The project went on two tracks: (1) drafting a Charter for an International Trade Organization (the ITO); and, (2) launching tariff negotiations on a multilateral basis.

The GATT was never intended to be an international organization but only to be a subsidiary agreement under the ITO Charter. Nevertheless, the ITO did not materialize and the GATT came into force by means of a Provisional Protocol, signed on 30 October 1947 and effective since 1 January 1948. The signatory countries to the Protocol agreed to apply the provisions contained in the GATT until the ITO could take over its administration. Hence, for 47 years, the GATT served as a de facto international organization, taking up some of the functions originally intended for the ITO.

The GATT developed rules for a multilateral trading system (MTS) through a series of trade negotiations or rounds. From 1947 to 1994, the GATT CONTRACTING PARTIES organized eight rounds of negotiations. The early rounds dealt mainly with tariff reductions on goods, but later rounds included other areas, such as, anti-dumping and non-tariff barriers.

The last round lasted from 1986 to 1994 and is generally known as the "Uruguay Round", which led to the creation of the WTO in 1994. The Uruguay Round brought about the biggest reform to the world trading system since the GATT was established. Since 1995, the WTO has performed the role of an international organization for trade rules.

Participants in the Uruguay Round concluded the Round by adopting the "Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations" ("the Final

Act"). After the Final Act follows the "Marrakesh Agreement Establishing the World Trade Organization" ("the Agreement Establishing the WTO") and its four Annexes, which are Trade in Goods(GATT 1994), Trade in Services(GATS 1994), Trade Related aspects of Intellectual Property Rights(TRIPS) and Plurilateral Trade Agreements. The first three annexes are called Multilateral Trade Agreements.

The GATT still exists as the WTO's treaty for trade in goods. The Agreement Establishing the WTO and its Annexes is referred to as "the WTO Agreements".

In the Preamble to the Agreement Establishing the WTO, the parties to the Agreement recognize the objectives they wish to attain through the MTS:

- raise living standards;
- ensure full employment;
- ensure a large and steadily growing volume of real income and effective demand; and,
- expand the production of and trade in, goods and services, while allowing for the optimal use of the world's resources in accordance with the objective of sustainable development.

The Agreement also recognizes the need for "positive efforts to ensure that developing countries, and especially the least-developed among them, secure a share in the growth in international trade commensurate with ... their economic development".

The WTO fulfills its objective by:

- ✓ administering the trade agreements between its Members;
- ✓ serving as a forum for trade negotiations;
- ✓ settling international trade disputes among its Members;
- ✓ reviewing Members' trade policies;
- ✓ ensuring greater coherence in global economic policy-making, including cooperating with the IMF and the World Bank; and,
- ✓ provide technical assistance (TA) to developing country Members.

2.1.5. Accession Process to the WTO

To integrate the given economy to the global trading system, countries are seeking membership to WTO in order to benefit from International trade. As described by Craig (2013) acceding to the WTO is far different from joining other international organizations as presented his argument that joining the WTO is a lengthy process of examination and negotiation in which the acceding country is obliged to make extensive concessions. Accession negotiations are deliberately one-sided affairs, with all of the requests coming from the existing members and the full burden of adjustment falling on the acceding country.

Hoekman et al. (2002) stressed that WTO accession negotiations partly have to do with whether the acceding member's policies and institutions are consistent with various aspects of the WTO agreements and partly with the specific tariff bindings and commitments in agriculture and services. Delays can occur on both sides. The acceding government may be unwilling to make needed liberalization commitments; for example, it may not offer to liberalize nontariff barriers, or it may propose binding tariffs at levels much higher than existing ones. Members, for their part, may not be satisfied with the level of liberalization proposed or may be unwilling to accept delays in bringing the laws and institutions of the applicant into conformity with WTO provision.

Accession to the WTO has its own process and to initiate the process, a country should submit an official request for accession to the WTO Director General. This request is considered during the next General Council meeting, and, in the case of a positive decision, the applicant country receives observer status and a Working Party opens to all WTO members. In the case of a large acceding country, many members participate in the Working Party, if the candidate is small, usually only the "Quad" countries (Canada, the EU, Japan and United States) as well as neighboring countries take part.

Next, the applicant should present a Memorandum on the Foreign Trade Regime. The Memorandum explains the policies and institutions of the acceding country and forms the basis for further negotiations. This document includes a description of economic policies and foreign trade in goods and services, the trade-related intellectual property regime, investment, economic integration agreements with third countries, the decision making process as well as the statistical appendix. After the Memorandum has been circulated among the WTO members; the "question-answer" stage starts. Members ask questions in order to clarify

indistinct points and wait for a reply from the applicant. This process is usually repeated several times until members are satisfied with the Memorandum. By the end of this stage, the Working Party issues a draft report, containing the Memorandum, the questions and answers and discussions of the Working Party.

At some point during the “question-answer” process, the acceding country should submit an initial offer on goods and services which consists of a tariff schedule with an indication of the “bound” level of tariffs and a commitment on market access for services.

Having completed the initial offer, the countries start bilateral negotiations. Members of the Working Party assess the initial offer and generally ask for further concessions and commitments. Negotiations continue until all sides are satisfied with the offer and result in signing a bilateral agreement. When the process of bilateral negotiations concludes, all commitments and concessions are combined in the Schedule of Concessions and Commitments on Goods and the Schedule of Specific Commitments on Services.

After that, the WTO Secretariat prepares the Accession Package, which consists of the following documents:

- The Working Party Report;
- The Protocol of Accession;
- The Schedule of Concessions and Commitments on Goods;
- The Schedule of Specific Commitments on Services.

This Accession Package should be adopted at the final working party meeting and passed for approval to the General Council or the Ministerial Conference. The decision of the General Council or the Ministerial Conference should be adopted by consensus, or by two thirds in a case in which at least one country has objections. The applicant country signs the Protocol of Accession and 30 days after becomes a member of the WTO.

2.1.6. Tariff Binding in the WTO

One of the benefits of WTO accession is obtaining access to the markets of other countries. WTO member states should apply low customs duties to the goods imported by them from

other WTO member states in accordance with WTO conditions. This tariff rate is defined at the end of multilateral talks held within the framework of WTO, and they cease the barriers applied by them in foreign trade. These conditions are not applied in case of importation of goods by WTO member states from non-WTO members (CESD, 2013).

The differences between the tariff bindings of recently acceded members and the original members of the WTO are summarized in the Table below. Developing countries often complain that they are obliged to give up much of their “policy space” in the WTO, with their commitments leaving them with little room to innovate or adjust. The data on countries’ accessions may support this contention with respect to tariffs: taken as a whole, the members that acceded between 1995 and 2012 were required to bind a larger share of their tariffs and were left with less “water” (i.e. freedom to adjust tariffs upward) than incumbent members. Alternatively, one could see this as a process by which the developed countries that generally have less water in their own tariff schedules avail themselves of the opportunity to ensure that the disparity between bound and applied rates is lower for the new members than it is for the older ones.

The most striking statistic is that all acceding members have been required to bind all of their tariffs, as compared to the 26.0 per cent of tariff lines that the average original member has kept unbound. For some products, the acceding countries have agreed to ceiling bindings that are far above any applied tariffs that they might ordinarily impose but, in general, the differences between the bound and applied tariffs is much lower for the acceding countries than it is for the rest. There are 35.8 percentage points of water in the average tariff of the average original member, meaning that such a country could more than quadruple its average applied tariff of 9.7 per cent without running afoul of its commitments. The countries that acceded during the WTO period could also raise their applied tariffs with some impunity, but not by nearly as much. The tariffs that they currently apply are also, on average, two percentage points lower than those of the incumbent members (Craig, 2013).

Table 2.1: Binding Coverage and simple average of final bound rates and applied rates for WTO members

	All Products				Agricultural Products			Non-Agricultural Products		
	Binding Coverage	Bound (A)	Applied(B)	Water(A-B)	Bound (A)	Applied(B)	Water(A-B)	Bound (A)	Applied(B)	Water(A-B)
Original Members(I)	74	45.5	9.7	35.8	65.2	15.8	49.4	33.7	8.7	25
Completed Accessions(II)	100	13.6	7.5	6.1	19.5	12.6	6.9	12.7	6.7	6
Difference(I-II)	-26	31.9	2.2	29.7	45.7	3.2	42.5	21	2	19

Source: Calculated from data supplied by the WTO Accessions Division (2013).

2.2. Empirical Literature

There are a number of studies undertaken to assess the impact of WTO accession on the acceding countries' economy by using CGE model including Azerbaijan, Russia, Ukraine and others.

Huseynov (2015) have used CGE model to examine the Welfare and Economy-Wide Effects of Azerbaijan's Accession to the WTO and the empirical results of tariff reduction scenario on the macroeconomic variables showed that import demand is estimated to increase by around 0.79 percent, real exchange rate tends to depreciate by around 0.96 percent and total domestic output that is sold domestically decreases by approximately 0.28 percent. However, the gross domestic output is estimated to increase marginally by around 0.03 percent. Reducing tariffs by half would also mean 45.07 percent less tariff revenue for the economy. Accordingly, this leads to a net revenue loss of the government, estimated to be as large as 5.25 percent. By assumption, government savings is endogenous to the model. Thus, to attain a balanced government budget, its savings (as a percentage of government's total revenue) decreases sharply by 63.64 percent. The economy-wide consumption price index decreases by 0.81 percent which in turn stimulates overall domestic demand while increasing it by approximately 0.91 percent. The lower consumption prices coupled with higher factor returns result in an increase in total household consumption that is estimated to be as large as 2.27 percent. Despite the negative changes in total investment, a slight improvement in overall net

trade balance and a strong increase in total household consumption lead to a moderate raise in the country's overall GDP, as large as 0.04 percent.

Another research paper studied on the Impact of WTO Accession on Azerbaijan economy by Bayramov et al. (2014) postulate that WTO accession will exert a positive impact on all three measures of general welfare, i.e. income, consumption and aggregate savings for the Azerbaijan economy. Both income and aggregate savings are forecasted to increase by approximately 11 percent in case Azerbaijan joins the World Trade Organization. Most interestingly, consumption is predicted to increase by a stunning 93 percent compared to the benchmark value. Our analysis suggests that households would be the primary beneficiaries of WTO accession.

In terms of other macroeconomic indicators, i.e. government savings, tax revenue, exports and imports; Exports are forecasted to decrease by 68 percent compared with a relatively modest increase in imports of 3 percent. Although revenues through customs and tariffs are likely to drop after WTO accession, tax revenue is projected to increase by 17 percent due to higher levels of consumption and increased household incomes. The results implicate that Azerbaijani exports will plummet in the case of WTO accession which is likely to trigger wide ranging consequences for the Azerbaijani oil industry.

Eromenko (2010) asserted that the Russian Federation has chosen to follow a protectionist strategy in negotiating tariff rates. The weighted average rates of import tariffs on agricultural products was 14.7% in 2001, but Russian authorities planned to agree initial Simple average bound at a level of 34.7%: it is intended that even the final bound rate after the transition period will stay at the level of 25%, which is even higher than prior to the WTO membership. The same picture is for industrial goods: the initial tariff rate is 14%, the final one almost 10%. Industries which are projected to receive a high level of protection are textiles, metallurgy, and machinery.

Kosse (2002) suggests that import tariffs reductions are key condition to Ukraine's accession to the WTO. Results obtained from simulation show that reduction of import tariffs increases national welfare. Therefore, membership in the WTO would be beneficial for Ukrainian consumers because of reduced import prices and of producers because of reduced prices of intermediate inputs and availability of new markets for their products. However, the Ukrainian government should also apply cost-benefit analysis of import tariffs reduction to every commodity separately because some commodities like agricultural products deserve special

treatment.

Mobariz (2015) stated that while the benefits of trade liberalization are of paramount importance, the cost is nonetheless critical for any country especially for vulnerable economies. Import liberalization through tariff cuts for a small country like Afghanistan may bring down the prices by the amount of tariffs cuts, increase imports and decrease the government revenue from tariffs. The general welfare of the economy which is the combination of consumer surplus, producer's surplus and government surplus (government revenue) depending on the effect of tariff cuts for different country may be either negative or positive. Though Afghanistan's current applied tariff rates are very low and the country as an LDC may not be required to undertake further commitment to reduce its current MFN applied tariff rates, still it has to bind its tariffs at certain rates.

From the Ethiopia's WTO accession perspective; there are various studies on different negotiation area from legal to economic issues. But the study is concentrated on some literatures conducted on trade in goods.

Henok (2014) analyzes the level of commitments both original and Recently Acceded Members (RAMs) had taken on agricultural and non-Agricultural Products in line with the LDCs accession guideline benchmarks to give insight for Ethiopia's trade in goods negotiation. In his analysis, there is no guarantee that Ethiopia will not be requested to bind its tariffs rates below the benchmark of 50%. As the experience of Article XII LDC members reveals, Ethiopia is unlikely to receive sympathy from WTO Members for its underdeveloped agricultural sector. LDCs such as Cambodia and Yemen were similarly situated underdeveloped economies with equal interest to protect their fragile agricultural sector from foreign competition, but end up binding their average agricultural tariffs at rates much lower than not only what the original LDC Members have had to bind but also that of some advanced developed members such as Norway and Switzerland.

Regarding Non-Agricultural Market Access (NAMA) Products; unlike in the case of agricultural products, not only the binding tariff rates but also the level of binding coverage varies considerably among WTO members. Currently, the binding coverage for NAMA products ranges from 0.2% to 100%. All Article XII LDC Members except Nepal (99.3%) bound 100% of their NAMA tariff lines.

In the long run, the WTO principle of progressive liberalization will mean that eventually Ethiopia will have to reduce its import tariffs provided that WTO members agree on further

cuts of bound tariffs in future – i.e. post Doha – multilateral negotiation rounds. Assuming that Ethiopia commits to an average tariff 60% higher than applied tariffs, and keeping in mind that the average reduction of bound tariffs for non-agricultural goods in previous WTO negotiation rounds was approx. one third each time, Ethiopia will have to reduce its applied tariffs after the second post-Doha round. Given that the period between the conclusions of negotiation rounds is more than ten years, it should be clear that a general obligation for Ethiopia to reduce import tariffs because of WTO membership is indeed a very long-term perspective (Bienen, 2010).

Mussie et al. (2015) have analyzed the Impact of WTO membership on the economy by using Recursive DCGE model to simulate four scenarios and the Simulation results indicates that despite the benefits obtained at aggregate level, the sectoral effects of WTO have remained mixed. In particular, the majority of domestic manufacturing activities tend to suffer from member forced Ethiopia to reduce the applied tariff by 5% due to increased competition from imports. A close look at this result implies that such adverse impacts of WTO accession may retard the realization of joining WTO.

2.3. Tariff Reforms in Ethiopia

There are various instruments of trade policy that the government of a country could deploy to maximize the welfare of its citizens. These include tariffs and non-tariff barriers, subsidies, export promotion as well as other administrative measures of protections that include quantitative restrictions. One of the most important instruments of trade policy that is widely used across the world is tariff.

A tariff can be defined as a tax levied on import of goods. Once a tariff is levied, the domestic price of the imported goods (P_{xd}) will be over and above the world price (P_{xw}) of the same commodity (i.e. $P_{xd} > P_{xw}$). The tariff is believed to shield domestic industries from foreign competition. A tariff might take different forms. It could be ad valorem, which means it is given as a percentage of the import values, which is the most common form ,or a specific value per unit of an imported good (such as \$5 per Kg of sugar). The ad valorem form is usually preferred because:

a) it is transparent as can be seen in price, and

b) it is readily comparable for it is given in percentage terms

There are some terminologies that we encounter in the tariff literature. This includes ‘tariff schedule’, which refers to the list of tariff rates applicable; the tariff bound (or scheduled), the tariff rate, which is agreed as a maximum with the WTO; the applied rate, which refers to the actual rate being used, and the tariff averages, which refers to the weighted average rate of all the tariffs used in a country (Alemayehu, 2009).

Table 2.2: Tariff Reforms on Import

Rounds of Reforms	Year	Maximum Tariff	Average Tariff	Number of Tariff Bands
Before Reform	Before 1993	230	41.6	23
1st Round	August 1993	80	-	-
2nd Round	January 1996	60		
3rd Round	-----1997	60	-	-
4th Round	January 1998	50	21.5	
5th Round	December 1998	40	19.5	-
6th Round	January 2003	35	17.5	6

Source: Ministry of Finance and Economic Development.

These revisions were conducted in order to implement certain objectives such as to afford protection to domestic industries, to help domestic industries become competitive while at the same time ensuring consumer welfare, to eliminate some of the discrepancies and contradictions that existed within the tariff regimes.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Research Design and Approach

As the study tries to analyze the impact of WTO accession on the Ethiopian economy from the market access for trade in goods negotiation point of view, it employ the ex-ante analysis of a recursive DCGE modeling approach adopted by IFPRI and the analysis on tariffs by using secondary data of world tariff profiles. Therefore, the research design for the study is causal and the quantitative approach of recursive DCGE model is selected because it permits the ex-ante simulation of a change in trade policy, which involves projecting the future effects on a set of economic variables of interest. Concomitantly, the analysis of world tariff profiles presented in the form of tables gives an insight on countries' average applied and bound tariffs on agricultural as well as non- agricultural aggregated product groups of the complex world merchandise trade.

3.2. Data Sources and Methods of Data Collection

The study used secondary data sources to make a simulation using recursive DCGE. The main data source used for running the model is the updated version of 2005/06SAM. The 2005/06 Ethiopian SAM is constructed by EDRI and it is updated for 2015/16 Ethiopian economic performance in terms of 10.2% average real GDP growth from 2006-2016 as well as maintaining the sectoral shares of the Economy by 41.4%,15.6% and 43% for agriculture, industry and service sectors respectively. By doing so, the model is numerically calibrated based on the updated version of 2005/06 SAM. The 2016 world tariff profiles prepared by WTO, UNCTAD and ITC with the import data from Ethiopian Revenue and Customs Authority is the main secondary data used for the study.

3.2.1. Social Accounting Matrix (SAM)

Input-Output (IO) table provides a systematic description of each sector's interdependence by tracing the flows of goods and services from one sector of the economy to all other sectors (inter-sectoral flows) and to itself (intra-sectoral flows).

A Social Accounting Matrix (SAM) is a comprehensive, economy wide data framework, typically representing the economy of a nation. More technically, a SAM is a square matrix in which each account is represented by a row and a column. Each cell shows the payment from the account of its column to the account of its row. Thus, the incomes of an account appear along its row and its expenditures along its column. The underlying principle of double-entry accounting requires that, for each account in the SAM, total revenue (row total) equals total expenditure (column total) (IFPRI, 2002).

Being an extension of the existing national economic accounts, a SAM is a consistent and complete representation of the socio-economic system that captures the interdependencies of institutional groups. It is both a conceptual framework and a data system that can support analysis of socio-economic policy issues, used to evaluate the socio-economic impact of exogenous changes, or serve as a database for general equilibrium modeling (Trinh et. al, 2012).

The SAM therefore incorporates institutional and structural details that capture all transfers and real transactions between industries and institutions in an economy. Moreover, since it also incorporates the IO table, it is a comprehensive economy-wide database with internally consistent set of accounts for production, incomes and expenditures. While the IO table disaggregates value added in each production activity, the SAM extends to show how payments to primary factors (land, labor, capital) are distributed to different household groups. It disaggregates households into various groups and shows the flow of incomes and expenditures of each household (EDRI, 2009).

A SAM is constructed using several basic sources of economic information: the economy's input-output table, the national accounts, government budgetary accounts, balance of payments and trade statistics. The input-output table provides information on the production sector of the economy, showing detailed inter-industry linkages and the contribution made by primary factors of production to each sector. Thus we know how much steel, rubber, plastics, etc. goes into the car industry. The macroeconomic accounts provide a breakdown of

aggregate demand according to consumption, investment, government spending and the international sector (exports and imports). The trade account usually contains data on the destination and product composition of exports and imports. These have to be reconciled with the national accounts as well as with the input-output table. This integration means that the resulting SAM, for example, shows not only how much steel, rubber, plastics, goes into the car industry but how much of each of those inputs are sourced domestically and how much sourced from abroad and from which trade partner. The government fiscal accounts provide information on public expenditures and revenues. Integrated with the other accounts in the SAM, it is possible to obtain information on government spending on domestically produced goods and imports and to determine how much revenues are generated from taxes applied to international trade (tariffs) (Piermartini and Teh, 2005).

3.3. Methods of Data Analysis

3.3.1. Model Description

The study used the recursive DCGE Model to analyze the impact of Ethiopia's WTO accession on its economy. The CGE model provides analysts with a laboratory controlled simulation experiments; various mixes of policies in various second best environments can be explored and analyzed (EDRI, 2005).

The distinguishing feature of a dynamic CGE model is that growth of output is possible. In a dynamic CGE model, households choose a consumption plan (a sequence of consumption decisions) during the period under consideration which maximizes the discounted stream of their utilities. This means that in some periods, households may consume more than they earn (dissave) while in other periods, they may consume less than they earn (save). For their part, firms choose a production plan (a sequence of production decisions) that maximizes their discounted stream of profits. The availability of savings from households makes it possible for firms to turn these savings into new capital stock thereby augmenting their productive capacity. The growth rate in a dynamic CGE model is endogenously determined by the savings and investment behavior of households and firms (Piermartini and Teh, 2005).

The CGE model is recursive dynamic, which means that certain parameters are updated between periods based on historical trends or results from the previous period. During this

time the model captures exogenous demographic and technological changes. Changes in the population, labor supply, human capital, and TFP are drawn from historical trends. Capital accumulation is determined endogenously, with previous-period investment generating new capital stock (Diao and Thurlow, 2012).

3.3.2. Model Specification

A suitable model for making ex-ante analysis of change in trade policy is Computable General Equilibrium model which is a model of fundamental economic links between incomes of various groups, demand pattern, multi-sector production structure, and foreign economies. The model incorporates behavioral equations describing the economic actions of agents, and the technological and institutional constraints facing them (Thissen, 1998).

CGE models have their roots in the Walrasian general equilibrium theory, which was re-formalized in the 1950s. The study of Arrow and Debreu (1954) is one of the fundamental studies which states that the situation exists when all markets are in equilibrium and demand does not exceed supply. In the applied sense, CGE modeling starts with the Leontief input-output analysis described in Leontief (1936, 1941). The central idea of this approach is to consider inter-linkages between different industries and economic agents. The output of each industry is used as an input for other industries or goes to final consumption, making all agents dependent on each other (Eromenko, 2010).

CGE models include explicit specification of the behavior of several economic agents and captures inter-linkages between those agents, thus these models are general. Households maximize utility; while producers either maximize profits or minimize costs and make decisions on consumption and production based on optimizing assumptions. There are also behavioral equations for other agents, such as government, foreign sector participants, etc.

Demand and supply decisions of economic agents define the level of prices and production such that demand is equal to supply for all commodities and factors; markets are in *equilibrium*.

CGE models are solved using special software and produce numerical results, so they are *computable*.

CGE models can be used for real world applications with actual input data and relevant

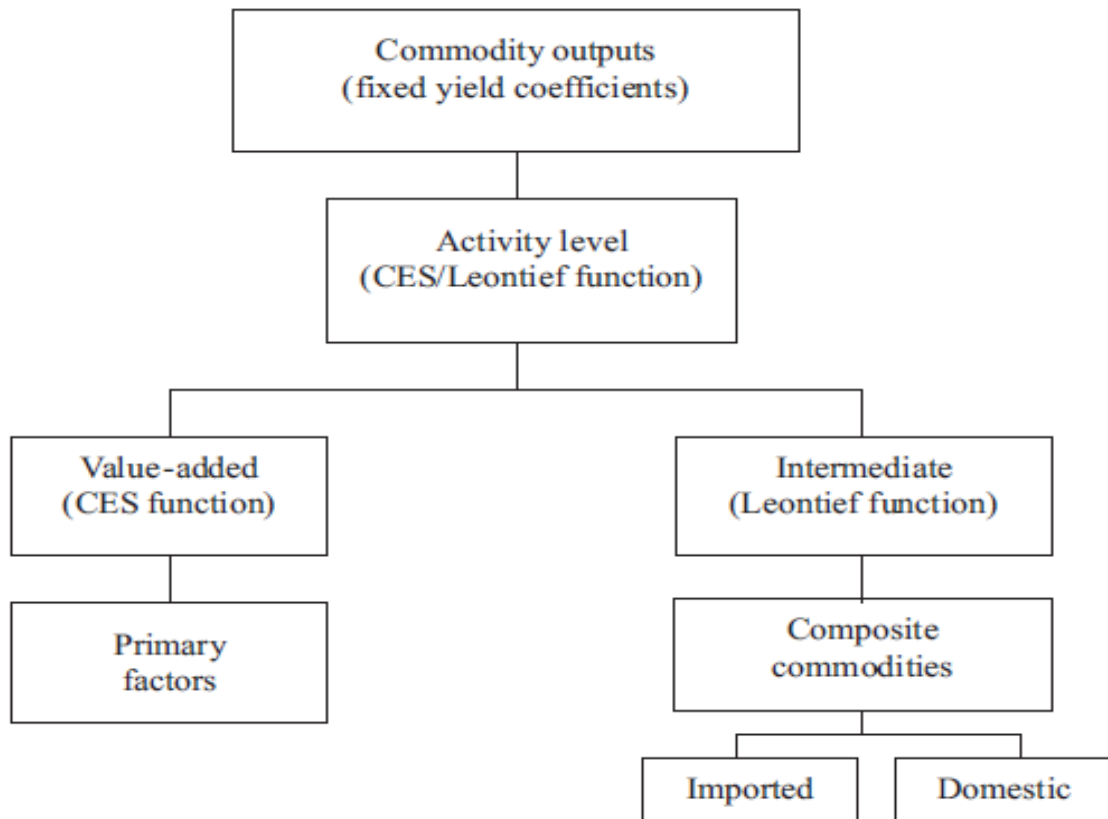
output. This feature makes the CGE method extremely useful for policy analysis of many issues, including changes in trade regime, tax reform, agricultural policy, regional development, etc. Because of this, such a model is also called an Applied General Equilibrium model (Ibid.).

3.3.2.1. Within –Period Component

(i) Production and prices

Producers combine primary factors with intermediate commodities to produce output. Three factors of production are identified in the model: capital, land and labour. Producers (or activities) are assumed to maximize profits subject to a production technology (Robinson, 2006). The technology is specified by a Constant Elasticity of Substitution (CES) function of the quantities of value-added and a Leontief function of aggregate intermediate input. Each activity produces one or more commodities according to a fixed yield coefficient. The optimal combination of factors is governed by a constant CES function. Producers respond to changes in relative factor returns by smoothly substituting between available factors. The factors are then combined with aggregate intermediate input to produce commodities. Given that an activity can produce more than one commodity, commodities produced by activities are related to activity levels using a Leontief production function. Notice that the use of fixed-shares is motivated by the fact that the combination of intermediate inputs per unit of output and the ratio of intermediate inputs to value added are determined by the level of technology. The final price of an activity's output is derived from the price of value-added and intermediates, together with any producer taxes or subsidies that may be imposed by the government per unit of output.

Figure 3.1: Production Technology



Source: Lofgren *et al.* (2002)

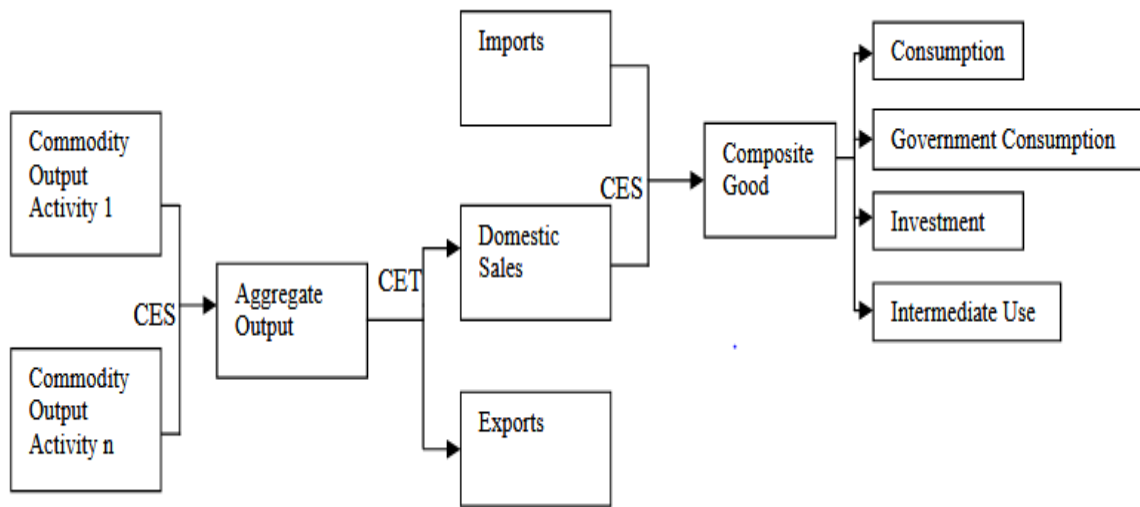
(ii) Commodity flow

It shows the flow of commodity from suppliers to the final demand. The supply of a particular commodity from each producer is combined to derive aggregate commodity output. The aggregate commodity output follows a CES function which allows demanders to substitute between the different producers supplying a particular commodity. Notice that the decision of producers is governed by a Constant Elasticity of Transformation (CET) function, which distinguishes between foreign and local markets. The choice of where to sell is determined by the profit or net revenue maximization principles, i.e. firms or producers sell in those markets where they can fetch the highest possible returns. Domestically produced commodities that are not exported are supplied to the domestic market.

On the demand side, consumers differentiate between local and imported goods and this imperfect substitution possibilities can be captured by a CES Armington specification. The

Armington elasticities vary across sectors, with lower elasticities reflecting greater differences between domestic and imported goods (Thurlow, 2008). The ratio of imports to domestic goods is determined by the cost minimizing decision-making of domestic demanders based on the relative prices of imports and domestic goods (both of which include relevant taxes. Under a small country assumption, Ethiopia is assumed to face exogenous world prices.

Figure 3.2 Flow of marketed commodities



Source: Morley *et al.* (2008)

(iii) Institutions and domestic demand

In the model, institutions are represented by households, enterprises, the government, and the rest of the world. Households are divided into groups: rural-poor, rural-non poor, urban-poor and urban-non poor. Households within each income category are assumed to have identical preferences, and are therefore modeled as ‘representative’ groups. Household preferences are represented by a Linear Expenditure System (LES) of demand, which is derived from the maximization of a Stone-Geary utility function subject to a household budget constraint.

Households receive income from the factors of production and transfers from other institutions. Transfers from the rest of the world to households are fixed in foreign currency as is the case for all transfers between the rest of the world and domestic institutions and factors. Households use their income to pay direct taxes, save, consume, and make transfers to other institutions. The direct taxes and transfers to other domestic institutions are defined as fixed shares of household income whereas the savings share is flexible for selected households.

Household consumption covers marketed commodities, purchased at market prices that include commodity taxes and transaction costs, and home commodities, which are valued at activity-specific producer prices. Household consumption is allocated across different commodities (both market and home commodities) according to LES demand functions, derived from maximization of a Stone-Geary utility function. Enterprises may also receive transfers from other institutions.

Enterprise incomes, which come from capital gain, are allocated to direct taxes, savings, and transfers to other institutions. Government collects taxes at fixed ad valorem rates and receives transfers from other institutions. Government consumes commodities and makes transfers to other institutions. It is assumed that both government consumption and transfer payments are fixed in real (quantity) terms. Government savings, the difference between government income and expenditure are assumed flexible. Final, transfer payments between the rest of the world and domestic institutions and factors are all fixed in foreign currency. Foreign savings or the current account deficit is the difference between foreign currency spending and receipts (Thurlow, 2008).

(iv) System constraint

Equilibrium in the goods market requires that demand for commodities equal supply. Aggregate demand for each commodity comprises household and government consumption spending, investment spending, and export and transaction services demand. Supply includes both domestic production and imported commodities. Equilibrium is attained through the endogenous interaction of domestic and foreign prices, and the effect that shifts in relative prices have on sectoral production and employment, and hence institutional incomes and demand. The supply of this factor is responsive to changes in real wage, which adjust to ensure that demand and supply are equal in equilibrium (Thurlow, 2008). The system constraint includes factor market, composite commodity market, and current account balance for the rest of the world, government balance and saving –investment balance.

3.3.2.2. Model Closure

- I. **External balance:** the level of foreign savings is fixed in foreign currency terms. In the context of a trade shock, like joining the WTO, any widening of the trade deficit due to growth in imports exceeding growth in exports must

therefore be offset through an overall reduction of spending on imports from all sources together with an overall increase in export earnings. This response is implicitly affected through a real exchange rate adjustment (current times Ethiopia use devaluation policy). Therefore the study use flexible exchange rate and fixed foreign saving.

- II. Government balance:** real expenditures and tax rates are fixed and government savings are flexible. Accordingly, the budget balance adjustments done by the government through a change in direct and indirect tax receipts, these are policy measures. Thus the study chooses government saving to be flexible and fixed tax rates.
- III. Savings-investment balance:** the savings rates of non-government institutions are fixed, and investment adjusts to ensure that savings equals investment in equilibrium. Hence, an increase in government dis-saving implicitly-crowds out investment by drawing down the amount of loan able funds available to the private sector. Therefore the study chooses the investment is saving driven closure.

Finally, the consumer price index is chosen as the numéraire, such that all prices in the model are relative to the numéraire. The model is homogenous of degree zero in prices, implying that a doubling of all prices does not alter the real allocation of resources. Accordingly, the model does not capture interactions between the financial and real sectors of the economy.

3.3.2.3. Between-period specification

The static model described has not able to account the second period effect. For instance change in capital on current investment depends upon the previous availability of capital. Therefore to solve this problem, the study use IFPRI model by Throw (2008), that extend static model into dynamic recursive model.

The dynamic model updates the parameter; it mainly focuses on capital formation, demographic and technological changes. The dynamic model is described as follows

- The process of capital accumulation is modeled endogenously, with previous-period investment generating new capital stock for the subsequent period. Although the allocation of new capital across sectors is influenced by each sector's initial share of aggregate capital income, the final sectoral allocation of capital in the current period is dependent on the capital depreciation rate and on sectoral profit-rate differentials from the previous period.
- Population growth is exogenously imposed on the model based on separately calculated growth projections. It is assumed that a growing population generates a higher level of consumption demand and therefore raises the supernumerary income level of household consumption. There is assumed to be no change in the marginal rate of consumption for commodities, implying that new consumers have the same preferences as existing consumers.
- Factor-specific productivity growth is imposed exogenously on the model based on observed trends for labour and capital.
- Growth in real government consumption and transfer spending is also exogenously determined between periods, since within-period government spending is fixed in real terms.

The dynamic model incorporates the following six equations in addition to the static model.

Cost Accumulation and Allocation Equations

$$AWF_{f,t}^a = \sum_a \left[\left(\frac{QF_{f,t}^a}{\sum_{a'} QF_{f,t}^{a'}} \right) WF_{f,t} \cdot WFDIST_{f,t}^a \right] \quad (1)$$

$$\eta_{f,t}^a = \left(\frac{QF_{f,t}^a}{\sum_{a'} QF_{f,t}^{a'}} \right) \left[\beta^a \left(\frac{WF_{f,t} \cdot WFDIST_{f,t}^a}{AWF_{f,t}^a} - 1 \right) + 1 \right] \quad (2)$$

$$\Delta K_{f,t}^a = \eta_{f,t}^a \left[\frac{\sum_c PQ_{c,t} \cdot QINV_{c,t}}{PK_{c,t}} \right] \quad (3)$$

$$PK_{c,t} = \sum_c PQ_{c,t} \left(\frac{QINV_{c,t}}{\sum_{c'} QINV_{c',t}} \right) \quad (4)$$

$$QF_{f,t+1}^a = QF_{f,t}^a \left(1 + \frac{\Delta K_{f,t}^a}{QF_{f,t}^a} - v_f \right) \quad (5)$$

$$QFS_{f,t+1}^a = QFS_{f,t}^a \left(1 + \frac{\sum \Delta K_{f,t}^a}{QFS_{f,t}^a} - v_f \right) \quad (6)$$

Source: Lofgren (2002).

Where

$AW_{f,t}^a$	Average capital rental rate in activity a at time t;
$WFDIST_{f,t}^a$	Distraction factor for capital f in activity a at time t;
$QINV_{c,t}$	Quantity of investment demand at time t;
$QF_{f,t}^a$	Quantity of demanded of factor f in activity a at time t;
$QFS_{f,t}^a$	Supply of capital f in activity a at time t;
$K_{f,t}^a$	Capital stock f employed in activity a at time t;
$\eta_{f,t}^a$	Share of new capital investment f for activity a at time t;
β^a	Inter-sectoral mobility of investment;
$PK_{c,t}$	Price of capital;
$PQ_{c,t}$	Price of commodity c; and
v_f	Depreciation of capital.

The dynamic model is solved as a series of equilibrium, each one representing a single year. By imposing the above policy-independent dynamic adjustments, the model produces a projected base year growth path. Policy changes can then be expressed in terms of change in relevant exogenous parameters, in our case, the change in import tariff rate and the model is re-solved for a new series of equilibriums. Differences between the policy- influenced new growth path and the base case growth path can then be interpreted as the economy- wide impact of the simulated policy.

3.3.3. Counterfactual Policy Simulations

The study lay out the counterfactual policy simulation scenarios based on the assumption of tariff reduction as a result of the accession to the WTO both during the accession process and once become the WTO member which would leads to trade policy reform and the designed model for the study is to test in what level the economy could be impacted by simulating each developed scenarios and to determine whether the reduction on average applied tariff rate for agricultural and non-agricultural product groups is acceptable or not. Since the current applied tariff reduction needs adjustment period of time; it is assumed that the tariff reduction is implemented after 10 years from now with the assumption that the economy keep the performance at the historical growth trend in the model based on the updated version of the 2005/06 SAM as the main data set. As a result the exogenous variable of tariff shock is introduced in 2027 and the model simulation gives results for four years up to 2030 to assess the changes on key economic variables as compared to the base.

In setting the counterfactual policy simulation scenarios; the 2016 world tariff profiles is used to get tariff data on product groups for agricultural¹ and non-agricultural sector².

Based on this tariff data; the average MFN applied tariff rate and simple average final bound rate for each product groups of Ethiopia and five WTO members namely Nepal, Cambodia, Afghanistan, Yemen and Liberia are organized to form the scenarios.

The WTO members mentioned above are selected as the best benchmark because of the reasons that they acceded to the WTO through accession process and at different time from Nepal's accession in 2004 to Liberia's accession in 2015, they have different negotiation experience with WTO members in terms of the commitments they have undertaken and more importantly their development status are similar with Ethiopia as they are LDCs.

Ethiopia's and these countries' simple average MFN applied tariff rate for each product groups under both agriculture and non-agriculture are compared as it is indicated that the Ethiopia's MFN applied tariff rates for different product groups are above the five Countries' average MFN applied tariff rate except for sugar & confectionary product group of agricultural

1 Animal Products; Dairy Products; Fruit, vegetables, plants Coffee, tea; Cereals & preparations; Oilseeds, fats &
2 Fish & fish products; Minerals & metals; Petroleum; Chemicals; Wood, paper, etc.; Textiles; Clothing; Leather, footwear, etc.; Non-electrical machinery; Electrical machinery; Transport equipment and Manufactures, n.e.s.

sector and petroleum & transport equipment product group of non-agricultural sector. In setting the scenarios; the tariff reduction of agriculture and non-agriculture with the protection of (keeping the current average applied tariff) the government's designated strategic sub-sectors which includes agro-processing, textile, clothing and leather & leather products are taken into account. As a result the study has designed the following three scenarios:

Scenario 1: Reduce the current average applied tariff rates of the agricultural sector to the average of the five WTO members for each product groups and keep the current applied tariff rate for non-agricultural Sector;

Scenario 2: Reduce the current average applied tariff rates of the non-agricultural sector to the average of the five WTO members for each product groups and keep the current applied tariff rate for Agricultural Sector;

Scenario 3: The combination of the above two scenarios.

3.3.3.1. Variable Definition & Hypothesis

As the study employs the recursive DCGE model; the exogenous variable which is determined outside the model for shocking the policy change to simulate the designed three scenarios in the model; is import tariff while the selected endogenous variables are real GDP at factor cost (GDPFC2), Absorption (ABSORP), Fixed Investment (FIXINV), Private Consumption (PRVCON), Imports, Exports and Government revenue which are macro-economic variables. In addition to that, price and quantity of import and export, household consumption expenditure and disaggregated activity production are endogenous variables.

According to international trade theory, it is hypothesized that because of tariff reductions real GDP at factor cost, absorption, private consumption, imports, exports and household consumption expenditure would increase while fixed investment, government revenue, price of import, price of export and disaggregated activity production would decrease.

CHAPTER FOUR: RESULTS & DISCUSSIONS

Accession to the WTO needs a comprehensive negotiation on various aspects including negotiation on market access for trade in goods and services which are taking place on bilateral basis with interested WTO members. The starting point in trade in goods negotiation is the submission of the initial offer by Ethiopia which needs setting bound tariff rates for each tariff lines according to the WCO HS classification and taking into account the simple applied tariff rates that Ethiopia currently uses with other duties and charges of 10% Sur tax which is applied only on imported products for which the negotiating WTO members wants binding at the current as well as the reduced applied tariff rates with the binding of ODCs at 0% as one of the means to achieve the objectives of the organization is progressive trade liberalization. On the other hand; Ethiopia wants a commitment that secures the highest policy space as the difference between the bound tariff rate and the applied tariff rate which is called “Binding Overhang” or “Water”; which enhances the country to raise the applied tariff up to the bound tariff rate when any kind of economic circumstances created such as import surge in the future after joining the organization since it has a legal background.

The two negotiating sides determine the simple average final bound tariffs by series negotiations as at what level it would have to be set. Even if this outcome is the result of the actual negotiation to be agreed on; the impact of possible outcomes should be evaluated to have a clear negotiation strategy as well as position as the economy might be affected positively as well as negatively. To have a clear stance and objective on the trade in goods negotiation; the model results and analysis on the applied as well as bound tariffs are linked to assess tariff reductions that could be resulted in both during and after the accession negotiation of the bilateral accession negotiation and the multilateral trade negotiation once become WTO member respectively; by taking longer time period of ten years for implementation. In line with that the possible commitment range for the negotiation on bound tariffs in which it is considered as acceptable by WTO members and best for Ethiopia for both agricultural and non-agricultural sectors is specified.

The source of results of the study is from simulation by using recursive DCGE and secondary data analysis. Recursive DCGE model can be applied to come up with numerical forecasts by obtaining results for endogenous variables based on certain assumptions about exogenous variables, their functional forms, and parameter values.

The study have used the updated version of 2005/06 SAM as a main data source to run recursive DCGE model by using GAMS software for the simulation of the three scenarios developed and analysis is to be made on the outcome of the simulation on key endogenous economic variables which are changed from the baseline because of the tariff shock introduced as an exogenous variable in the discussion part. The result of the model helps to assess the impact of reductions for the average applied tariff on the economy that Ethiopia used currently if it would be agreed as part of the accession negotiation to the WTO on the market access for trade in goods or once become a WTO member through multilateral tariff negotiation to fulfill the organization objective of progressive liberalization. The three scenarios that are simulated are tariff reduction in agricultural as well as non-agricultural sectors separately by protecting the government's strategic sub-sectors and the combination of the two scenarios as the third scenario of the full impact of tariff reduction. In the second part by using secondary data of the 2016 world tariff profiles for Ethiopia's and the six WTO members' namely Nepal, Cambodia, Yemen, Afghanistan, Laos and Liberia which are acceded to the WTO through accession process at different period of time with different kinds of commitments on market access on trade in goods with LDCs status; average MFN applied and bound tariff rate for agricultural and non-agricultural product groups are assessed to set the range of the simple average bound tariff that would be acceptable by members of the WTO and the best commitment on market access for trade in goods for Ethiopia. The two results from the recursive DCGE model simulation and analysis on tariffs are presented as follows by using tables and charts along with discussion for assessing the impact of tariff reduction on the economy and setting the range for average bound tariff on both agricultural and non-agricultural sectors.

4.1. Model Result

To present and make analysis on the model result; key economic variables are selected as they are relevant to the study objectives. The impact of the three simulated scenarios on real GDP, government revenue, price and quantity of imports & exports, household consumption expenditure is presented as follows.

4.1.1. Impact of Tariff Reduction on Macro-Economic Variables

4.1.1.1. Real GDP

Table 4.1: Impact of Tariff Reduction on Key Macro-Economic Variables (% change from initial value)

Macro-Economic Variables	INITIAL	BASE	Scenario 1	Scenario 2	Scenario 3
ABSORP	164208.7	9.0621	9.0627	9.0929	9.0932
PRVCON	112060.7	10.2449	10.246	10.2808	10.2815
FIXINV	31885.83	3.9881	3.9821	3.9736	3.9675
EXPORTS	16531.69	15.5501	15.6086	15.744	15.7977
IMPORTS	-46849.4	11.5799	11.6277	11.7387	11.7829
GDPFC2	122324.8	10.2643	10.2728	10.3157	10.3236

Source: CGE Simulation Result

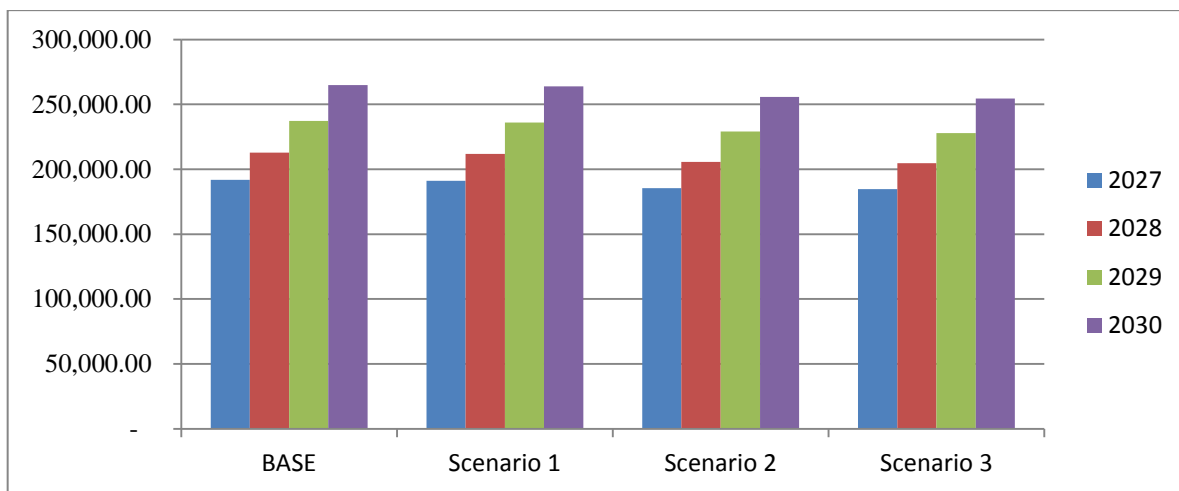
The above table shows percentage change of the three simulations on key macro-economic variables by using the three scenarios. All variables except fixed Investment have positive value in all simulated three scenarios but the third scenario as the reduction of tariffs in both agriculture and non-agriculture with keeping the current applied average tariff on strategic sub-sectors have the highest percentage change for exports and imports by 0.25% and 0.2% from the base while private consumption and absorption are increased by 0.04% and 0.03% respectively from the base. However, fixed investment is decreased by 0.02%. Overall, real GDP at factor cost is increased by 0.06%.

To make analysis on the model result, the third scenario which is tariff reduction on both agriculture and non-agriculture by maintaining the current applied average tariffs on the strategic sub-sectors is used because it shows the full impact on the economy. As compared to the base scenario of no exogenous shock of tariff reductions by maintaining the current status-quo; the third scenario have a positive moderate increase in real GDP at factor cost by 0.06% because of the reason that a decrease in fixed investment by 0.02% compensated by higher increase in private consumption by 0.04% with the slight improvement of trade balance by 0.04% as export and import increased by 0.25% and 0.2% respectively. The increase in export and import is attributed to the economic reasoning that tariff reductions makes increase in the demand for import as the import price decreases in Birr which makes imports less expensive and the real exchange rate depreciates as Birr becomes cheaper in terms of USD because of

the assumption that the current account balance is fixed; in reaction to the rise in import demand the exchange rate decreases as a result of the increase in the demand for foreign exchange which also encourages exports by making it cheaper in the world market.

4.1.1.2. Impact of Tariff Reduction on Government Revenue

Figure 4.1: Government Revenue (Millions of Birr)



Source: CGE Simulation Result

The above graph shows that the amount of the government revenue in millions of Birr for the time period from 2027 to 2030 for the base and the three scenarios. As it can be seen; the government revenue decreases in all scenarios as compared to the base because of certain tariff reduction applied in the respective scenarios simulations but the amount of decrement varies from one scenario to the other. The third scenario resulted in the highest reduction of the government revenue because of the combined effect of tariff reduction on both agricultural and non-agricultural sector with the tariff protection of the strategic sub-sectors to make them to be competitive in the domestic and world market. The government revenue in the third scenario is reduced by 3.82%, 3.87%, 3.90% and 3.89% in 2027, 2028, 2029 and 2030 respectively as compared with the government revenue in the base scenario. As a result government saving which are flexible decreases by 6.75% on average from 2027 to 2030 of the period for tariff shock. As imports of Ethiopia concentrates on non-agriculture products than agriculture products; greater decrease in government revenue in the second scenario of tariff reduction for imports of non-agricultural products than agricultural imports are resulted.

4.1.2. Impact of Tariff Reduction on Import and Export

4.1.2.1. Price of Import

Table 4.2: Import Price by Sectors (% growth)

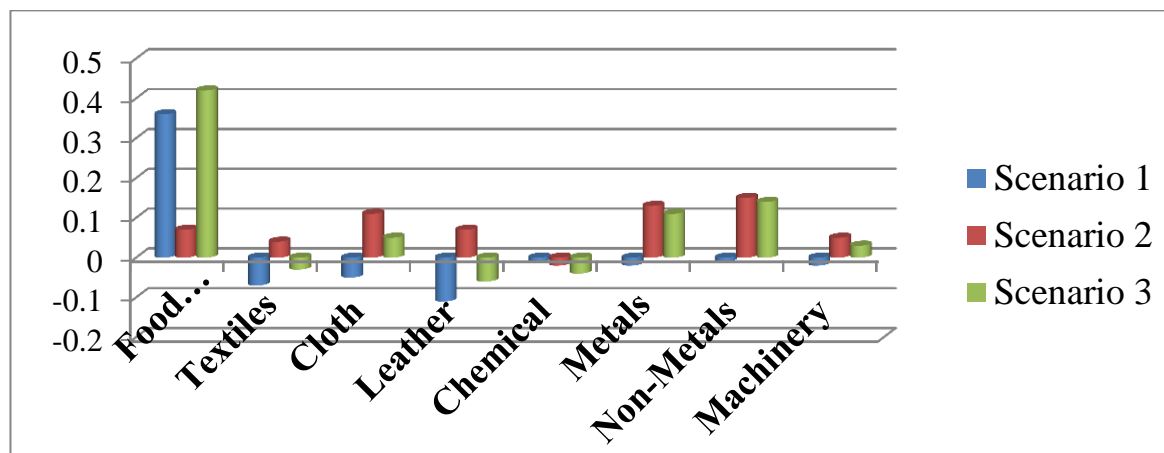
Sectors of the Economy	BASE	Scenario 1	Scenario 2	Scenario 3
Agriculture Sector	-2.07	-2.29	-2.11	-2.33
Manufacturing sector	-2.05	-2.03	-2.14	-2.12
Service Sector	-2.10	-2.05	-2.15	-2.09

Source: Own Computation based on CGE Result

The average percentage change in import prices for agriculture, non-agriculture and service sectors for the base and the three scenarios are presented in the above table in which it is indicated reduction by negative value. The highest decrease for agriculture is emanated from the third scenario which is the tariff reduction of both agriculture and non-agriculture with the protection of the strategic sub-sector as import prices are decreased by 2.33% on average while for non-agriculture the second scenario produces a 2.14% decrease in import price followed by the third scenario with 2.12% and the first scenario with 2.03% reduction on average. The same is true for service sector as Non-Agriculture since the second scenario forces the average import prices to decrease by 2.15%.

4.1.2.2. Quantity of Import

Figure 4.2: Import Quantity by Commodity (% Change)



Source: CGE Simulation Result

The above chart indicates that the percentage change in quantity of imports for major import items in the three scenarios from the base which have mixed results. Food processing has greater percentage change in the first and third scenarios as compared to other major import items with positive change in all three scenarios. While textiles and leather which are the government's strategic sub-sectors decreases its imports of quantity by 0.03% and 0.06% respectively but it is increased for cloth by 0.05% in the third scenario.

4.1.2.3. Price of Export

Table 4.3: Export Price by Sectors (% growth)

Sectors of the Economy	BASE	Scenario 1	Scenario 2	Scenario 3
Agriculture Sector	-2.20	-2.14	-2.29	-2.23
Manufacturing sector	-2.26	-2.20	-2.41	-2.34
Service Sector	-2.10	-2.05	-2.15	-2.09

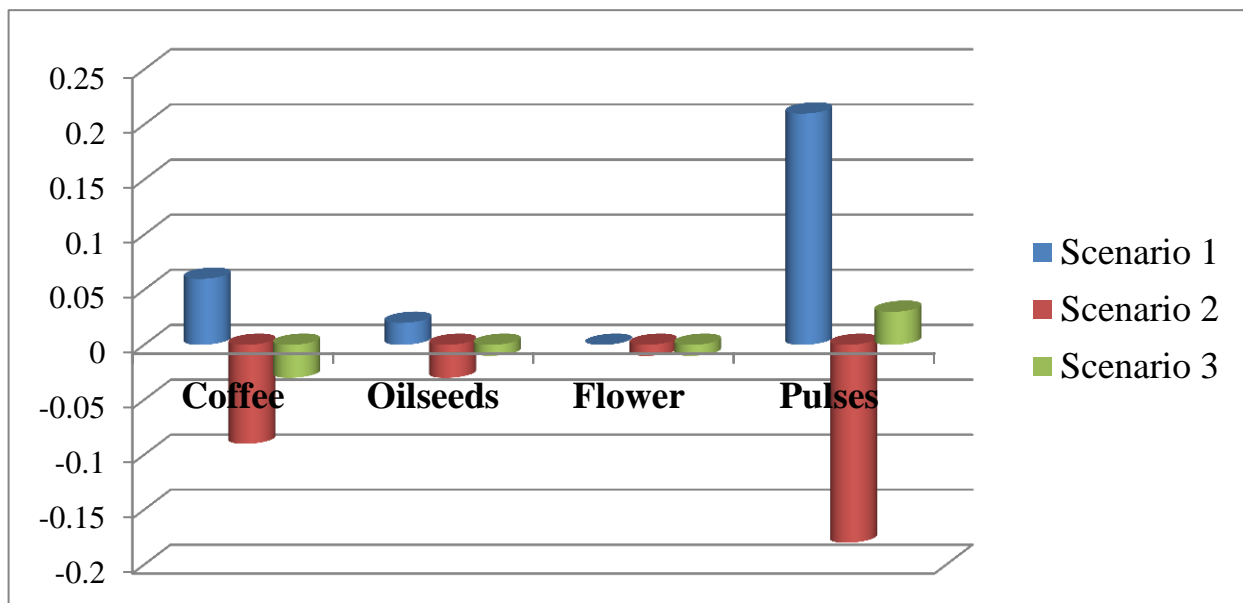
Source: Own Computation based on CGE Result

As the price of imports, the average percentage change on the price of export for the three sectors in the economy is presented on the above table which has a negative value of

reduction. As Ethiopian major export items are agricultural products; the highest decrease is on the second scenario (2.29%) which is the reduction of tariffs for non-agricultural sector while the third scenario (2.23%) has a lower decrease in the price of export as compared to the second scenario but higher reduction in relation to the base (2.20%) and the first scenarios (2.14%).

4.1.2.4. Quantity of Export

Figure 4.3: Export Quantity by Commodity (% Change)

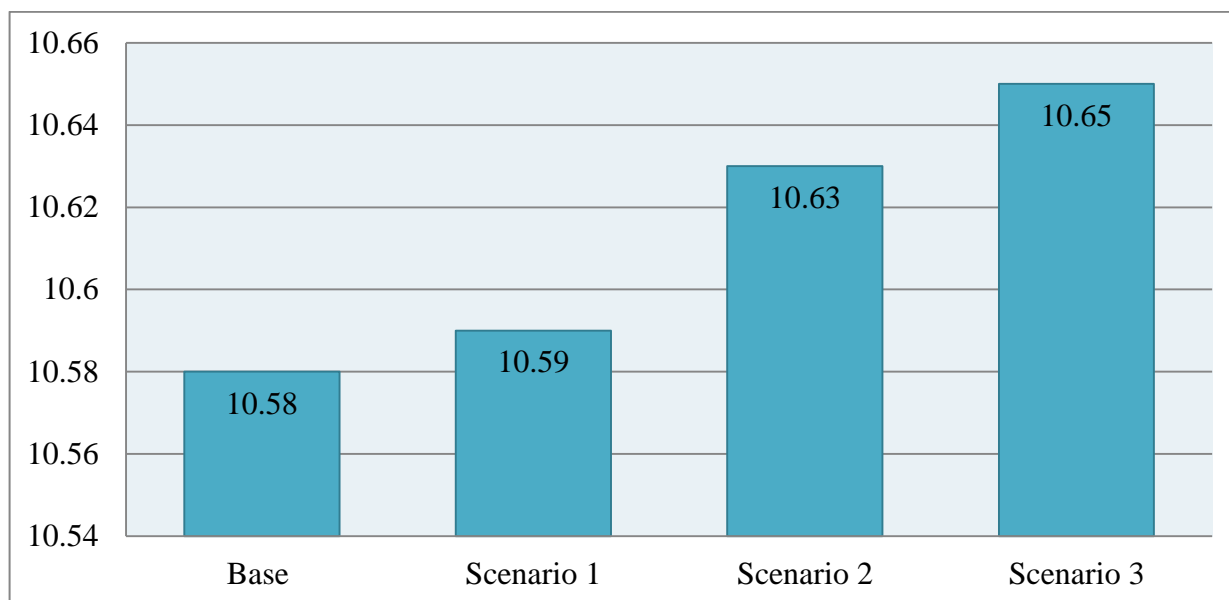


Source: CGE Simulation Result

As the above chart shows, the growth in quantity of major agricultural export items in the first scenario is stronger as coffee (0.06%), oilseeds (0.02%) and pulses (0.21%) increases in relation to the base but for flower it is not changed. The third scenario has shown that the export quantity of Coffee decreased by 0.03% and of Oilseeds & Flower by 0.01% but the export quantity of pulses is increased by 0.03%.

4.1.3. Impact of Tariff Reduction on Disaggregated Activity Production Levels

Figure 4.4: Disaggregated Activity Production Levels (total % change)



Source: CGE Simulation Result

As the above chart shows, the total percentage change in the disaggregated activity production levels increases in all scenarios as compared to the base as the third scenario has the highest percentage change by 10.65% with the second scenario by 10.63% while the first scenario by 10.59% has occupied the second and third position respectively. However, there is the variation across the commodity of agricultural, non-agricultural and services sectors as there is an increment, decrement and no change for the three scenarios as compared to the base percentage change. For example, the government's strategic sub-sectors for which there is no tariff reductions like textile have higher percentage change in the first scenario (12.11%) as compared to the base (12.08%) while leather has increased from the base (4.73%) for the first scenario (4.81%) and the third scenario (4.78%). (See Appendix G for detail)

4.1.4. Impact of Tariff Reduction on Household Consumption Expenditure

Table 4.4: Household Consumption Expenditure (% change)

Groups of Households	INITIAL	BASE	Scenario 1	Scenario 2	Scenario 3
hh-hc-pr ³	9456.87	8.03	8.01	8.04	8.02
hh-hc-np	31233.85	9.91	9.92	9.93	9.93
hh-ho-pr	5147.47	7.99	8.01	8.02	8.04
hh-ho-np ⁴	13319.32	9.78	9.80	9.80	9.82
hh-dp-pr ⁵	5626.93	8.73	8.71	8.74	8.73
hh-dp-np	12147.93	9.89	9.89	9.91	9.91
hh-pa-pr	1178.18	7.836	7.836	7.853	7.85
hh-pa-np ⁶	5964.60	9.56	9.57	9.58	9.59
hh-nf-pr ⁷	2248.20	9.57	9.59	9.61	9.63
hh-nf-np	14618.52	9.05	9.08	9.08	9.11
hh-lu-pr	1173.74	9.73	9.75	9.76	9.78
hh-lu-np ⁸	9945.08	9.34	9.358	9.364	9.39

Source: CGE Simulation Result

The above table reflects the households' growth in consumption expenditure in terms of percentage change for poor (pr) and non-poor (np) households lived in the six agro-ecological zones that the SAM designated. As expected because of tariff reductions which induce imports to be cheap; the consumption expenditure in the three scenarios increases as compared to the base growth rate. In the third scenario; as there is tariff reduction on both sectors with the exception of some sub-sectors which are identified as the strategic ones, the growth percentages are higher with the exception of poor household in humid cereals (hh-hc-pr) which is lowered by 0.01% and no percentage change in poor household in draught prone (hh-dp-pr).

Households are better off since tariff reduction leads to a drop in price for the majority of consumption goods and services in the domestic market; which in turn improves the

³ Household in Humid Cereals(poor)

⁴ Household in Humid Enset (non-poor)

⁵ Household in Drought Prone(poor)

⁶ Household in Pastoralist(non-poor)

⁷ Household in Small Urban(poor)

⁸ Household in Large Urban(non-poor)

purchasing power of households to spend more and the consumption expenditure for the ten out of twelve household groups increases with the exception of poor household in draught prone (hh-dp-pr) and poor household in humid cereals (hh-hc-pr).

4.2. Analysis on Applied and Bound Tariffs

A number of countries that joined the organization after 1995 through accession process have taken a commitment to bind at a lower tariff rate as their applied tariff rate is decreased. For example as China's simple average final bound is 15.7% for agriculture and 9.2% for non-agriculture, Vietnam bound its tariff at 19.1% for agriculture and 10.4% for non-agriculture while Ukraine's simple average final bound is 11% and 5% for the two sectors in its order. But for LDCs, there is some flexibility in the level of commitments they would undertake through the negotiation process by taking into accounts their development status by WTO members to facilitate their accession process in order to enhance the integration of its economy into the multilateral trading system as the adoption of the 2002 guideline for LDCs accession even if it is not implemented practically in the recent LDCs accession yet.

Based on the world tariff profile; simple average MFN applied tariff and simple average final bound for agricultural and non-Agricultural sectors by product groups for Ethiopia and six WTO members namely Cambodia, Nepal, Afghanistan, Liberia, Laos and Yemen are organized to make analysis. For analysis on the simple average MFN applied tariff; Laos is not included because of some product groups have higher applied tariff than the bound tariff because of the transition period for adjustment that the country acquired in the accession negotiation. These WTO members are selected for the reason that their economic development is similar with Ethiopia as they are all LDCs, they acceded WTO through accession negotiation process and the commitments they have agreed can be taken as the benchmark given the two reasons. The results of the analysis on tariffs are presented below.

4.2.1. Comparison of Applied Tariffs on Agricultural Sector among different Countries

Table 4.5: Simple Average MFN Applied Tariffs on Agricultural Product Groups (%)

Product Groups	Nepal	Cambodia	Yemen	Afghanistan	Liberia	Maximum	Average	Ethiopia
Beverages & tobacco	57.0	23.7	13.4	10.2	21.5	57	25.2	32.1
Coffee, tea	23.3	26.7	12.4	6.8	16.3	26.7	17.1	28.8
Fruit, Vegetables, Plants	11.6	11.9	16.2	11.3	10.9	16.2	12.4	28.0
Dairy Products	16.0	20.9	6.0	9.2	7.9	20.9	12.0	27.5
Animal Products	10.5	26.7	12.0	3.9	5.3	26.7	11.7	22.1
Cereals & preparations	13.3	12.4	6.4	6.3	9.7	13.3	9.6	19.4
Oilseeds, fats & oils	9.5	8.1	6.5	2.9	8.4	9.5	7.1	16.2
Other Agricultural Products	8.2	11.1	6.0	5.1	11.8	11.8	8.4	15.2
Sugar & confectionery	14.4	7.0	5.4	5.9	13.2	14.4	9.2	8.5
Cotton	14.0	0.0	9.0	2.5	5.0	14	6.1	10.0
Average	14.3	14.9	10.4	7.1	10.6	14.9	11.9	22.1

Source: Own Computation based on World Tariff Profiles

As the above table indicated Ethiopia has the highest average MFN applied tariff rate on coffee, tea (28.8%), fruit, vegetables, plants (28%), dairy products (27.5%), cereals & preparations (19.4%), oilseeds, fats & oils (16.2%) and other agricultural products (15.2%) as compared with five members of the WTO. The agricultural simple average MFN applied tariff rate of Ethiopia is also high with 22.1 % as a 7.2 percentage point difference with the 14.9% of Cambodia which is ranked first in comparison with the remaining four acceded countries to the WTO. The maximum average MFN applied tariff applied by the four acceded WTO members ranges from 57% on beverages & tobacco and 9.5% on oilseeds, fats & oils applied by Nepal. The current simple average MFN applied tariff of Ethiopia for the ten product groups under agricultural sector is higher than the five WTO members average tariffs which are used for developing the three scenarios with non-agricultural sector product groups for simulation in the model as the result is presented in the above section.

4.2.2. Comparison of Applied Tariffs on Non-Agricultural Sector among different Countries

Table 4.6: Simple Average MFN Applied Tariffs on Non-Agricultural Product Groups (%)

Product Groups	Nepal	Cambodia	Yemen	Afghanistan	Liberia	Maximum	Average	Ethiopia
Clothing	19.9	14.1	10.0	9.9	20.0	20.0	14.8	35.0
Textile	12.6	5.4	6.1	4.8	11.7	12.6	8.1	28.0
Fish and Fish Products	10.6	22.5	24.6	4.7	8.9	24.6	14.3	21.3
Manufactures, n.e.s	11.6	14.7	5.4	7.7	15.7	15.7	11.0	21.7
Petroleum	21.2	9.9	7.6	8.6	9.2	21.2	11.3	6.4
Transport Equipment	19.5	15.8	6.5	7.0	8.3	19.5	11.4	11.4
Leather, footwear etc	11.5	12.6	7.3	6.6	13.3	13.3	10.3	18.6
Electrical Machinery	10.6	17.3	5.1	6.1	9.5	17.3	9.7	17.4
Wood, Paper etc	14.0	9.9	6.2	5.7	15.6	15.6	10.3	11.9
Minerals and metals	12.5	7.4	6.4	6.0	7.6	12.5	8.0	13.5
Non-Electrical Machinery	6.9	13.4	5.0	3.8	7.4	13.4	7.3	8.0
Chemicals	11.4	7.3	5.7	5.0	6.9	11.4	7.3	10.9
Average	12.0	10.6	7.0	5.7	10.1	12.0	10.3	16.6

Source: Own Computation based on World Tariff Profiles

The above table shows the Simple average MFN applied tariff rate on product groups for non-agricultural sector of Ethiopia and the five WTO members. Ethiopia has applied the highest applied tariff rate on clothing (35%), textile (28%), manufactures, nes (21.7%), leather, footwear etc (18.6%), electrical machinery (17.4%) and minerals & metals (13.5%). Among the listed product groups clothing, textile and leather, footwear etc have got special attention as they are strategic sub-sectors because of the comparative advantage they have over other sub-sectors and protected by tariffs to be competitive in the domestic and international market. Ethiopia has also the highest average MFN applied tariff rate on non-agricultural sector (16.6%) as Nepal (12%) have the highest among the five WTO members.

The highest average MFN applied tariff rate on product groups of the five acceded WTO members ranges from 24.6% on fish and fish products applied by Yemen to 11.4% on

chemicals applied by Nepal. The average for the simple average MFN applied tariff on the twelve product groups of the sector is lower than Ethiopia except petroleum (11.3%) which is higher by 4.9% and It is the same for transport equipment (11.4%).The average tariffs in percentages are used for developing the scenarios with the agricultural sector to simulate by using the model and the results are presented in the above section.

As the tables on comparison of applied tariffs on agricultural and non-agricultural sector among different countries shows Ethiopia have the highest simple average applied MFN tariffs on both agricultural and non-agricultural sectors in terms of both sectoral and product groups as compared to the five selected acceded LDCs to the WTO of which the commitments they have undertaken are used as a benchmark for Ethiopia’s WTO accession as the trade in goods negotiation have a profound impact on the economy and have a center stage role in the whole process of accession negotiation which is very tedious, complex and time taking as the gap between the interests of WTO members and the stance that Ethiopia could have wouldn’t have been minimized without long and difficult bilateral market access trade in goods negotiations.

4.2.3. Comparison of Bound Tariffs on Agricultural Sector of WTO member Countries

Table 4.7: Final Average Bound Tariffs on Agricultural Product Groups (%)

Product Groups	Nepal	Cambodia	Yemen	Afghanistan	Liberia	Laos	Maximum	Average
Beverages & tobacco	85.7	42.8	44.4	58.2	26.6	17.6	85.7	45.9
Cereals & preparations	45.9	29.1	20.3	36.2	21.3	16.0	45.9	28.1
Dairy Products	45.8	36.5	17.5	31.2	23.2	5.0	45.8	26.5
Fruit, Vegetables, Plants	40.6	26.4	29.5	45.8	24.2	19.5	45.8	31.0
Sugar & confectionery	45.0	27.8	20.5	35.3	21.6	14.1	45.0	27.4
Coffee, tea	40.8	36.6	40.3	16.7	27.8	41.7	41.7	34.0
Animal Products	36.0	32.5	22.4	30.5	33.2	16.7	36.0	28.6
Cotton	36.0	7.0	25.0	20.2	15.0	9.0	36.0	18.7
Oilseeds, fats& oils	34.2	21.9	20.3	18.0	20.2	19.4	34.2	22.3
Other Agricultural Products	30.8	23.3	19.3	22.7	18.4	22.1	30.8	22.8
Average	41.5	28.2	25.0	33.7	23.8	19.2	41.5	28.5

Source: Own Computation based on World Tariff Profiles

The above table shows the six acceded WTO members commitments on simple average final bound tariff on ten product groups of agriculture with the maximum and average tariffs. The maximum bound tariff of the sector is Nepal's commitment which is the first LDC to accede to the WTO on 41.5% while the minimum is of Laos which gets a transition period to adjust to the agreed bound tariff on 19.2%. In terms of product groups; beverages & tobacco (85.7%), cereals & preparations (45.9%), dairy Products (45.8%) and sugar & confectionery (45%) by Nepal and fruit, vegetables, plants (45.8%) by Afghanistan have the highest bound tariff as compared to other product groups. The average bound tariff of the six acceded LDCs in terms of product groups ranges from 45.9% for beverages & tobacco to 18.7% for cotton. The distribution of the maximum simple average final bound tariffs with the average tariffs is different as there is an even distribution of the final bound tariffs among the selected member states.

4.2.4. Comparison of Bound Tariffs on Non-Agricultural Sector of WTO member Countries

Table 4.8: Final Average Bound Tariffs on Non-Agricultural Product Groups (%)

Product Groups	Nepal	Cambodia	Yemen	Afghanistan	Liberia	Lao PDR	Maximum	Average
Fish and Fish Products	23.1	23.6	42.0	6.9	35.5	30.7	42.0	27.0
Wood, Paper etc	24.5	25.1	21.5	10.0	32.1	29.4	32.1	23.8
Leather, footwear etc	27.3	28.7	21.5	8.7	30.3	25.9	30.3	23.7
Manufactures, n.e.s	20.9	25.2	19.7	10.5	30.2	22.3	30.2	21.5
Clothing	29.9	17.5	25.0	29.9	30.0	19.9	30.0	25.4
Textile	26.3	10.0	21.7	15.2	28.1	17.7	28.1	19.8
Transport Equipment	27.6	24.4	20.8	6.9	22.9	20.0	27.6	20.4
Electrical Machinery	20.9	27.2	17.7	5.8	21.5	13.2	27.2	17.7
Chemicals	21.5	9.6	18.5	6.4	27.1	19.6	27.1	17.1
Minerals and metals	25.3	20.4	19.2	11.7	26.6	15.5	26.6	19.8
Petroleum	15.0	23.9	24.0	13.3	24.0	6.7	24.0	17.8
Non-Electrical Machinery	19.5	15.6	19.7	4.8	20.5	12.5	20.5	15.4
Average	23.6	17.8	20.6	10.3	27.2	18.7	27.2	20.8

Source: Own Computation based on World Tariff Profiles

As the above table shows Liberia has secured the highest simple average final bound tariff on non-agricultural sector by 27.2% and Afghanistan have the lowest Bound tariff with 10.3%. As compared to agriculture, non-agriculture have lower average Bound tariffs on both sectoral and product groups terms as there is only one product group above 40% which has agreed on fish and fish Products (42%) by Yemen and the next product groups with highest simple average final bound tariffs are wood, paper etc (32.1%), leather, footwear etc (30.3%), manufactures, n.e.s (30.2%) and clothing (30%) agreed by Liberia. The average of the bound tariffs of the six acceded WTO members ranges from 27% for fish and fish products to 15.4% for non-electrical machinery which is the same as the maximum bound tariffs as it shows even distribution of bound tariffs in terms of product groups among the six member countries.

As the tables presented on the comparison of bound tariffs on agricultural and non-agricultural sectors of WTO member Countries tries to show the comparison of the simple average final

bound tariffs of the six WTO members on both product groups and sectoral basis; the range of the simple average bound tariff is calculated by taking the average and the maximum of each product groups of the six acceded WTO members under both sectors and the average is calculated to give simple average bound tariff for the two sectors. The range helps to predict the possible as well as realistic commitments on trade in goods on the basis of the simple average final bound tariff commitments of these member countries taken on both sectors.

The calculated result specified that the range for the simple average bound tariff is 28.5% to 44.7% for agriculture while 20.8% to 28.8% for non-agriculture. The upper limit bound tariffs for both sectors are higher than the maximum of Nepal's 41.5% for agricultural sector and Liberia's 27.2% for non-agricultural sectors among the six acceded WTO members. As the difference between the simple average bound tariff and the simple average MFN applied tariff; the range gives a policy space from 6.4% to 22.6% for agriculture and 4.2% to 12.2% for non-agriculture since Ethiopia's simple average MFN applied tariff is 22.1% for agriculture & 16.6% for non-agriculture.

As the simple average bound tariff approaches to the upper limit; it gives greater policy space to Ethiopia because having the highest simple average final bound tariff have a number of advantages which includes:

- It could be used as a safeguard mechanism when the country faces an import surge;
- It will halt to further tariff reductions in the multilateral trade negotiation once become the WTO member because it creates a negotiation space;
- It could be used as to protect strategic sectors in the future.

CHAPTER FIVE: CONCLUSION & RECOMMENDATIONS

5.1. Conclusion

Ethiopia started its accession process to the WTO after formal application in 2003. The submission of Memorandum on Foreign Trade Regime(MFTR) in 2006 and replied for three rounds of questions raised by the working party members of the WTO which are interested in Ethiopia's accession to the WTO with the conduct of three working party meetings are followed. As the fact finding continues throughout the accession negotiation process; the submission of an initial offer on goods which consists of a tariff schedule with an indication of the "bound" level of tariffs is the starting point to make the bilateral negotiation with interested working party members that continues until all sides are satisfied with the offer. After concluding the bilateral negotiations; the agreement will be signed between Ethiopia and each of the working party members that makes the negotiation. The same negotiation process is also applied to market access for trade in services. Finally, all commitments and concessions will be combined to have a single Schedule of Concessions and Commitments on Goods and the Schedule of Specific Commitments on Services which are the main accession package and legally binding after membership depending on the terms and conditions of the outcome of the negotiation.

On the basis of this fact, the main endeavor of the study is to analyze the impact of Ethiopia's accession to the WTO from the perspective of the market access for trade in goods negotiation on the economy. In relation to that, the range for the simple average bound tariff on both agricultural and non-agricultural sectors as the likely negotiation outcome is identified. To achieve the objective of the study, It is used the recursive DCGE Model and tariff analysis in the form of table presentation.

The model used the updated version of the 2005/06 SAM as a main dataset to simulate the three developed scenarios of tariff reductions on the current simple average applied tariff of Ethiopia on both Sectors in terms of its product groups by keeping the strategic sub-sectors for the economy separately and the combined two scenarios as a third scenario. It is assumed that tariff reductions are implemented after 10 years from now for making adjustment and the time period for the simulation output of the designed scenarios is from 2027 to 2030. The third

scenario as a combination of tariff reductions on both sectors without the strategic sub sector enhances to assess the full impact as the difference from the base scenario to analyze the impact on the economy. According to the simulation result; export and import increased by 0.25% and 0.2% which improve the trade balance by 0.04%, an increase in private consumption by 0.04% and a decrease in fixed investment by 0.02%. Overall there is a positive increment of real GDP at factor cost by 0.06%.

The disaggregated activity production levels increases in total percentage change terms in all three scenarios as compared to the base but there are variations in terms of commodity and the third scenario has the higher increase of the total percentage change from 10.58% of the base to 10.65%. The Households welfare is become increased since the consumption expenditure of the ten out of twelve household groups increases as compared with the base with the exception of poor household in draught prone (hh-dp-pr) and poor household in humid Cereals (hh-hc-pr).

As tariff reductions have a negative effect on government revenue, it is decreased by 3.82%, 3.87%, 3.9% and 3.89% in 2027, 2028, 2029 and 2030 respectively as compared to the base scenario of the current status quo.

According to the model result, it can be conclude that tariff reductions to some extent in the long run as part of WTO accession process and multilateral trade negotiation once become a WTO member have a positive impact on the economy but there are some endogenous economic variables that have a negative effect like government revenue and fixed investment. However, to keep the current economy performance as it is since tariff reductions require a policy change and time to be implemented for adjustment; the current accession negotiation wouldn't have brought such a policy change at least in the short run.

The status of the country's development might bring some flexibility in the accession process to be given by WTO members as they have taken a commitment to facilitate and accelerate the accession of LDCs and more importantly based on the experience the six WTO members namely Cambodia, Nepal, Afghanistan, Liberia, Laos and Yemen which are selected for the reason that their economic development is similar with Ethiopia as they are all LDCs, acceded to WTO through accession negotiation process and the commitments they have agreed are taken as the benchmark given the two reasons; provide its own implication for Ethiopia's possible concessions and commitment on the market access for trade in goods.

Based on these countries commitment on simple average final bound tariff, the range for the bound tariff rates in which it is considered as best for Ethiopia and acceptable by WTO members on agricultural and non-agricultural sectors is identified as 28.5% to 44.7% for agriculture while 20.8% to 28.8% for non-agriculture. The upper limit bound tariffs for both sectors are higher than the maximum of Nepal's 41.5% for agricultural sector and Liberia's 27.2% for non-agricultural sectors among the six acceded WTO members. As the difference between the simple average bound tariff and the simple average MFN applied tariff; the range gives a policy space from 6.4% to 22.6% for agriculture and 4.2% to 12.2% for non-agriculture since Ethiopia's simple average MFN applied tariff is 22.1% for agriculture & 16.6% for non-agriculture.

As the simple average bound tariff approaches to the upper limit; it gives greater policy space to Ethiopia which could be used as to protect its development interests in general and as a safeguard mechanism when an import surge arises, to halt further tariff reductions in the multilateral trade negotiation once become the WTO member as it creates enough negotiation space and to protect strategic sectors in the future in particular.

5.2. Recommendations

Based on the study results discussed and the conclusion given; the following recommendations are outlined:

- As the model result shows, the reduction of the current simple average applied tariff on agricultural and non-agricultural sectors in the long run have a positive impact on key economic variables including real GDP at factor cost, export, import and consumption. Therefore, Ethiopia should have designed a well evaluated trade policy framework that have a strategy and program which enhances the integration of the country to the multilateral trading system and have taken into account the domestic interests as well as the protection of key strategic sectors that would have the economy as part of the accession process to the WTO in the short run and once become a WTO member in the long run;
- Ethiopia should have pursue a negotiation strategy that would secure the maximum benefit from the trade in goods negotiation to achieve the upper limit of the simple

average final bound range as the study identify at 44.7% for agricultural sector and 28.8% for non-agricultural sector because of the reason that it guarantees higher policy space of 22.6% and 12.2% as the country in need of using for the future;

- As the Ethiopian economy grows; the demand from WTO members would rise and the cost of accession increases even further which minimize the flexibility could be granted as an LDC and increase the possible level of commitment that Ethiopia would agree because of the reason that Ethiopia's development status could be changed as the government targets to become middle income country by 2025. To avoid such possibilities; the government should give stronger commitment to facilitate Ethiopia's accession to the WTO through strengthen institutional capacity, better coordination with different stakeholders including the private sector to take into account their interest on the negotiation with other measures;
- Ethiopia should have establish a road map for WTO accession negotiation along with other regional and bilateral trade negotiation such as the Continental (CFTA) and COMESA Free Trade Area in order to make the country beneficial from such negotiation outcomes and increase the contribution of international trade to the country's development in general and economic growth in particular.

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LIST OF APPENDICES

Appendix A: Definition of Product Groups

Product Group	Harmonized System nomenclature 2012
Agricultural Products	
Animal products	Ch. 01, Ch. 02, 1601-02
Dairy products	0401-06
Fruit, vegetables, plants	Ch. 07, Ch. 08, 1105-06, 2001-08,0601-03, 1211, Ch. 13, Ch. 14
Coffee, tea	0901-03, Ch. 18 (except 1802), 2101
Cereals and preparations	0407-10, 1101-04, 1107-09, Ch. 19, 2102-06, 2209, Ch. 10
Oilseeds, fats & oils	1201-08, Ch. 15 (except 150410, 150420), 2304-06, 3823
Sugars and confectionery	Ch. 17
Beverages and Tobacco	2009, 2201-08 & Ch. 24
Cotton	5201-5203
Other agricultural Products	Ch.05 (except 0508, 051191), 0604, 1209-10, 1212-14, 1802, 230110, 2302-03, 2307- 09, 290543-45, 3301, 3501-05, 380910, 382460, 4101-03, 4301, 5001- 03, 5101-03, 5301-02 & 0904-10
Non-Agricultural Products	
Fish and fish products	Ch. 03, 0508, 051191, 150410, 150420, 1603-05, 230120
Minerals and metals	2601-17, 2620, Ch. 72-76 (except 7321-22), Ch. 78-83 (except 8304-05),Ch. 25, 2618-19, 2621, 2701-04, 2706- 08, 2711-15, Ch.31, 3403, Ch. 68-71 (except 6807, 701911-19, 701940-59), 911310-20
Petroleum	2709-10
Chemicals	2705, Ch. 28-30 (except 290543-45, 300590), Ch. 32- 33 (except3301, 330620) , Ch. 34 (except 3403, 3406), 3506-07, 3601-04, Ch. 37-39 (except 380910, 3823, 382460, 392112-13, 392190)
Wood, paper, etc.	Ch.44, 45, 47, 48, 49, 9401-04 (except 940490), 961900
Textiles	300590, 330620, 392112-13, 392190, 420212, 420222, 420232, 420292, Ch. 50-60 (except 5001-03, 5101-03, 5201-03, 5301-02), Ch. 63, 640520, 640610, 6501-05, 6601, 701911-19,

	701940-59, 870821, 8804, 911390, 940490, 961210
Clothing	Ch. 61-62
Leather, footwear, etc.	Ch. 40, Ch. 41 (except 4101-4103), 4201-05 (except 420212, 420222, 420232, 420292), 4302-04, Ch. 64 (except 640520, 640610), 9605
Non-electrical machinery	7321-22, Ch. 84 (except 846721-29), 850860, 852841, 852851, 852861, 8608, 8709
Electrical machinery	846721-29, Ch. 85 (except 850860, 852841, 852851, 852861, 8519-8523 but including 852352)
Transport equipment	Ch. 86 (except 8608), 8701-08 (except 870821), 8711-14, 8716, 8801-03, Ch. 89
Manufactures, not elsewhere specified	2716, 3406, 3605-06, 4206, Ch. 46, 6506-07, 6602-03, Ch. 67, 6807, 8304-05, 8519-23 (excluding 852352), 8710, 8715, 8805, Ch. 90-93 (except 9113), 9405-06, Ch. 95-97 (except 9605, 961210, 961900)

Appendix B: Macro-Economic Variables (% change)

Macro-Economic Variables	INITIAL	BASE	Scenario 1	Scenario 2	Scenario 3
ABSORP	164208.673	9.0621	9.0627	9.0929	9.0932
PRVCON	112060.681	10.2449	10.246	10.2808	10.2815
FIXINV	31885.8335	3.9881	3.9821	3.9736	3.9675
DSTOCK	4351.4823	-	-	-	-
GOVCON	15910.6763	5.7	5.7	5.7	5.7
EXPORTS	16531.6899	15.5501	15.6086	15.744	15.7977
IMPORTS	46849.3958	11.5799	11.6277	11.7387	11.7829
GDPMP	133890.967	9.6001	9.6008	9.6338	9.634
GDPMP2	133890.967	9.6001	9.6008	9.6338	9.634
NETITAX	11566.161	-	-	-	-
GDPFC2	122324.806	10.2643	10.2728	10.3157	10.3236

Appendix C: Price of Imports (% change)

Commodities		INITIAL	BASE	Scenario 1	Scenario 2	Scenario 3
cwhea	row	21.1904	-2.0849	-2.3361	-2.1202	-2.3686
cmaiz	row	14.2749	-2.0954	-2.3629	-2.1366	-2.4015
cpuls	row	39.5390	-2.0852	-2.3237	-2.1207	-2.3564
cvege	row	19.7643	-2.0796	-2.4776	-2.1121	-2.5065
cfrui	row	8.8416	-2.0281	-2.3063	-2.0328	-2.3060
ccott	row	70.1245	-2.0908	-2.1690	-2.1294	-2.2053
cteal	row	48.8727	-2.0277	-2.2180	-2.0323	-2.2185
ctoba	row	88.5754	-2.0356	-2.1285	-2.0444	-2.1343
ccoff	row	311.6267	-2.0615	-2.3080	-2.0842	-2.3271
cocrp	row	26.4175	-2.0492	-2.2468	-2.0653	-2.2592
ccatt	row	1.0462	-2.0921	-2.3684	-2.1315	-2.4051
cmilk	row	1.0181	-2.0983	-2.5389	-2.1410	-2.5790
cpoul	row	1.0375	-2.0940	-2.3733	-2.1344	-2.4111
caprd	row	1.0216	-2.0975	-2.2729	-2.1398	-2.3129
cfish	row	0.7142	-2.0270	-1.9734	-2.1828	-2.1279
cfore	row	1.1360	-2.0746	-2.0195	-2.1265	-2.0695
ccoal	row	1	-2.0634	-2.0086	-2.2462	-2.1898
cngas	row	1	-2.0676	-2.0128	-2.2566	-2.2000
comin	row	1.3146	-2.0469	-1.9927	-2.2061	-2.1503
cmeat	row	1	-	-	-	-
cdair	row	1.0581	-2.0897	-2.0341	-2.1276	-2.0700
cvprd	row	1.3451	-2.0430	-1.9888	-2.0557	-1.9999
cgmll	row	1.1310	-2.0733	-2.0183	-2.1024	-2.0455
cpsgr	row	1.5449	-2.0147	-1.9466	-2.0124	-1.9430
cptea	row	1.2342	-2.0556	-2.2922	-2.0751	-2.3079

cfood	row	1.1579	-2.0706	-2.3127	-2.0983	-2.3370
cbeve	row	1.5305	-2.0201	-2.0987	-2.0206	-2.0962
cptob	row	1.6926	-2.0003	-2.0610	-1.9903	-2.0481
ctext	row	1.1549	-2.0708	-2.0158	-2.0984	-2.0416
cclth	row	1.4288	-2.0320	-1.9782	-2.0388	-1.9835
cleat	row	1.1665	-2.0636	-2.0089	-2.0874	-2.0309
cwood	row	1.1274	-2.0761	-2.0210	-2.1568	-2.0998
cpapr	row	1.1326	-2.0748	-2.0197	-2.1544	-2.0975
cprtl	row	1	-2.0362	-1.9823	-1.9217	-1.8660
cfert	row	1	-2.0443	-1.9901	-2.1997	-2.1441
cchem	row	1.2694	-2.0504	-1.9961	-2.1661	-2.1101
cnmet	row	1.6499	-2.0114	-1.9583	-2.2815	-2.2273
cmetl	row	1.3426	-2.0368	-1.9828	-2.1814	-2.1261
cmach	row	1.1846	-2.0662	-2.0114	-2.2145	-2.1579
cvehe	row	1.1421	-2.0710	-2.0160	-2.0982	-2.0414
ceequ	row	1.1220	-2.0698	-2.0148	-2.2979	-2.2413
coman	row	1.0531	-2.0907	-2.0351	-2.4676	-2.4103
cwatr	row	1	-2.1025	-2.0465	-2.1475	-2.0894
ctrad	row	1	-2.1025	-2.0465	-2.1475	-2.0894
chotl	row	1	-2.1025	-2.0465	-2.1475	-2.0894
ctran	row	1	-2.1025	-2.0465	-2.1475	-2.0894
ccomm	row	1	-2.1025	-2.0465	-2.1475	-2.0894
cfsrv	row	1	-2.1025	-2.0465	-2.1475	-2.0894
cbsrv	row	1	-2.1025	-2.0465	-2.1475	-2.0894
creal	row	1	-2.1025	-2.0465	-2.1475	-2.0894
cosrv	row	1	-2.1025	-2.0465	-2.1475	-2.0894
ceduc	row	1	-2.1025	-2.0465	-2.1475	-2.0894
cheal	row	1	-2.1025	-2.0465	-2.1475	-2.0894

Appendix D: Quantity of Imports (% change)

Commodities		INITIAL	BASE	Scenario 1	Scenario 2	Scenario 3
cwhea	row	93.08	12.69	13.59	12.81	13.66
cmaiz	row	0.17	11.45	11.85	11.53	11.92
cpuls	row	8.9	14.45	15.01	14.57	15.12
cvege	row	0.16	12.33	13.15	12.44	13.25
cfroi	row	2.11	11.4	11.94	11.45	11.98
ccott	row	0.05	25.79	26.14	25.75	26.09
cteal	row	0.02	18.17	18.21	18.17	18.21
ctoba	row	0.67	15.32	15.34	15.22	15.24
ccoff	row	0.01	11.79	12.82	11.81	12.83
cocrp	row	11.02	15.34	15.9	15.43	15.98
ccatt	row	4.01	16.17	16.84	16.3	16.97
cmilk	row	1.86	23.26	25.35	23.51	25.58
cpoul	row	6.16	13.16	13.6	13.25	13.68
caprd	row	3.53	12.9	13.18	12.99	13.27
cfish	row	5.57	11.15	11.1	11.38	11.33
cfore	row	1.89	19.1	18.99	19.38	19.27
ccoal	row	12.27	-7.72	-7.62	-7.87	-7.78
cngas	row	26.93	11.82	11.78	12.06	12.01
comin	row	41.33	29.03	28.96	29.16	29.08
cdair	row	83.69	22.51	22.32	22.73	22.52
cvprd	row	758.97	11.44	11.4	11.48	11.43
cgmll	row	111.51	6.5	5.71	6.76	6.02
cpsgr	row	343.02	12.48	12.38	12.46	12.35
cptea	row	1.95	18.59	18.99	18.64	19.03

cfood	row	421.24	15.89	16.25	15.96	16.31
cbeve	row	208.57	8.98	9.1	9.01	9.14
cptob	row	64.45	11.59	11.68	11.61	11.7
ctext	row	1627.98	12.73	12.66	12.77	12.7
cclth	row	1066.05	9.63	9.58	9.74	9.68
cleat	row	113.08	18.01	17.9	18.08	17.95
cwood	row	374.32	7.66	7.6	7.81	7.75
cpapr	row	713.87	11.54	11.61	11.29	11.36
cptrl	row	8711.25	10.23	10.22	10.2	10.2
cfert	row	1932.41	10.04	10	10.03	9.99
cchem	row	4886.66	12.14	12.13	12.12	12.1
cnmet	row	350.89	15.72	15.7	15.85	15.83
cmetl	row	4943.66	9.81	9.8	9.96	9.95
cmach	row	5652.38	5.06	5.04	5.11	5.09
cvehe	row	4536.71	7.91	7.9	8.01	7.99
ceequ	row	4784.4	15.89	15.88	16.37	16.37
coman	row	463.45	13.81	13.75	15.01	14.95
cwatr	row	1.7	8.21	8.11	8.34	8.24
ctrad	row	84.33	11.41	11.42	11.55	11.57
chotl	row	494.38	9.89	9.88	9.89	9.88
ctran	row	7458.89	10.86	10.87	10.95	10.96
ccomm	row	302.88	11.11	11.11	11.2	11.19
cfsrv	row	564.09	10.79	10.78	10.86	10.86
cbsrv	row	1694.03	10.98	11	10.88	10.9
creal	row	32.15	10.82	10.8	10.88	10.86
cosrv	row	2.92	11.96	11.93	12.11	12.09
ceduc	row	72.53	7.69	7.68	7.75	7.73
cheal	row	2.92	8.02	8.01	8.07	8.05

Appendix E: Price of Exports (% change)

Commodities		INITIAL	BASE	Scenario 1	Scenario 2	Scenario 3
cpuls	row	36.6224	-2.1229	-2.0663	-2.1790	-2.1201
coils	row	24.4589	-2.1868	-2.1281	-2.2786	-2.2172
cvege	row	17.8339	-2.1311	-2.0742	-2.1918	-2.1326
cfrui	row	6.1882	-2.3184	-2.2555	-2.4867	-2.4196
cchat	row	183.4822	-2.5145	-2.4450	-2.8043	-2.7281
ccoff	row	272.0684	-2.1666	-2.1086	-2.2471	-2.1865
cflow	row	144.9792	-2.1347	-2.0777	-2.1974	-2.1380
cocrp	row	20.5592	-2.2027	-2.1436	-2.3037	-2.2415
ccatt	row	1	-2.1139	-2.0575	-2.1651	-2.1065
cmilk	row	1	-2.1068	-2.0507	-2.1541	-2.0959
cpoul	row	1	-2.1116	-2.0554	-2.1616	-2.1032
caprd	row	1	-2.1077	-2.0515	-2.1555	-2.0972
cfish	row	1	-2.3273	-2.2642	-2.5010	-2.4335
cdair	row	1	-2.1169	-2.0605	-2.1698	-2.1112
cgmll	row	1	-2.1417	-2.0845	-2.2083	-2.1487
cpsgr	row	1	-2.4882	-2.4196	-2.7612	-2.6862
cptea	row	1	-2.1824	-2.1239	-2.2718	-2.2105
cfood	row	1	-2.1467	-2.0894	-2.2162	-2.1563
cbeve	row	1	-2.4028	-2.3371	-2.6222	-2.5513
cptob	row	1	-3.1241	-3.0320	-3.8624	-3.7500
ctext	row	1	-2.1465	-2.0892	-2.2158	-2.1560
cclth	row	1	-2.2883	-2.2264	-2.4388	-2.3730
cleat	row	1	-2.1616	-2.1037	-2.2393	-2.1788
cwood	row	1	-2.1368	-2.0798	-2.2007	-2.1413
cpapr	row	1	-2.1391	-2.0819	-2.2042	-2.1447

cchem	row	1	-2.1986	-2.1396	-2.2972	-2.2352
cmctl	row	1	-2.2584	-2.1975	-2.3915	-2.3270
cvehe	row	1	-2.1460	-2.0887	-2.2150	-2.1552
ceequ	row	1	-2.1484	-2.0910	-2.2187	-2.1588
ctrad	row	1	-2.1025	-2.0465	-2.1475	-2.0894
chotl	row	1	-2.1025	-2.0465	-2.1475	-2.0894
ctran	row	1	-2.1025	-2.0465	-2.1475	-2.0894
ccomm	row	1	-2.1025	-2.0465	-2.1475	-2.0894
cfsrv	row	1	-2.1025	-2.0465	-2.1475	-2.0894
cbsrv	row	1	-2.1025	-2.0465	-2.1475	-2.0894
creal	row	1	-2.1025	-2.0465	-2.1475	-2.0894
cosrv	row	1	-2.1025	-2.0465	-2.1475	-2.0894

Appendix F: Quantity of Exports (% change)

Commodities		INITIAL	BASE	Scenario 1	Scenario 2	Scenario 3
cpuls	row	5.5	1.02	1.23	0.84	1.05
coils	row	43.94	6.44	6.46	6.41	6.43
cvege	row	2.93	2.84	3.05	2.71	2.92
cfrui	row	3.84	4.14	4.32	3.77	3.96
cchat	row	1.66	-8.07	-7.87	-8.98	-8.76
ccoff	row	9.27	6.18	6.24	6.09	6.15
cflow	row	0.88	2.69	2.69	2.68	2.68
cocrp	row	12.63	-2.05	-1.83	-2.4	-2.16
ccatt	row	484.57	-0.58	-0.47	-0.71	-0.59
cmilk	row	25.12	-6.71	-6.52	-6.93	-6.73
cpoul	row	26.13	2.28	2.36	2.2	2.28

caprd	row	194.19	1.95	2.04	1.87	1.96
cfish	row	26.99	2.96	2.99	2.64	2.67
cdair	row	24.84	-6.35	-6.14	-6.61	-6.38
cgml	row	219.8	14.54	16.33	13.97	15.62
cpsgr	row	75.12	-0.98	-0.78	-1.6	-1.38
cptea	row	23.56	-3.28	-2.94	-3.45	-3.11
cfood	row	51.37	-4.88	-4.58	-5.01	-4.71
cbeve	row	59.02	12.66	12.67	12.29	12.31
cptob	row	7.36	14.56	14.78	13.46	13.7
ctext	row	121.96	11.3	11.42	11.11	11.24
clth	row	8.69	25.4	25.47	24.39	24.47
cleat	row	430.59	-5.51	-5.26	-5.79	-5.52
cwood	row	0.96	21.48	21.57	20.81	20.92
cpapr	row	67.11	30.45	30.61	29.48	29.68
cchem	row	229.7	-27.91	-27.66	-28.16	-27.9
cmctl	row	333.73	15.28	15.41	14.8	14.95
cvehe	row	135.1	9.68	9.68	9.74	9.74
ceequ	row	172	34.88	34.89	35.54	35.56
ctrad	row	336.42	11.15	11.17	11.16	11.18
chotl	row	403.54	9.57	9.58	9.53	9.54
ctran	row	4600.16	12.63	12.62	12.42	12.42
ccomm	row	512.29	12.17	12.16	12.02	12.02
cfsrv	row	237.67	9.59	9.61	9.56	9.58
cbsrv	row	380.18	15.9	16.02	15.2	15.32
creal	row	101.83	7.63	7.66	7.66	7.69
cosrv	row	76.21	8.6	8.6	8.58	8.58

Appendix G: Disaggregated Activity Production Levels (% change)

Activities	INITIAL	BASE	Scenario 1	Scenario 2	Scenario 3
ateff-hc	3164.97	14.44	14.46	14.46	14.48
ateff-ho	350.47	-3.17	-3.11	-3.2	-3.14
ateff-dp	1464.43	-0.3	-0.18	-0.3	-0.18
ateff-pa	34.36	-12.32	-12.26	-12.36	-12.3
abarl-hc	1693.74	12.16	12.18	12.17	12.18
abarl-ho	153.61	9.11	9.13	9.12	9.14
abarl-dp	660.48	9.28	9.37	9.31	9.4
abarl-pa	33.91	-2.58	-2.55	-2.59	-2.56
awhea-hc	2989.17	7.71	7.45	7.6	7.32
awhea-ho	337.52	4.42	4.18	4.31	4.06
awhea-dp	956.76	16.22	16.01	16.16	15.94
awhea-pa	73.63	-3.64	-3.88	-3.76	-4.02
amaiz-hc	3189.26	8.1	8.11	8.09	8.1
amaiz-ho	502.17	1.8	1.86	1.81	1.86
amaiz-dp	1004.63	10.9	11	10.93	11.03
amaiz-pa	329.49	3.17	3.2	3.17	3.19
asorg-hc	1270.27	11.99	12.01	11.99	12
asorg-ho	77.29	4.7	4.76	4.71	4.77
asorg-dp	841.88	7.93	8.03	7.95	8.06
asorg-pa	292.45	9.89	9.91	9.89	9.91
apuls-hc	2425.11	5.33	5.27	5.3	5.24
apuls-ho	453.08	11.3	11.26	11.29	11.25
apuls-dp	1054.42	8.77	8.79	8.76	8.79
apuls-pa	121.2	11.38	11.32	11.36	11.3
aoils-hc	1130.34	6.97	6.97	6.97	6.97

aoils-ho	4.58	6.97	6.97	6.97	6.97
aoils-dp	663.5	6.97	6.97	6.97	6.97
aoils-pa	56.82	6.97	6.97	6.97	6.97
avege-hc	752.84	2.66	2.66	2.65	2.65
avege-ho	474.95	10.37	10.41	10.38	10.42
avege-dp	253	7.55	7.64	7.57	7.66
avege-pa	149.48	10.95	10.95	10.94	10.95
afrui-hc	92.78	2.46	2.43	2.43	2.39
afrui-ho	119.98	10.14	10.14	10.13	10.13
afrui-dp	18.51	7.33	7.39	7.33	7.39
afrui-pa	18.4	10.72	10.68	10.69	10.65
anset-hc	877.55	9.24	9.24	9.24	9.24
anset-ho	1020.93	9.24	9.24	9.24	9.24
acott-hc	401.04	8.23	8.23	8.23	8.23
acott-dp	171.87	8.23	8.23	8.23	8.23
asugr-hc	137.33	8.51	8.51	8.51	8.51
asugr-ho	173.17	8.51	8.51	8.51	8.51
asugr-dp	28.03	8.51	8.51	8.51	8.51
asugr-pa	11.45	8.51	8.51	8.51	8.51
ateal-hc	15.89	5.38	5.38	5.38	5.38
achat-hc	376.11	6.61	6.61	6.61	6.61
achat-ho	155.7	6.61	6.61	6.61	6.61
achat-dp	53.06	6.61	6.61	6.61	6.61
achat-pa	1365.26	6.61	6.61	6.61	6.61
atoba-ho	18.91	-0.14	-0.14	-0.14	-0.14
acoff-hc	2705.96	7.95	7.95	7.95	7.95
acoff-ho	1374.99	7.94	7.94	7.94	7.94
acoff-dp	73.9	7.94	7.94	7.94	7.94
acoff-pa	507.34	7.94	7.94	7.94	7.94

aflow-hc	144.98	3.21	3.21	3.21	3.21
aocrp-hc	1414.14	2.24	2.11	2.19	2.06
aocrp-ho	315.27	10.77	10.68	10.76	10.67
aocrp-dp	957.1	8.24	8.18	8.24	8.19
aocrp-pa	161.2	11.88	11.74	11.86	11.72
acatt-hc	3560.11	7.42	7.42	7.42	7.43
acatt-ho	1246.68	7.44	7.45	7.45	7.45
acatt-dp	1443.55	7.34	7.35	7.35	7.36
acatt-pa	390.42	7.39	7.39	7.39	7.4
amilk-hc	4242.21	7.33	7.35	7.32	7.33
amilk-ho	1610.28	7.36	7.37	7.35	7.36
amilk-dp	1308.98	7.26	7.28	7.25	7.26
amilk-pa	752.44	7.31	7.32	7.29	7.31
apoul-hc	246.61	7.56	7.57	7.57	7.57
apoul-ho	95.62	7.59	7.59	7.59	7.6
apoul-dp	130.64	7.49	7.5	7.49	7.5
apoul-pa	34.17	7.53	7.54	7.54	7.54
aaprd-hc	1185.56	7.17	7.18	7.17	7.19
aaprd-ho	298.49	7.2	7.21	7.2	7.21
aaprd-dp	704.24	7.1	7.11	7.1	7.12
aaprd-pa	236.97	7.14	7.15	7.14	7.16
afish	42.86	5.08	5.08	4.97	4.97
afore	6207.91	7.52	7.51	7.49	7.48
aomin	735.59	3.59	3.59	3.59	3.59
adair	4111.41	7.4	7.44	7.38	7.41
avprd	8.41	9.09	9.13	9.12	9.15
agmll	655.35	12.33	13.66	11.94	13.13
amsrv	873.12	15.35	15.31	15.3	15.25
apsgr	1159.73	7	7.05	7.02	7.07

aptea	131.73	7.32	7.35	7.32	7.35
afood	2478.49	5.44	5.44	5.44	5.44
abeve	1834.78	10.57	10.55	10.52	10.49
aptob	229.37	13.11	13.14	13.02	13.03
atext	1349.88	12.08	12.11	12.05	12.08
aclth	353.85	16.66	16.66	16.34	16.34
aleat	1065.56	4.73	4.81	4.7	4.78
awood	107.85	14.09	14.1	13.78	13.8
apapr	699.74	23.22	23.35	22.4	22.57
achem	1610.35	-9.15	-9.01	-9.35	-9.21
anmet	1167.76	-24.92	-24.81	-25.31	-25.19
ametl	1963.92	13	13.07	12.68	12.75
amach	15.32	2.71	2.72	2.72	2.72
avehe	410.85	9.12	9.11	9.19	9.18
aeegu	304.59	33.86	33.87	34.51	34.53
aoman	1590.08	12.69	12.65	12.47	12.44
aelec	1474.49	12.35	12.35	12.31	12.31
awatr	1571.06	11.06	11.05	11.09	11.08
acons	23717.22	4.8	4.8	4.8	4.8
atrad	26047.8	11.28	11.3	11.35	11.37
ahotl	8254.24	9.72	9.72	9.7	9.7
atran	8633.52	12.28	12.27	12.12	12.12
acomm	1624.54	11.83	11.82	11.75	11.75
afsrv	3457.68	10.15	10.16	10.17	10.18
absrv	448.87	15.78	15.89	15.08	15.2
areal	10146.35	9.21	9.21	9.25	9.25
aosrv	2922.12	10.24	10.23	10.31	10.29
apadm	10428.19	5.73	5.73	5.73	5.73
aeduc	5236.44	6.2	6.19	6.18	6.18

aheal	1409.95	6.6	6.58	6.57	6.56
total	191638.57	10.58	10.59	10.63	10.65

Appendix H: Government Revenue (Millions of Birr)

Year	BASE	Scenario 1	Scenario 2	Scenario 3
2027	191,972.48	191,047.51	185,584.41	184,635.04
2028	212,816.60	211,784.50	205,649.73	204,590.44
2029	237,213.26	236,127.65	229,100.01	227,968.22
2030	264,957.54	263,904.55	255,797.22	254,643.95

Appendix I: Model Specification

Appendix I1: Model Sets, Parameters and Variables

Symbol	Explanation	Symbol	Explanation
Sets			
$a \in A$	Activities	$c \in CMR(\subset C)$	Regionally imported commodities
$a \in ALEO(\subset A)$	Activities with a Leontief function at the top of the technology nest	$c \in CMNR(\subset C)$	Non-regionally imported commodities
$c \in C$	Commodities	$c \in CT(\subset C)$	Transaction service commodities
$c \in CD(\subset C)$	Commodities with domestic sales of domestic output	$c \in CX(\subset C)$	Commodities with domestic production
$c \in CDN(\subset C)$	Commodities not in CD	$f \in F$	Factors
$c \in CE(\subset C)$	Exported commodities	$i \in INS$	Institutions (domestic and rest of world)
$c \in CEN(\subset C)$	Commodities not in CE	$i \in INSD(\subset INS)$	Domestic institutions
$c \in CM(\subset C)$	Aggregate imported commodities	$i \in INSDNG(\subset INSD)$	Domestic non-government institutions
$c \in CMN(\subset C)$	Commodities not in CM	$h \in H(\subset INSDNG)$	Households
Parameters			
$cwts_c$	Weight of commodity c in the CPI	pwm_c	Import price (foreign currency)
$dwts_c$	Weight of commodity c in the producer price index	$pwmr_{cr}$	Import price by region (foreign currency)
ica_{ca}	Quantity of c as intermediate input per unit of activity a	$qdst_c$	Quantity of stock change
$icd_{cc'}$	Quantity of commodity c as trade input per unit of c' produced and sold domestically	qg_c	Base-year quantity of government demand
$ice_{cc'}$	Quantity of commodity c as trade input per exported unit of c'	$qinv_c$	Base-year quantity of private investment demand
$icer_{cc'r}$	Quantity of commodity c as trade input per exported unit of c' from region r	$shif_{if}$	Share for domestic institution i in income of factor f
$icm_{cc'}$	Quantity of commodity c as trade input per imported unit of c'	$shii_{ii'}$	Share of net income of i' to i ($i' \in INSDNG$; $i \in INSDNG$)
$icmr_{cc'r}$	Quantity of commodity c as trade input per imported unit of c' from region r	ta_a	Tax rate for activity a
$inta_a$	Quantity of aggregate intermediate input per activity unit	$tins_i$	Exogenous direct tax rate for domestic institution i
iva_a	Quantity of aggregate intermediate input per activity unit	$tins01_i$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates
mps_i	Base savings rate for domestic institution i	tm_c	Import tariff rate
$mps01_i$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates	tmr_{cr}	Regional import tariff
pwe_c	Export price (foreign currency)	tq_c	Rate of sales tax
$pwer_{cr}$	Export price by region (foreign currency)	$trnsfr_{if}$	Transfer from factor f to institution i

Symbol	Explanation	Symbol	Explanation
Greek Symbols			
α_a^a	Efficiency parameter in the CES activity function	δ_c^t	CET function share parameter
α_a^{va}	Efficiency parameter in the CES value-added function	δ_{fa}^{va}	CES value-added function share parameter for factor f in activity a
α_c^{ac}	Shift parameter for domestic commodity aggregation function	γ_{ch}^m	Subsistence consumption of marketed commodity c for household h
α_c^q	Armington function shift parameter	θ_{ac}	Yield of output c per unit of activity a
α_c^t	CET function shift parameter	ρ_a^a	CES production function exponent
α_c^m	Shift parameter in the CES regional import function	ρ_a^{va}	CES value-added function exponent
α_c^e	Shift parameter in the CES regional export function	ρ_c^{ac}	Domestic commodity aggregation function exponent
β^a	Capital sectoral mobility factor	ρ_c^q	Armington function exponent
β_{ch}^m	Marginal share of consumption spending on marketed commodity c for household h	ρ_c^t	CET function exponent
δ_a^a	CES activity function share parameter	ρ_c^m	Regional imports aggregation function exponent
δ_{ac}^{ac}	Share parameter for domestic commodity aggregation function	ρ_c^e	Regional exports aggregation function exponent
δ_c^q	Armington function share parameter	η_{fat}^a	Sector share of new capital
ν_f	Capital depreciation rate		
Exogenous Variables			
\overline{CPI}	Consumer price index	\overline{MPSADJ}	Savings rate scaling factor (= 0 for base)
\overline{DTINS}	Change in domestic institution tax share (= 0 for base; exogenous variable)	\overline{QFS}_f	Quantity supplied of factor
\overline{FSAV}	Foreign savings (FCU)	$\overline{TINSADJ}$	Direct tax scaling factor (= 0 for base; exogenous variable)
\overline{GADJ}	Government consumption adjustment factor	\overline{WFDIST}_{fo}	Wage distortion factor for factor f in activity a
\overline{IADJ}	Investment adjustment factor		
Endogenous Variables			
AWF_{ft}^a	Average capital rental rate in time period t	QF_{fa}	Quantity demanded of factor f from activity a
$DMPS$	Change in domestic institution savings rates (= 0 for base; exogenous variable)	QG_c	Government consumption demand for commodity
DPI	Producer price index for domestically marketed output	QH_{ch}	Quantity consumed of commodity c by household h
EG	Government expenditures	QHA_{ach}	Quantity of household home consumption of commodity c from activity a for household h
EH_h	Consumption spending for household	$QINTA_a$	Quantity of aggregate intermediate input
EXR	Exchange rate (LCU per unit of FCU)	$QINT_{ca}$	Quantity of commodity c as intermediate input to activity a
$GOVSHR$	Government consumption share in nominal absorption	$QINV_c$	Quantity of investment demand for commodity
$GSAV$	Government savings	QM_c	Quantity of imports of commodity c
$INVSHR$	Investment share in nominal absorption	QMR_{cr}	Quantity of imports of commodity c by region r

Symbol	Explanation	Symbol	Explanation
Endogenous Variables Continued			
MPS_i	Marginal propensity to save for domestic non-government institution (exogenous variable)	QER_{cr}	Quantity of exports of commodity c to region r
PA_a	Activity price (unit gross revenue)	QQ_c	Quantity of goods supplied to domestic market (composite supply)
PDD_c	Demand price for commodity produced and sold domestically	QT_c	Quantity of commodity demanded as trade input
PDS_c	Supply price for commodity produced and sold domestically	QVA_a	Quantity of (aggregate) value-added
PE_c	Export price (domestic currency)	QX_c	Aggregated quantity of domestic output of commodity
PER_{cr}	Export price by region (domestic currency)	$QXAC_{ac}$	Quantity of output of commodity c from activity a
$PINTA_a$	Aggregate intermediate input price for activity a	RWF_f	Real average factor price
PK_{ft}	Unit price of capital in time period t	$TABS$	Total nominal absorption
PM_c	Import price (domestic currency)	$TINS_i$	Direct tax rate for institution i ($i \in INSDNG$)
PMR_{cr}	Import price by region (domestic currency)	$TRII_{i'}$	Transfers from institution i' to i (both in the set INSDNG)
PQ_c	Composite commodity price	WF_f	Average price of factor
PVA_a	Value-added price (factor income per unit of activity)	YF_f	Income of factor f
PX_c	Aggregate producer price for commodity	YG	Government revenue
$PXAC_{ac}$	Producer price of commodity c for activity a	YI_i	Income of domestic non-government institution
QA_a	Quantity (level) of activity	YIF_{if}	Income to domestic institution i from factor f
QD_c	Quantity sold domestically of domestic output	ΔK_{fat}^a	Quantity of new capital by activity a for time period t
QE_c	Quantity of exports		

Appendix I2: Model Equations

Production and Price Equations	
$QINT_{ca} = ica_{ca} \cdot QINTA_a$	(1)
$PINTA_a = \sum_{c \in C} PQ_c \cdot ica_{ca}$	(2)
$QVA_a = \alpha_a^{va} \cdot \left(\sum_{f \in F} \delta_{fa}^{va} \cdot (\alpha_{fa}^{vaf} \cdot QF_{fa})^{-\rho_a^{va}} \right)^{\frac{1}{\rho_a^{va}}}$	(3)
$W_f \cdot \overline{WFDIST}_{fa} = PVA_a \cdot (1 - tva_a) \cdot QVA_a \cdot$	
$\left(\sum_{f \in F'} \delta_{fa}^{va} \cdot (\alpha_{fa}^{vaf} \cdot QF_{fa})^{-\rho_a^{va}} \right)^{-1} \cdot \delta_{fa}^{va} \cdot (\alpha_{fa}^{vaf} \cdot QF_{fa})^{-\rho_a^{va}-1}$	(4)
$QVA_a = iva_a \cdot QA_a$	(5)
$QINTA_a = inta_a \cdot QA_a$	(6)
$PA_a \cdot (1 - ta_a) \cdot QA_a = PVA_a \cdot QVA_a + PINTA_a \cdot QINTA_a$	(7)
$QXAC_{ac} = \theta_{ac} \cdot QA_a$	(8)
$PA_a = \sum_{c \in C} PXAC_{ac} \cdot \theta_{ac}$	(9)
$QX_c = \alpha_c^{ac} \cdot \left(\sum_{a \in A} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}} \right)^{\frac{1}{\rho_c^{ac}-1}}$	(10)
$PXAC_{ac} = PX_c \cdot QX_c \left(\sum_{a \in A'} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}} \right)^{-1} \cdot \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}-1}$	(11)
$PER_{cr} = pwer_{cr} \cdot EXR - \sum_{c' \in CT} PQ_{c'} \cdot icer_{c'cr}$	(12)
$QE_c = \alpha_c^e \cdot \left(\sum_{r \in R} \delta_{cr}^e \cdot (QER_{cr})^{-\rho_c^e} \right)^{\frac{1}{\rho_c^e}}$	(13)
$\frac{PER_{cr}}{PE_c} = QER_{cr} \cdot \left(\sum_{r' \in R} \delta_{cr'}^e \cdot (QER_{cr'})^{-\rho_c^e} \right)^{-1} \cdot \delta_{cr}^e \cdot (QER_{cr})^{-\rho_c^e-1}$	(14)
$PE_c = pwe_c \cdot EXR - \sum_{c' \in CT} PQ_{c'} \cdot ice_{c'c}$	(15)
$QX_c = \alpha_c^t \cdot \left(\delta_c^t \cdot QE_c^{\rho_c^t} + (1 - \delta_c^t) \cdot QD_c^{\rho_c^t} \right)^{\frac{1}{\rho_c^t}}$	(16)
$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c} \cdot \frac{1 - \delta_c^t}{\delta_c^t} \right)^{\frac{1}{\rho_c^t-1}}$	(17)
$QX_c = QD_c + QE_c$	(18)
$PX_c \cdot QX_c = PDS_c \cdot QD_c + PE_c \cdot QE_c$	(19)
$PDD_c = PDS_c + \sum_{c' \in CT} PQ_{c'} \cdot icd_{c'c}$	(20)

Production and Price Equations Continued

$$PMR_{cr} = pwmr_{cr} \cdot (1 + tmr_{cr}) \cdot EXR - \sum_{c' \in CT} PQ_c \cdot icmr_{c'cr} \quad (21)$$

$$QM_c = \alpha_c^m \cdot \left(\sum_{r \in R} \delta_{cr}^m \cdot (QMR_{cr})^{-\rho_c^m} \right)^{\frac{1}{\rho_c^m}} \quad (22)$$

$$\frac{PMR_{cr}}{PM_c} = QMR_{cr} \cdot \left(\sum_{r' \in R'} \delta_{cr'}^m \cdot (QMR_{cr'})^{-\rho_c^m} \right)^{-1} \cdot \delta_{cr}^m \cdot (QMR_{cr})^{-\rho_c^m - 1} \quad (23)$$

$$PM_c = pwm_c \cdot (1 + tm_c) \cdot EXR + \sum_{c' \in CT} PQ_c \cdot icm_{c'c} \quad (24)$$

$$QQ_c = \alpha_c^q \cdot \left(\delta_c^q \cdot QM_c^{-\rho_c^q} + (1 - \delta_c^q) \cdot QD_c^{-\rho_c^q} \right)^{\frac{1}{\rho_c^q}} \quad (25)$$

$$\frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c} \cdot \frac{\delta_c^q}{1 - \delta_c^q} \right)^{\frac{1}{1 + \rho_c^q}} \quad (26)$$

$$QQ_c = QD_c + QM_c \quad (27)$$

$$PQ_c \cdot (1 - tq_c) \cdot QQ_c = PDD_c \cdot QD_c + PM_c \cdot QM_c \quad (28)$$

$$QT_c = \sum_{c' \in C'} (icm_{cc'} \cdot QM_{c'} + icmr_{cc'} \cdot QMR_{c'} + ice_{cc'} \cdot QE_{c'} + icer_{cc'} \cdot QER_{c'} + icd_{cc'} \cdot QD_{c'}) \quad (29)$$

$$\overline{CPI} = \sum_{c \in C} PQ_c \cdot cwts_c \quad (30)$$

$$DPI = \sum_{c \in C} PDS_c \cdot dwts_c \quad (31)$$

Institutional Incomes and Domestic Demand Equations

$$YF_f = \sum_{a \in A} WF_f \cdot WFDIST_{fa} \cdot QF_{fa} \quad (32)$$

$$YIF_{if} = shif_{if} \cdot [YF_f - transfr_{rowf} \cdot EXR] \quad (33)$$

$$YI_i = \sum_{f \in F} YIF_{if} + \sum_{i' \in INSDNG'} TRII_{ii'} + transfr_{i\text{gov}} \cdot \overline{CPI} + transfr_{i\text{row}} \cdot EXR \quad (34)$$

$$TRII_{ii'} = shii_{ii'} \cdot (1 - MPS_{i'}) \cdot (1 - tins_{i'}) \cdot YI_{i'} \quad (35)$$

$$EH_h = \left(1 - \sum_{i \in INSDNG} shii_{ih} \right) \cdot (1 - MPS_h) \cdot (1 - \overline{tins}_h) \cdot YI_h \quad (36)$$

$$PQ_c \cdot QH_{ch} = PQ_c \cdot \gamma_{ch}^m + \beta_{ch}^m \cdot \left(EH_h - \sum_{c' \in C} PQ_{c'} \cdot \gamma_{c'h}^m \right) \quad (37)$$

$$QINV_c = LADJ \cdot \overline{qinv}_c \quad (38)$$

$$QG_c = \overline{GADJ} \cdot \overline{qg}_c \quad (39)$$

$$EG = \sum_{c \in C} PQ_c \cdot QG_c + \sum_{i \in INSDNG} transfr_{i\text{gov}} \cdot \overline{CPI} \quad (40)$$

Institutional Incomes and Domestic Demand Equations Continued

$$\begin{aligned}
 YG = & \sum_{i \in \text{INSDNG}} \overline{\text{tins}_i} \cdot YI_i + \sum_{a \in A} \text{ta}_a \cdot PA_a \cdot QA_a + \sum_{c \in \text{CMNR}} \text{tm}_c \cdot \text{pwm}_c \cdot QM_c \cdot \text{EXR} + \\
 & \sum_{r \in R} \sum_{c \in \text{CMR}} \text{tmr}_{cr} \cdot \text{pwmr}_{cr} \cdot QMR_{cr} \cdot \text{EXR} + \sum_{c \in C} \text{tq}_c \cdot PQ_c \cdot QQ_c + \sum_{f \in F} YF_{\text{gov } f} + \text{trnsfr}_{\text{gov row}} \cdot \text{EXR}
 \end{aligned} \tag{41}$$

System Constraints and Macroeconomic Closures

$$QQ_c = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + QG_c + QINV_c + \text{qdst}_c + QT_c \tag{42}$$

$$\sum_{a \in A} QF_{fa} = QFS_f \tag{43}$$

$$QFS_f / QFS_f^0 = \left(\frac{RWF_f}{RWF_f^0} \right)^{\text{etals}_f} \tag{44}$$

$$RWF_f = \left(\frac{YF_f}{QFS_f} \right) / \left(\frac{CPI}{CPI^0} \right) \tag{45}$$

$$YG = EG + GSAV \tag{46}$$

$$\begin{aligned}
 & \sum_{c \in \text{CMNR}} \text{pwm}_c \cdot QM_c + \sum_{r \in R} \sum_{c \in \text{CMR}} \text{pwmr}_{cr} \cdot QMR_{cr} \cdot \sum_{f \in F} \text{trnsfr}_{\text{row } f} \\
 = & \sum_{c \in \text{CENR}} \text{pwe}_c \cdot QE_c + \sum_{r \in R} \sum_{c \in \text{CER}} \text{pwer}_{cr} \cdot QER_{cr} + \sum_{i \in \text{INSD}} \text{trnsfr}_{i \text{ row}} + FSAV
 \end{aligned} \tag{47}$$

$$\sum_{i \in \text{INSDNG}} \text{MPS}_i \cdot (1 - \overline{\text{tins}_i}) \cdot YI_i + GSAV + \text{EXR} \cdot FSAV = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot \text{qdst}_c \tag{48}$$

$$\text{MPS}_i = \overline{\text{mps}_i} \cdot (1 + \text{MPSADJ}) \tag{49}$$

Capital Accumulation and Allocation Equations

$$AWF_{fat}^a = \sum_a \left[\left(\frac{QF_{fat}}{\sum_{a'} QF_{fa't}} \right) \cdot WF_{fat} \cdot WFDIST_{fat} \right] \tag{50}$$

$$\eta_{fat}^a = \left(\frac{QF_{fat}}{\sum_a QF_{fa't}} \right) \cdot \left(\beta^a \cdot \left(\frac{WF_{fat} \cdot WFDIST_{fat}}{AWF_{fat}^a} - 1 \right) + 1 \right) \tag{51}$$

$$\Delta K_{fat}^a = \eta_{fat}^a \cdot \left(\frac{\sum_c PQ_{ct} \cdot QINV_{ct}}{PK_{ft}} \right) \tag{52}$$

$$PK_{ft} = \sum_c PQ_{ct} \cdot \frac{QINV_{ct}}{\sum_{c'} QINV_{c't}} \tag{53}$$

$$QF_{fat+1} = QF_{fat} \cdot \left(1 + \frac{\Delta K_{fat}^a}{QF_{fat}} - \nu_f \right) \tag{54}$$

$$QFS_{ft+1} = QFS_{ft} \cdot \left(1 + \frac{\sum_a \Delta K_{fat}^a}{QFS_{ft}} - \nu_f \right) \tag{55}$$

DECLARATION

I, the undersigned, declare that this thesis is my original work, prepared under the guidance of Sisay Debebe (PhD). All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

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Signature

June, 2017

ENDORSEMENT

This Thesis has been submitted to St. Mary's University School of Graduate Studies for examination with my approval as a university advisor.

Sisay Debebe (PhD)

Advisor

St. Mary's University, Addis Ababa

Signature

June, 2017