SCHOOL OF GRADUATE STUDIES

EVALUATING ETHIOPIA'S AGRICULTURAL EXPORT POTENTIAL: EMPIRICAL EVIDENCE USING GRAVITY MODEL

AMARE ALEMAYE MERSHA

ADDIS ABABA UNIVERSITY

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Evaluating Ethiopia's Agricultural Export Potential: Empirical Evidence Using Gravity Model

AMARE ALEMAYE MERSHA

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Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for degrees in any other academic institution, and that all sources of materials used have been duly acknowledged.

Declared by:

Name: Amare Alemaye Mersha

Signature: _____

Date: _____

This paper has been submitted for examination with my approval as a university advisor.

Advisor's Name: Girma Estiphanos (PhD)

Signature: _____

Date: _____

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School of Graduate Studies

This is to certify that this thesis prepared by Amare Alemaye, entitled: *Evaluating Ethiopia's Agricultural Export Potential: Empirical Evidence Using Gravity Model* and submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Economics (International Economics) complies with regulations of the university and meets the accepted standards with respect to originality and quality.

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Table of Contents

List of Figures

List of Tables

List of Acronyms

CES: Constant Elasticity of Substitution

CGE: Computable General Equilibrium

CIM: Contract Intensive Money

COMESA: Common Market for Eastern and Sothern Africa

CPA: Consumer price Index

CSA: Central Statistical Agency of Ethiopia

ECM: Error Correction Model

ERCA: Ethiopia's Revenue and Customs Authority

GDP: Gross Domestic Product

GDPPC: GDP Per Capita

GMM: Generalized Method of Moments

GTP: Growth and Transformation Plan

IMF: International Monetary Fund

MoANR: Ministry of Agriculture and Natural Resources

MoFED: Ministry of Finance and Economic Development

NBE: National Bank of Ethiopia

OECD: Organization for Economic Cooperation and Development

OLS: Ordinary Least Square

PPML: Pseudo-Poisson Maximum Likelihood

RCA: Revealed Comparative Advantage

RoW: Rest of the World

TCI: Trade Conformity Index

TII: Trade Intensity Index

UNDP: United Nations Development Program

VAR: Vector Autoregressive

WB: World Bank

WTO: World Trade Organization

Abstract

Both theories and evidences indicates that the large share of Ethiopia's export is mainly primary/agricultural products. Owing to this fact, this study attempted to empirically figure out what determines the agricultural export trend of Ethiopia with 38 major trading partners over the study period, 1995-2015. The augmented dynamic gravity model has been estimated using system GMM technique where the log form agricultural export of Ethiopia to the major trading partners is the dependent variable. The coefficients obtained are then used to predict the agricultural export trade potentials for Ethiopia. The empirical result revealed that application of dynamic gravity models is likely to produce consistent results where the lagged agricultural export has a positive and statistically significant effect on current agricultural export flows. Apart from this, other traditional gravity model variables such as Ethiopia's population and home country's trade openness are found to have positive and significant impact towards agricultural export of Ethiopia. Importing country's population, distance and home country's contract intensive money variables as well were found to be significant in affecting Ethiopia's agricultural export negatively.

As far as agricultural export potential is concerned, European countries remained to be the dominant future potential destinations of Ethiopia's agricultural export. Specifically, agricultural export potential to countries including Israel, Switzerland, Greece, Norway, Finland, Sweden, Romania and Austria are not yet exploited. This implies that export promotion towards these economies has to be prioritized through bilateral trade agreement arrangements and reduction in public sector bottlenecks to exporters.

Keywords: Ethiopia; Dynamic Gravity Approach; Agricultural Export Potential; System GMM Estimators.

CHAPTER I: INTRODUCTION

1.1. Background of the Study

Ethiopia has joined the list of the fastest growing economies in the world and the country is the second most populous country in Africa with a population of around 97 million (MoFED, 2015). The economy of Ethiopia is amongst those economies in the world which are highly dependent on agriculture by which the sector contributes about 46.3% to the total growth in the country, 60% to export and 80% to the total employment (IMF, 2014). In the recent years, however, the service sector is taking the lead in terms of growth contribution which is highly criticized by intellectuals since an economy which is highly service based would not have a sustainable growth path. This criticism seems like plausible since the service sector do not really create its own output rather it serves as an intermediate to convert the outputs produced by the other sectors.

Although there are some recent improvements regarding performance of the economy, Ethiopia is still among the poorest countries in the world with an estimated Gross Domestic Product (GDP) of $61.6 billion and a Per capita GDP of $550 by 2015 (World Bank, 2015). Other welfare indicators also show that well-being of mass of the population is at a lower level relative to the rest of the world. For instance, 63 years of life expectancy at birth, 40 % literacy rate and 28.7% of the population below poverty line. Based on these considerations, the country is ranked as the 140th country in terms of per capita income (PCI) with higher unemployment, inflation and level of corruption (WB, 2015).

Though the role of foreign trade to Ethiopia's economy is very significant (trade accounts for about 25- 50 % of its GDP by for the period 1995-2015), exports of the country are not

diversified rather dominated by few products which includes coffee, oilseeds, leather and leather products, pulses, meat and meat products, fruits and vegetables, live animals, chat, gold, flower and electricity (ERCA and NBE, 2015). According to annual report 2014/15 of the National Bank of Ethiopia, nine of the aforementioned export items excluding gold and electricity jointly generated around 80% of the total export earnings over the period 2002/03−2014/15. The agricultural raw material export of the country also contributes a lot (16% of the 2013/14 merchandise export) as it is indicated in World Bank's trade database. Moreover, coffee and oilseeds alone contributed more than half of the total earnings in the last three years. From this trend, one can easily observe that the export trade is highly dependent on a limited variety of agricultural commodities. Overtime, there seems to be slight improvements in the degree of diversification as some other products like flower, live animals and pulses become significant export items (ERCA, 2014). In addition, the share of coffee (almost the sole export item over history) has declined continuously. Since agriculture is a very significant contributor of the country's export, finding out a way to boost its export competitiveness and maximize the gains would no longer be questionable. This invites the researcher to undertake a research work with a particular target to explain the determinants of Ethiopia's agricultural export using gravity model approach as a technique.

1.2. Statement of the Problem

Today in the modern world country's participation in international trade and its growth over time plays a crucial role for poverty reduction and narrowing income inequality among people. For developing nations, international trade (particularly export) provide employment opportunities and earnings to pay for many products that they cannot produce at home and for the advanced technology they used (Salvatore, 2005). The most important single insight

in all of international economics is that there are gains from international trade-that is, when countries sell goods and services to each other, this exchange is almost always to their mutual benefit (Krugman and Obstfeld, 2003). International trade can also play an important role for development since it can lead to the full utilization of domestic resources, expansion in the size of the market which makes division of labor and economies of scale possible, transmission of new ideas, technology, and managerial and other skills and stimulate and facilitate the international flow of capital from developed to developing countries. Owing to this fact, Ethiopia has engaged in international trading transactions with many countries all over the world.

Ethiopia's continent based geographical distribution of total export trade elucidates that Asia and Europe followed by Africa remained the largest markets for Ethiopian exports accounting for 38.4%, 33.6% and 20.2% respectively of total exports in 2014/15. Only 7% and 0.8% of the total exports were destined to the Americas and Oceania respectively (NBE, 2014/15). In terms of country specific trend, Germany (14%) and Saudi Arabia (10%) took the largest share in absorbing Ethiopia's agricultural export for the periods between 1995-2015. Netherlands, China, Austria, Japan, France, Finland, United Arab Emirates, Sudan, Djibouti, United Kingdom and Israel as well are found to be the most important economies for having good importing trade partnership with Ethiopia (ERCA, 2015).

As far as agricultural export trend of Ethiopia is concerned, the growth over time indicates that there were erratic changes to the country's total agricultural export. This is obvious that the agricultural sector in the country is highly dependent on what is happening on nature mainly on weather condition. More specifically, the period from 1995-2004 has been known for a more or less steady growth of agricultural export. The period after 2004 till the period

where the First Growth and Transformation Plan (GTP I[1]) has been commenced in 2010 however reflects that agricultural export of Ethiopia has been growing rapidly that ranges between 3-38 percent. In this regard, the bad weather conditions and coffee diseases occurred in most of Ethiopia's agricultural export competitors especially Latin American countries has contributed for the significant boost of Ethiopia's agricultural export to the rest of the world. Right after GTP I has been launched, the growth in agricultural exports of Ethiopia has been growing at a declining rate and even the last three years of GTP I were known for downward moves of the sector's growth which is mainly explained by the government's intention to expand other sectors of the economy which forces to give a relatively less emphasis to the agricultural sector.

Despite the unanimous acceptance of the fact that international trade plays a significant role to nation's growth and development, there are different arguments in explaining the determinants of international trade and specialization. To mention some; the classical (Torrens-Ricardo) theory, emphasizes that trade determinants are to be found in technological differences between countries. The Heckscher-Ohlin theory stresses on the differences in factor endowments between different countries. The neoclassical theory as well (which has had a longer gestation) argues that trade determinants are to be found simultaneously in the differences between technologies, factor endowments, and tastes of different countries. The last element accounts for the possible presence of international trade,

[1] *GTP I (2010/11-2014/15) is a planning initiative by the government of Ethiopia with the objective to maintain the double digit real GDP growth rate of 11%, attain the Millennium Development Goals, to expand access and quality of health and education services, ensuring macroeconomic stability and stable democratic and developmental state (FDRE GTP II, 2016).*

even if technologies and factor endowments were completely identical between countries (Gandolfo, 1998).

Cognizant this fact, several previous studies attempted to examine the determinants of international trade of nations with their trading partners (see studies by Kim et al, 2003; Batra, 2004; Nam, 2004; Kristjansandottir, 2005; Antonucci and Manzocchi, 2005; Simwaka, 2006; Mafizur, 2010; Hatab et al, 2010; Bahadur, 2012). These studies applied gravity model of trade for different nations and commonly identified that the volume of trade between pairs of countries is a positive function of the GDP of the two countries, similar membership to regional integration agreement, exchange rate[2], partner countries total import demand and the trade openness of the partner's economy, and negative function of the distance between them which is taken as a proxy for transportation and transaction costs. However, the results also indicated ambiguous sign of some variables like population and GDP per capita. Similar studies with a gravity model approach in Ethiopia by Michael, 2011; and Abdulaziz, 2013 found that GDP per capita of both exporting and importing countries found to have positive and significant impact on Ethiopia's bilateral exports whereas, distance between countries negatively affect their bilateral trade. Rahman's (2011) finding however indicates that an increase in home country's GDP per capita has adverse effect on Egyptian agricultural export.

This particular study has two novelties unlike previous studies. First the previous studies have been inconclusive on the impact of the variables identified in the aforementioned part.

[2] *Exchange rate is defined in its price quotation way where it represents domestic currency per unit of foreign currency (Pilbeam, 2006).*

The results on different determinant variables mainly population vary in sign, magnitude and level of significance from one study to another. On the top of that, the studies paid less emphasis to the possible impact of financial development and economic agents access to financial institutions on bilateral trade, thus they are not comprehensive. Second, there was no attempt or little attempt has been made to figure out the determinants of Ethiopia's bilateral trade with the rest of the world with a particular focus on agricultural products with a more recent data. This seems unfair since agriculture has the lion share (60%) of the country's total export (IMF, 2014).

Different researchers including Kebede, 2011; Gebreyesus, 2011 and Abdulaziz, 2013 attempted to figure out the main potential determinants of Ethiopia's bilateral trade with an emphasis either on total trade flows or total export flows and few agricultural product items using the gravity model approach. However, both theories and evidences show that developing countries in general and Ethiopia in particular exports mainly agricultural primary products so that trying to figure out the major determinants and potentials of the country's bilateral trade had been noticed to be more plausible using gravity model taking aggregate agricultural export items into consideration. Besides, there is no any empirical research using dynamic gravity model with latest data up to 2015 in understanding the factors influencing Ethiopia's agricultural export flows with the major trading partners. Owing to this fact this study, attempted to look into this matter and the findings could help to design appropriate and relevant interventions. By describing the existing situation and conducting rigorous econometrics analysis to substantiate the comprehensive findings with regard to underlying determinants of agricultural export of Ethiopia with the major trading partner countries, the study also attempted to bridge the previously mentioned gaps.

1.3. Objectives of the Study

The primary objective of the study is to identify the determinants of Ethiopia's agricultural export flow to its major trading partner countries using gravity model. The specific objectives of the study are as follows:

i. To estimate the determinants of agricultural export flows of Ethiopia with the major trading partners, and
ii. To evaluate Ethiopia's agricultural export trade potential to its trading partners.

1.4. Research Questions

The research problem has been approached by answering the following major and decisive research questions:

- Can the augmented gravity model of trade explain the agricultural export flows of Ethiopia with the major trading partner countries?
- What factors are responsible to explain the agricultural export flows of Ethiopia with the major importing partner countries?
- Did Ethiopia fully exploit its agricultural export potential with the major trading partner countries?

1.5. Significance of the Study

The gravity model is widely used in the empirical literature to evaluate the determinants of bilateral trade. To name some, Antonucci and Manzocchi (2005); Mafizur (2010); Abu et al. (2010); Kebede, 2011; Gebreyesus, 2011 and Abdulaziz, 2013 employed the standard gravity model to figure out the causative factors of export of countries. In line with these literatures, this study made use of the dynamic gravity model to evaluate the determinants of agricultural

exports of Ethiopia with the major trading partner countries. Thus, this study contributes to the literature on the application of gravity model in Ethiopia for the researchers, learners, policy makers in particular and for all other interested individuals/groups. This study is also valuable, as it also attempted to evaluate whether Ethiopia still has some untapped agricultural export potential with the trading partners under consideration.

1.6. Scope and Limitation of the Study

With a general fact of understanding that the export destiny of Ethiopia is dominated by Europe, Asia, Africa and North America, this study has been confined to agricultural exports of Ethiopia to European, Asian, African and North American countries over the period 1995-2015. The data problem on bilateral exports with a particular emphasis to agricultural products has been the most frustrating challenge for the study as different sources have got incomplete information. Therefore, it would have been very useful to extend this study by incorporating additional dummy variables in to our model and take panel vector-cointegration tests into consideration.

1.7. Organization of the Paper

The rest of the paper is organized as follows. The second chapter gives a brief review of both theoretical and empirical literatures in line with the trade theories and determinants of agricultural exports. Subsequently, the third chapter deals with overall overview of Ethiopian economy in general and agricultural sector related issues in particular. Chapter four explains the model specification, data type and nature used along with the adopted methodology. The econometric analysis is discussed in chapter five. The last chapter deals with conclusions and policy implications based on findings obtained from the analysis.

CHAPTER II: LITERATURE REVIEW

2.1. Theoretical Literature

2.1.1. Conceptual Definition

The term agriculture is broadly defined as cultivation of land. More specifically, it is the science and art of producing crops and livestock for economic purposes and from the natural resources of the earth (Annadurai et al, 2010). On the top of that, causing the land to produce more abundantly, and at the same time, protecting it from deterioration and misuse is the primary purpose of agriculture. In line with this, agriculture as an economic activity includes horticulture, fruit growing, seed growing, dairy farming and livestock breeding and keeping, the use of land as grazing land, meadow land, osier land, market gardens and nursery grounds, and the use of land for woodlands where that use ancillary to the farming of land for Agricultural purposes (Agriculture Act ,2014; Annadurai et al, 2010).

The Ethiopian Ministry of Agriculture and Natural Resources (MoANR) as well treats agriculture as a biological production process, which depends on the growth and development of selected plants and animals within the local environment. More specifically, the records from Ethiopian Revenue and Customs Authority indicates that cereal and crop productions, animal and animal genetic materials (livestock products), horticulture, chat, fruits and vegetables, oil seeds and pulses and coffee and tea are the major marketable agricultural products in the country. On the basis of this understanding, this study defines agriculture in the above context and considers the aforementioned agricultural products as the major export items of Ethiopia eligible to our study despite the fact that mineral, power/electricity and some manufactured products are still registered as exportable items. Taking the above contextual

definition into consideration, the theoretical foundations of international trade has been presented in the next section.

2.1.2. Historical Development of Trade Theories

The issue of why nations trade among themselves and what really determines the trading transactions between nations has been a fundamental question for all interested in the area of international trade and relations (Gandolfo, 1998). One obvious reason to be given would be countries engaged in trade among themselves as the same reason why individuals trade with each other in the sense that nature has made uneven distribution of factors of production which makes it hard for all nations to produce what they are in need to meet their unlimited wants. Countries being endowed in different factors of production allow them to produce and sell some goods and services more efficiently than the others. It is therefore in-line with tis fact where trade theories starting from the traditional to the modern ones have been introduced.

Although there is no single trade theory that can alone describe the pattern of international trade, the current well known and acceptable modern trade theories like the gravity model were developed through evolution of ideas in the past. Among the different international trade theories, the Ricardian Model of Comparative Advantage, the Heckscher-Ohlin (H-O) Model and the New Trade Theories are worth mentioning where the discussion below presents the influential trade theories to better understand the causes, structure and volume of international trade including the benefit out of it.

As far as the development of international trade theories is concerned, the Mercantilist view of International trade took the lead. It was Mercantilists (17^{th} -18^{th} C.) idea for nations to build a strong external sector through emphasizing on export and restriction on imports. This trade

theory strongly believed in accumulation of precious metals (mainly gold and silver) as a basis to wealth of nations so that they could manage to have increased national output and higher employment level (Mikic, 1998). As part of the effort to promote the export sector, mercantilist trade theory mainly advocates government's regulation of imports through tariffs, quotas and other commercial policies which implies that international trade between nations was a zero-sum game.

Generally speaking, it seems that political hegemony of countries was the key determinant to international trade transactions in the sense that countries with great political power were expected to export a lot as they strongly believed that exporting was good because it generated gold and silver for the national treasury, while importing was bad as it drained these precious metals from the national treasury and they were in favor of high import restrictions and lower internal tolls (Alemayehu, 2010).

As a response to the Mercantilist's trade theory, the Classical trade theory came into existence with a doctrine of free trade. Adam Smith was among the influential classical trade theorists who introduced the idea of Absolute Advantage where countries engaged in international trade could benefit without requiring exports to be higher than imports as far as they trade different goods and services based on the absolute advantage. With regard to what determines trade between nations, a country would export and import those products they had an absolute advantage and disadvantage respectively (Alemayehu and Sen, 2010) and this indicates how reducing trade restrictions could benefit both importing and exporting countries.

Being started by Adam Smith, the idea of free trade has been advocated by David Ricardo (1817) and he made some modifications to Adam Smith's idea of Absolute Advantage to

answer questions on what might happen when one country has absolute advantage in the production of all goods over its trading partners (Dunn and Mutti, 2004). Ricardo's theory of comparative advantage suggests that countries should specialize in the production and export of those goods they produce most efficiently and buy goods that they produce less efficiently from other countries (*ibid*).

The Heckscher-Ohlin (H-O) model, which has been also known to be Heckscher-Ohlin-Samuelsson (H-O-S) Model after Samuelson applied mathematical derivations to the original H-O model, on the other hand (1919-1924) was proposed as an alternative to the Ricardian model of basic comparative advantage. It predicts that countries will export those goods that make intensive use of locally abundant factors and will import products that make intensive use of factors that are locally scarce and expensive (Alemayehu, 2010; Gandolfo, 1996). This implied the fact that international trade between nations would be able to bring about factor price equalization across nations.

The theory of international trade has also been advanced to new and modern trade theories including intra-industry/product differentiation, technological gap (Posner), product life cycle, global strategic rivalry, national competitive advantage (Porter) and country similarity (Linder's Hypothesis) trade theories among the newly introduced and dominant in the contemporary international trade theorization (Mikic, 1998). Unlike to the classical trade theories, the new trade theories are commonly firm based theories developed within the framework of imperfect competition, globalization and existence of multinational corporations (Pugel, 2012; Salvatore, 2004). Among the newly introduced trade theories, country similarity theory (Liner's Hypothesis) postulates that trade between economies is usually determined by existence of country similarity (language, culture, consumption nature) between the two

countries. This new trade theory together with the traditional theories mainly backs most of the variables incorporated in a gravity model.

2.1.3. Measures of Trade Potential

As far as measuring the existence of untapped agricultural export potential of Ethiopia with its selected major trading partners is one objective of this study, we keep in a brief discussion of theories on how to measure trade potential[3]. Different numerical techniques (both indexes and models) can be used to assess the level of bilateral trade potential between trading partner counters (Scrimgeour, 2013). The underneath discussion briefly summarizes the commonly used ones.

Computable General Equilibrium (CGE) models are often used to simulate the impact of bilateral or regional trade agreements on bilateral trade as it is noted by Helmers and Pasteels (2006). Though the CGE model enables to make ex-ante[4]simulations, its applicability however is very limited especially for low income countries due to its inherent complexity and the results tend to be very sensitive (Piermartin and Teh, 2005). As a result, results of the model are used to give an order of magnitude rather than providing precise numbers. For studies not interested in assessing trade potential at commodity level and relays on gravity model to explain the major determinants of export, assessment of trade potential will be limited to ex-

[3] *Trade potential is broadly defined as the maximum possible trade that can be achieved within the context of frictionless trade, given the current level of trade, transport and institutional set up (Kalirajan, 1999; Kalirajan and Findlay, 2005).*

[4] *Ex-ante (simulation) analysis can be undertaken to answer 'what if' questions while ex-post analysis is a study that uses historical data to explain the behavior of economic variables. The most commonly encountered models regarding ex-ante analysis are Computable General Equilibrium (CGE) models despite the fact that their application is complex and assumptions taken by the model are highly sensitive (Piermartin and Teh, 2005).*

post trade analysis which is less complex and empirically proven to perform very well (Anderson and van Wicoop, 2003; Helmers and Pasteels, 2005; Raghuranmapatruni, 2011).

In terms of indexes, Trade Intensity Index (TII) is used to determine whether the value of trade between two countries is greater or smaller than would be expected on the basis of their importance in world Trade (Raghuranmapatruni, 2011). The index is calculated as the share of a given country's export going to its trading partner divided by the share of world exports going to the same partner.

Mathematically, the index is expressed as follows:

$$TII = {(X_{ij}/X_{it})}\Big/{(X_{wj}/X_{wt})} \dots\dots\dots\dots\dots\dots (2.1)$$

Where X_{ij} and $X_{wj}$is the value of country 'i' and world exports to country 'j' respectively, X_{it} represents country i's total exports and X_{wt} is total world exports.

On the basis of this calculation, a greater than one value of the computed index indicates a higher degree of trade intensity between the two given economies. On the other hand, a computed index being closer to zero would imply a lesser degree of trade intensity between countries.

TII has also been used with its modified version where export of the Rest of the World (RoW[5]) is used instead of world exports. The modified Trade Intensity index (TII') is computed as follows:

[5] *RoW export is defined as World export excluding Country 'i'*

$$TII' = {(X_{ij}/X_{it})}\Big/{(X_{Rj}/X_{Rt})} \ldots\ldots\ldots\ldots\ldots (2.2)$$

Where X_{ij} and $X_{Rj}$is the value of country 'i' and rest of the world exports to country 'j' respectively, X_{it} represents country i's total exports and X_{Rt} is total rest of the world exports.

Similar with the TII, an index of TII' more (less) than one indicates a bilateral trade flow that is larger (smaller) than expected, given the partner country's importance in world trade. Both the original and modified trade performance and potential measures are criticized for not providing the exact untapped amount of a country's trade with its trading partners (Batra,2004; Bouna, 2015).

Another measure of trade performance and potential which is mainly used to assess a country's export potential is the one developed by Balassa (1965). This measure is based on Revealed Comparative Advantage (RCA) which indicates whether a country is in the process of extending the products in which it has a trade potential, as opposed to situations in which the number of products that can be competitively exported is static. In addition to this, this measure of export trade potential allows countries to understand the potential trade prospects with new trading partners. More specifically, this measure is used to assess trade/export potential of a specific product where the RCA index of country i for product j is measured by the product's share in the country's exports in relation to its share in world trade:

$$RCA_{ij} = {(X_{ij}/X_{it})}\Big/{(X_{wj}/X_{wt})} \ldots\ldots\ldots\ldots\ldots (2.3)$$

Where X_{ij} and $X_{wj}$is the value of country 'i' and world exports of product 'j' respectively, and X_{it} and X_{wt} refers to country i's and world's total exports. An index value of less than one

indicates that the country has a revealed comparative disadvantage in the product while the country is said to have a revealed comparative advantage in the product if the index exceeds unity.

The other trade potential measure used by Nam (2004) to figure out the trade potential between China, Japan and S. Korea was Index of Trade Conformity (ITC) which is measured by share of each commodity from the aggregate export or import of the countries under consideration. Mathematical calculation of ITC between country j's export structure and country k's import structure is measured by:

$$ITC_{jk} = \sum_{i=1}^{n}(X_{ij} * M_{ik}) \Big/ \sqrt{\sum_{i}^{n} X_{ij}^{2} * \sum_{i}^{n} M_{ik}^{2}} \quad \ldots\ldots\ldots\ldots\ldots (2.4)$$

Where X_{ij} and X_{ij} respectively denotes the share of commodity 'i' in country j's aggregate exports and country k's imports, $\sum_{i=1}^{n}$ refers to the sum of all the n commodities i = 1,2,3, …., n.

As far as assessing the export potential of countries with their trading partners is concerned, ITC and RCA indexes are not free from criticism as they are only useful to assess for each specific export items of the country which makes it highly data intensive and it is not to the best interest of this study as our study is intended to figure out sectoral export potentials of the country with a particular emphasis to agriculture.

Notwithstanding their importance to explain the state of trade flows, trade indices including TII, ITC and RCA do not enable researchers to quantify the amount of trade potential among nations as they only provide the insights for the (in)existence of potentials. On the top of this,

these indexes also suffer from other problems like sensitivity to the level of aggregation, inappropriate measurement of changes in intra-industry trade, ignorance of the level of trade (consider the structure only), inability to show dynamic effects and to examine the impact of policy shocks, etc. This situation has led Mikic and Gilbert, 2007; Gebreyesus, 2011; and Abdulaziz, 2013 to perceive trade indices as the 2nd best as compared to the 1st best modeling tools.

With an interest of getting the 1st best approaches of assessing Ethiopia's agricultural export potential, the other trade potential measure which is more applicable to empirical studies is the one calculated as a ratio of predicted trade (P) to actual trade (A). The difference between P and A is also used to calculate export potentials. For this calculation, the data on actual trade obtained from data sources and the data on predicted trade which is estimated with the help of the coefficients of the gravity model are taken (Jacob et al 2001; Batra, 2004; Bahadur, 2012**)**. Gravity models are econometric models that many economists often use for ex-post analyses of international trade flows. The model can also predict future trade values if we apply simulation to the already estimated model (Piermartini and Teh, 2005/06).

The gravity model of trade is one of the most empirically successful approaches in economics, both to explain the state of trade flows and estimate trade potentials (Helmers and Pasteels, 2005). Apart from this, the model is also widely used as a baseline model for estimating the impact of a variety of policy issues (Baldwin and Taglioni, 2006). Gravity models outperform trade indices, particularly to achieve more specific targets. More specifically, there are various basic advantages that gravity models can offer, while trade indices cannot. The model has (i) high explanatory power in explaining bilateral trade flows, (ii) it provides an easy method to test the role that other variables play in affecting trade (iii) measure the impact of policy

shocks or trade agreements (Piermartini and Teh, 2005) (iv) capture the level as well as structure of trade (Alemayehu et al, 2010) and (v) it also enables us to incorporate dynamic effects in our analysis and quantify trade potential among economies (Bun and Klaassen, 2002). It is therefore with these circumstances that we prefer the gravity model as the more appropriate and 1st best modelling tools for our study. It should be noted, however, that in analyzing trade between two countries, say X and Y, the model makes no provision for third party effects (Batra, 2004). That is, the model does not capture the conditions and opportunities that prevail between X and Z as well as Y and Z.

Having the advantage of using gravity model in mind, there are two major approaches to examine the flow of trade and predict trade potential among trading partner economies. Out-of-sample approach is the first one where a gravity equation is used to estimate parameters for highly integrated (liberal) economies and then the same coefficients are used to predict the natural trade relations between the benchmark countries and those starting to integrate (Egger, 2002; Benedictis and Vicarelli, 2005). Then comparing the predicted (potential) trade values against the observed (actual) trade flow indicates whether there exists unexploited trade potential or not. However, this approach has had difficulties to categorize economies into liberated or not. The second approach on the other hand is called the in-sample-approach which is the most recently used one (Egger 2002, Benedictis et al, 2005). Under this approach there is no need to categorize trading partners as a liberal (integrated) and integrating rather all integrated and integrating countries are directly included in the regression analysis and then residuals of the estimated gravity equation represent the difference between estimated and actual trade relations.

The in-sample approach however is not free from drawbacks. For example, Egger (2002) has severely criticized this approach for being misleading as any large systematic difference between the in-sample projection and the actual trade flows could only indicate problems of misspecification in the econometric model. Therefore, one should expect a noise residuals which do not have any more systematic variation within the existence of consistent and efficient estimator. As a best solution to this problem, Egger (2002) proposed the use of either out-of-sample approach or autoregressive model of order one (AR (1)) where the application of an AR(1) model yields consistent and efficient estimator, which eliminates the systematic difference between observed and in-sample predicted values where our study has made use of the latter approach.

Benedictis and Vicarelli (2005) on the other hand noted that the out-of-sample approach itself is not free from drawbacks if models are not properly specified from the very beginning in the sense that if there is misspecification problem to estimate the bilateral trade flows between the groups of countries taken to be a benchmark, then the bias will be transmitted to the projection of the natural bilateral trade flows of the targeted countries. In addition, having benchmark and target countries with the same socio-economic characteristics to apply out-of-sample approach is not an easy task (Simwaka, 2010). Therefore, neither of the two strategies used to quantify trade potentials can be considered immune from the eventuality of serious bias if the equation regressed is not properly specified (Benedictis and Vicarelli, 2005; Simwaka, 2010).

From the previous discussion, we observe that there is a widespread tendency to draw strong conclusions from the sign of the difference between potential and effective trade flows (Benedictis and Vicarelli, 2005) in spite of which approach/strategy is used. In this regard, having a positive difference implies existence of untapped trade potential between the two

trading partners which calls for country specific export promotion and broader bilateral integration to the need to anticipate major distribution changes caused by the expansion of bilateral trade flows in the near future (Batra, 2004). A negative sign in the difference between potential and effective trade on the other hand is an implication of successful partnership implying that actual trade has reached its potential level and no social cost can be expected from future integration (Ibid).

Having preferred the gravity approach for our study, it is crucial to look at the origin and theoretical foundations of the model which are presented in the upcoming part with an aim to justify the gravity model's consistency with economic theory.

2.1.4. Gravity Model of Trade and its Application in Developing Countries

This part of the paper is dedicated to a brief review of Gravity Model's theoretical foundation and some of its links with the standard/traditional trade theories followed by its applicability in low income countries like Ethiopia.

The gravity equation has been frequently and successfully used for nearly fifty-five years to further understanding of the determinants of bilateral trade flows across countries and, subsequently, to analyze commercial policy measures. The gravity model for trade is analogous to the Newtonian physics function that describes the force of gravity. It has been known since the seminal work of Jan Tinbergen (1962) that the size of bilateral trade flows between any two countries can be approximated by a law called the "gravity equation" by analogy with the Newtonian theory of gravitation. Just as planets are mutually attracted in proportion to their sizes and proximity, countries trade in proportion to their respective GDPs and proximity. Initially the gravity equation was thought of merely as a representation of an

empirically stable relationship between the size of economies, their distance and the amount of their trade. Gravity model has also been used as an instrument for trade openness measure (Frankel and Romer, 1999), to measure the drivers of international capital flows (Papaioannou, 2009) and estimate the effect of contract enforcement and/or institutional set ups on international bilateral trades (Thuresson, 2008).

It has been known since the terminal model explains the flow of trade between a pair of countries as being proportional to their economic "mass" (national income) and inversely proportional to the distance between them.

In its generic form, the standard gravity equation is given by:

$$F_{ij} = G\frac{M_i M_j}{D_{ij}^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.5)$$

Where F_{ij} represents the gravitational force between two objects, G is a gravitational constant while $M_{i(j)}$ refers to mass of the two objects i(j) and D_{ij} indicates the distance between the two objects.

According to the law of universal gravitation discovered by Newton in 1687, the standard gravity model applicable to explain the flow of trade between trading partner countries describes that the trade between two countries is determined positively by each country's GDP, and negatively by the distance between them where the formulation would be given as:

$$T_{ij} = \alpha Y_i^{\beta_1} Y_j^{\beta_2} D_{ij}^{\beta_3} \varepsilon_{ij} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.6)$$

Where T_{ij}refers to trade between countries i and j; GDP of the respective countries are given by Y_i and Y_j which represents economic size of the two countries; D_{ij} represents the distance between capital cities of the two countries and $\alpha, \beta_1, \beta_2, \beta_3$ are parameters to be estimated. The last term, ε_{ij} represents a random disturbance term showing the influence of omitted variables and statistical errors with an assumption that ε_{ij} has normal distribution with its mean to be zero.

The model could also be expressed in linear form as the works of Anderson (1979), Bergestrand (1985 and 1989), Helpman and Krugman (1985) and Hatab et al (2010) provides rigorous explanation for the log-linear form. Therefore, the linear form of the model looks like:

$$\ln T_{ij} = \alpha + \beta_1 \ln Y_i + \beta_2 \ln Y_j - \beta_3 \ln D_{ij} + \varepsilon_{ij} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.6)$$

The extraordinary stability of the gravity equation and its power to explain bilateral trade flows prompted the search for a theoretical explanation for it. The empirical literature pays no more than lip service to theoretical justification. The first important attempt to provide a theoretical basis for gravity models was the work of Anderson (1979). Anderson presented a theoretical foundation for the gravity model based on the constant elasticity of substitution (CES) preferences and goods that are differentiated by region of origin (the so-called Armington assumption) and where consumers have preferences defined over all the differentiated products. Under the existence of differentiated products, whatever the price, a country will consume at least some of every good from every country. All goods are traded, all countries trade and, in equilibrium, national income is the sum of home and foreign demand for the unique good that each country produces.

The early criticism against gravity model were mainly arisen from the model's nature of being a purely an econometric tool without a theoretical basis. As a response to this criticism subsequent elaborations have shown that the model is far from being a purely econometric tool without a theoretical basis and the model can arise out of a range of trade theories. In particular, Bergstrand (1985 and 1989) followed Anderson (1979) to show that the gravity model is a direct implication of a model of trade based on monopolistic competition developed by Paul Krugman (1980). In this model, identical countries trade differentiated goods because consumers have a preference for variety. Models with monopolistic competition overcome the undesirable feature of Armington models whereby goods are differentiated by location of production by assumption. Firm location is endogenously determined and countries are specialized in the production of different sets of goods. With the same objective of searching for theoretical foundation to the gravity model, Deardorff (1998) shows that a gravity model can arise from a traditional factor-proportions explanation of trade. Eaton and Kortum (2002) as well derived a gravity-type equation from a Ricardian type of model, and Helpman et al (2008) and Chaney (2008) obtained it from a theoretical model of international trade in differentiated goods with firm heterogeneity.

Prominent theories of international trade have found the model to be consistent with theories of trade based upon models of imperfect competition and with the Hecksher – Ohlin model. In this regard, Frankel (1997) gives the credits to Helpman and Krugman (1985) for the standard gravity model where the proportionate relationship between trade flows and country size developed by Helpman however do not include a role for distance. The gravity models used after this on the other hand incorporated distance as an explanatory variable due to the fact that it is a proxy for transport cost, time elapses during shipment (especially for perishable

products), synchronization costs[6] and transaction costs.

The more recent contribution by Deardorff (1995 and 1998) shows that the gravity model can be derived from two extreme cases of the classical framework of the Hecksher-Ohlin model. Frictionless trade is the first case where the absence of all impediments to trade in homogenous products causes producers and consumers to be indifferent among trading partners. By taking the existence of homogeneous products that could make consumers indifferent, the randomly expected trade flows correspond exactly to the simple frictionless gravity equation if preferences are identical and homothetic or if demands are uncorrelated with supply and they depart from that equation systematically when there are such correlations. The second case on the other hand is that different countries produce distinct goods, as in the H-O model with complete specialization. Expression for bilateral trade are derived, first with Cobb-Douglas preferences and then with CES preferences where distance is included in the second case of the model.

Notwithstanding with the aforementioned attempts of providing theoretical foundation to the basic gravity model, most of the recent studies used the augmented version of the model which includes additional variables to control for differences in geographic factors, historical ties and at times economic factors like the overall trade policy and exchange rate risk.

Generally speaking, finding a particular theoretical model that best describes the empirical findings of the gravity model is a matter of contention which also not the intention of this study. The main point, however, is that it seems possible to derive the gravity model equation

[6] *Synchronization Costs are incurred when factories combine multiple inputs, the timing of these needs to be synchronized so as to prevent emergence of bottlenecks and these costs increase with increasing distance (Grana et al, 2002; Letendre, 2013).*

from a variety of leading theories and the objective of this study is not to demand a new theory to the basic gravity model. On the top of this, the very fact that the equation has gone from an amazing poverty of theoretical foundations to an embarrassment of riches has motivated many authors to refer to this model as the "workhorse" of empirical trade studies (Eichengreen and Irwin, 1998; Cheng and Wall, 2001).

Upon its empirical success to explain bilateral trade flows, applicability of gravity model to explain bilateral trade determinants and subsequent assessment of developing country's trade potential with their trading partners has been recognized by the contemporary international trade obsessed researches including Batra, 2004; Sebei and Daya, 2006; Simwaka, 2006; Bhattacharya et al, 2007; Ramos, 2007; Alam et al, 2009; Thapa, 2009; Hatab et al, 2010; Rahman, 2010; Gebreyesus, 2011; Kebede, 2011; Michael, 2011; Abdulaziz, 2013; Bahre, 2015; Niang, 2016 and others as the details are presented in the empirical literature part of the study.

2.2. Empirical Literature

Taking the above theoretical frameworks as a benchmark, various empirical studies have been carried out in the area of what determines flow of bilateral trades between nations in Europe, Asia, Africa and Ethiopia even though the high percentage shares of the research task are concentrated to predicting trade potentials. Though the area is rich in literatures, we will concentrate on the case of developing countries where the major works that have been done in the area are thoroughly synthesized and presented as follows.

2.2.1. Previous Studies in Asia and Europe

To start with the empirical studies, the study carried out by Kim et al (2003) determined bilateral trade patterns of Organization for Economic Cooperation and Development (OECD) countries using a dynamic gravity equation. Given the sample of 10 countries with annual data covering 25 years (1975-1999), the authors showed that the national product differentiation model explains food and agricultural trade more properly and the pattern of bilateral trade could quickly adjust to changes in relative income between countries. Furthermore, the researchers clearly indicated the positive impact of world income growth on bilateral trade. On the basis of the obtained results, the researchers concluded that countries that have experienced a relatively higher income growth rate, such as China, will experience high inward foreign direct investment in large-scale manufacturing industries, resulting in higher export growth rates than import growth rates in these industry sectors.

Similarly, Nam (2004) examined the trade structure of the three Northeast Asian Countries, i.e., China, Japan and Korea as these countries experienced significant changes and progress in their economic relationships in trade. The author used a gravity model and Index of Trade Conformity (ITC) to estimate the trade potential that exits between the three countries. On the basis of the analyzed cross sectional data of the year 2001 over 21 countries, potential trades between the three countries has significantly passed the actual trade where the author suggests to implement trade facilitation measures, utilize complementarity of trade between them and introduce institutional integrations like regional trade arrangements so as to attain the potential trade.

Using an augmented gravity approach, Batra (2004) has estimated India's trade potential

around the world with the help of OLS estimation technique of a cross section data for the year 2000. The author first analyzed the flow of trade between India and its partners and use the coefficients obtained to predict trade potential for the country. The natural logarithm of total merchandise trade being the dependent variable, estimation results indicate that the gravity model works well, explaining about 69% of the variation in bilateral trade with all variables of interest (income, distance, common border and preferential trade agreements) found statistically significant. From an in-sample estimation strategy, Batra (2004) indicated that India has huge potential trade. Among countries that showed high potential for trade expansion with India include China, United Kingdom, Italy, France, Georgia and Uzbekistan.

In another research report produced by Kristjansandottir (2005), a gravity model has been applied to examine the determinants of Icelandic exports based on panel data on exports from 4 sectors, to 16 countries over a period of 11 years. The estimated results indicated that the size and wealth of Iceland does not seem to matter much for the volume of exports rather distance together with GDP and population of the recipient country, trade bloc and sector effects matter and that marine products vary considerable in their sensitivity to distance and country factors.

Antonucci and Manzocchi (2005) had explored the determinants of bilateral trade of Turkey with European Union (EU) countries over the period between 1967-2001. Estimation results have shown that Turkish trade exchanges with the former Soviet Union (CIS) and Mediterranean countries overshoot the predictions of the gravity model. Thus, the researchers concluded that, despite the long history of preferential relations, trade between Turkey and the EU is simply what geography and economic size would predict nothing less but nothing more. This is because Turkey's trade is historically and culturally more oriented towards

Mediterranean and CIS countries, so that the preferential treatment and the customs union provided by the EU are not enough to revert this pattern and make trade volumes with the EU rise beyond the gravity benchmark. Finally, the researchers indicated that only Turkey's full membership of the EU could lead to a special trade relation with EU countries.

The rapid transition of China from a closed agricultural society to an industrial powerhouse motivated Bussiere and Schnatz (2006) to use gravity model (two step fixed effect model) and trade integration indicators to assess the China's natural place in the world economy. The results revealed that China is well integrated in the world markets especially in most euro countries, North America, Latin America and East Asian emerging countries while China's international trade has been positively influenced by its economic size, trading partners being member of trade agreements (NAFTA and CAFTA) while distance is found to affect China's bilateral trade negatively.

Bhattacharya et al (2007) as well employed a gravity model impact analysis to assess the likely gains and losses of India-China trade cooperation. The authors took the very fact that India and China have significant bilateral trade potential and the two countries motivation of negotiation for free trade arrangements among themselves. In line with their ultimate goal, the authors used a-10 years (1995-2005) data to estimate and predict the potential benefits and losses of the two countries due to different preferential trading arrangements and free trade arrangements. Bilateral trade between the two countries being the dependent variable, the empirical results indicates that free trade arrangement is a win-win situation to both countries despite the fact that, in the short run India's potential gain is relatively less compared to china due to high tariffs while the long run benefits of India is expected to exceed that of China in the long run as tariff levels are brought at par with them.

With an objective to estimate the trade potential of Turkey with its trading partner countries, Karagoz and Saray (2010) as well has been applied a gravity model approach to first analyze the gravitational factors on trade flows and estimate the trade potential for Turkey using the coefficients of the model. In this attempt, it was found that the trade volume between Turkey and Asia-Pacific countries is positively and negatively affected from economic size of the countries and distance respectively while the effect of population was found to be negligible. The authors have used the coefficients estimated from the fixed effect gravity model and concluded that there exists a promise for expansion of trade for Turkey with trading partners including Papua New Guinea, Peru, Maynamar, Mexico, Laos and Brunei. On the other hand, the finding reveals that Turkey's actual trade with the rest of trade partners like USA, Japan, Canada, Australia and others has exceeded its trade potential.

By the same fashion, Rahman (2010) applied a generalized gravity model together with a panel data estimation technique to analyze Bangladesh's export trade pattern. A total of 31 countries were part of the study on the basis of their importance of trading partnership with Bangladesh and availability of data. The estimated results obtained from a-28 years (1972-1999) data analysis revealed that the main significant factors to determine Bangladesh's exports were the exchange rate, partner country's total import demand, and the openness of the Bangladesh economy. Among all these variables, only transportation cost had a negative and insignificant effect while the others have had a positive impact on Bangladesh's export.

Empirically, Raghuranmapatruni (2011) has used data over the years 1990-2009 for 16 industrial clusters to analyze the bilateral trade relations between two economic giants, India and China. She utilized trade intensity and revealed comparative advantage indexes apart from the usual gravity model where the finding revealed that India's revealed comparative

advantage value is higher for textile commodities followed by clothing. China's revealed comparative advantage value on the other hand is found to be the top in clothing industry followed by electronic data processing and office equipment.

According to Thapa (2012), a gravity model approach was used to evaluate the determinants of foreign trade and estimate the trade potential of Nepal using secondary data including 19 major trade partners. The findings revealed that gross national income has influenced Nepla's export positively while the effect of distance has been found to be negative. The study used coefficients of the estimated model to predict Nepal's foreign trade for the year 2009 and trade potentiality was calculated with the help of the ratio of predicted trade to actual trade. The estimated result of trade potentiality indicated that Nepal has exceeded trade potentiality with her 10 trading partners; Australia, Canada, China, India, Malaysia, New Zealand, Singapore, Switzerland, UK, and USA.

The Gravity of China's African export promise has also been addressed by Johnston et al (2014) as a response to China's critics for exchanging resources for manufacturing products with African countries. A gravity model of China's import trade across three growth-path-aligned economic geography typologies-resource rich; landlocked and resource-poor; coastal and resource-poor African countries has been used to estimate African countries export potential towards China. Data between 1995-2009 has been collected from 49 African countries to apply Pseudo-Poisson Maximum Likelihood (PPML) estimation technique where resource countries including Ethiopia exports below the potential level. The results also revealed that GDP and Population of the exporting African country together with China's population, existence of sharing similar linguistic orientation and recognition of market economy status have had positive and significant effect on China's import from African

countries. The effect of distance, being landlocked and failure to recognize the One China Policy appears to be significantly negative.

Sejdini and Kraja (2014) on the other hand took a sample of 27 import/export partner countries over the year 1993-2012 and apply an augmented gravity models to explain the key factors contributed to both import and export trade developments of Albania. The estimations were made by taking import and export variables of Albania independently. Trading Partner countries population and GDP per capita, existence of free trade agreements and common border were found to have significant positive impact for the import model. Likewise, the export model result revealed that, Albania's export has been a positive function of existence of common border and free trade agreements, population of Albania and Albania's GDP. The effect of distance variable on the other hand was found to be negative for both import and export models.

2.2.2. Previous Studies in African Countries

Coming to Africa, the empirical work of Sebei (2006) conducted with the help of trade potential indexes has found that the existing agricultural trade between South Africa and Kenya is biased in favor of South Africa as South Africa's agricultural export is more diversified compared to Kenya. The study was intended to examine agricultural trade flows between Kenya and South Africa with an emphasis to identify the existing trade patterns and scan for potential opportunities. The nature if the two countries economy has been investigated over the study period (2000-2004) is explained well, the two countries were recommended to trade in those agricultural goods in which they have comparative advantage. In this regard export of cereals, sugar, miscellaneous edible preparations and beverages were the items

where South Africa has a comparative advantage while Kenya's comparative advantage lies on export of tobacco, sugar, raw hides and vegetables.

With an application of econometric gravity model, Simwaka (2006) had examined Malawi's trade with a sample of 8 trade partner countries over the period 2000-2004. The estimated results indicated that Malawi's bilateral trade is positively determined by the size of the economies (GDP of the importing country) and similar membership to regional integration agreement. On the other hand, distance between Malawi and her trading partners, as a proxy to transportation cost, and exchange rate volatility were found to have a negative influence on Malawi's bilateral trade.

A study compiled by Hatab et al (2010) employed the standard gravity model and analyzed the main determinants of Egypt's agricultural exports to its major trading partners for the period 1994 to 2008. Major findings of the research indicated that Egypt's GDP and depreciation in Egyptian Pound against the currencies of its partners stimulates agricultural exports. On the other hand, the increase in Egypt's GDP per capita causes exports to decrease, which is attributed to the fact that an increase in economic growth, besides the increasing population, raises the demand per capita for all normal (particularly agricultural) goods. Likewise, distance (as a proxy for transportation costs) has been found to have a negative influence on agricultural exports.

Niang (2016) used annual data of the period 2005 to 2006 and applied an Ordinary Least Square Method to estimate the augmented gravity model of trade between Senegal and Morocco. Export models of the two countries were estimated against variables of trade partner countries where the result confirmed that GDP of partner countries, cultural factors measured

by common language and common colonizer, existence of border between countries, credit availability to the private sector, energy consumption in the country of origin have had positive effect on trade flows. The effect of distance between partner countries and macroeconomic instability captured by inflation rate was found to be negative for both countries.

Regarding trade potential, Morocco has a significant trade potential to export to its neighbor countries (Algeria, Tunisia), European countries (Germany, Portugal, UK, Denmark), Asian Countries (Bangladesh, Singapore and Japan) and Latin America (Ecuador) while its trade potential is saturated for Northern African countries (Libya and Egypt), for Sub-Saharan African countries including Senegal and for other European countries like Spain, France, Italy and The Netherlands. The situation for Senegal on the other hand was found to be different where the country's trade potential is found to be very poorly exploited vis-à-vis Northern African countries such as Algeria and Libya and even lesser with Tunisia and Morocco, European countries (Germany, Russia and Denmark), Asian Countries (Pakistan, Saudi Arabia, Japan, Bangladesh, Malesia, and south Korea) and Latin American countries (Argentina, Brazil, and Mexico).

2.2.3. Previous Studies in Ethiopia

In his attempt to examine whether Ethiopia's exports are determined by movements in real exchange rate or not, Kebede (2011) applied a dynamic panel data gravity model and took two main subsectors; namely, Coffee and Oilseeds using bilateral exports to seventeen major trading partners over the period 2000-2009. Accordingly, the results of the study show that both lagged and current real exchange rates are not in a position to exert significant effect on

the bilateral exports of the country. Finally, he suggested complementary measures like diversifying exports from traditional primary commodities to nontraditional price elastic export items, expanding exports destinations and giving due attention to the quality of exports to be taken to gain competitiveness in the international market.

Empirically, Michael (2011) employed a gravity model approach for a 5-years data spanning from 2003-2007 to examine the factors that affect the bilateral trade in services in Africa. A total of 11 trading partner countries from Europe, North America and Asia were selected to examine 49 African countries trade in service with each of the 11 ones. Accordingly, the findings mainly illustrate that trade in services in Africa, though it is at its infancy stage, has been positively influenced by nation's per capita GDP, number of total labour force they possess, number of internet users, colonial history and common language between the partnering countries. Distance between trading partners and being a landlocked country have had a deteriorating effect on trade in services.

Hailegiorgis (2011) used annual time series macroeconomic data over the period 1974 to 2009 to examine the export performance and determinants of oilseeds in Ethiopia. The very fact that Ethiopia's export earning being less diversified and dependent on few traditional agricultural products has motivated the author to figure out what determines the export performance of one of the agricultural export items, oilseeds. The results from the classical linear regression and error correction model divulges that real output and nominal exchange rate variables were able to determine the export performance of oilseed in Ethiopia.

The overall export performance of determinants of Ethiopia has been analyzed by Wondaferahu (2013) using a VAR[7] model analysis for the period 1970/71-2010/11. Both the short run and long run estimates were investigated using Johansson co-integration and Vector error correction approaches. The findings revealed that export performance has found to be positively influenced by real effective exchange rate, trade openness, real GDP of home country, infrastructural development and private credit as a ratio of GDP (financial development) while the effect of trading partner's real GDP was found to be insignificant. Accordingly, the author suggests to maintain high and sustainable economic growth, improvements in infrastructural facilities and credit access, maintaining conducive and stable exchange rate policies and reducing trade restrictions has to get due emphasis so as to improve the relatively poor performance of Ethiopia's export.

Abdulaziz (2013) empirically identified the main determinants of Ethiopia's bilateral exports and addresses the question of whether Ethiopia has untapped export potentials with the Middle Eastern Countries or not. He utilized G2SLS estimation technique using 13 years (1995-2007) panel data of 15 exporting partners. Accordingly, GDP per capita of both exporting and importing countries found to have positive and significant impact on Ethiopia's bilateral exports while distance between countries negatively affect their bilateral trade. With regard to the trade potential, the Index of Trade Conformity (ITC) revealed that Ethiopia has the highest unexploited potential in U.A. E and significant amount in Saudi Arabia.

By employing the recent innovations of the gravity model and GMM estimation technique, Gebreyesus (2015), estimated the trade potential of Ethiopia with her 36 trading partners over

[7] *Vector Autoregressive Model.*

the period 1995-2009. The estimated results indicated that economic size (GDP) of trading pairs is found to have a positive significant effect while distance, population size of the trading partners, per capita GDP differential were found to have inverse and significant impact on the pattern of trade. Export diversification which advances the narrow export dependency and improvement of infrastructure that reduces transaction costs were recommended to exploit Ethiopia's untapped trade potential with Asian, European and African countries.

Though only an error correction modelling approach has been utilized, Hassen (2015) attempted to estimate the major determinants of coffee export potential in Ethiopia over the period 1965-2005. His major specification as focused towards the supply side factors only where the error correction model result indicates that Ethiopia's coffee export supply in the short run is determined by real exchange rate (positively), foreign capital inflow (negatively) and real income (positively) and about 78.7 percent of the disequilibrium has been corrected each year bay change in export supply of coffee. Domestic price, real exchange rate, real income and terms of trade were also found to have a decisive determining power of coffee's export in the long run.

In conclusive, both the theoretical and empirical literatures elucidated that economic variables like comparative advantage on production, productivity (growth), GDP, GDP per capita, population, exchange rate, geographical proximity, transportation cost, technological changes, regional trading blocs, cultural and common colonial affiliation variables were found to be significant determinants of countries bilateral trade flows.

2.3. An Eagle Eye Review of Literatures Consulted

As we have seen above, there is no relevant work done to rely to understand what really determines Ethiopia's aggregate agricultural export to its trading partners and subsequent attempts to measure the existing trade potential. On the top of this, a critical review of the previous consulted empirical literatures illustrates the existing knowledge gap in the area. First and foremost, the previous studies have been inconclusive on the impact of the variables identified as the major determinant to export especially the effect of population vary in sign, magnitude and significance level from one study to another. The effect of population has been found to be negligible as it was revealed by the study of Kristjansandottir (2005); and Karagoz and Seray (2010) while it shows a positive effect of population on trade/export flows of countries as it was revealed by Sejdini and Kraja (2014), Johnston et al (2014) and Bassiere and Schnatz (2006) findings. Population of home country has also been affecting Egyptians agricultural export negatively. The effect of importing countries population as well shows negative effect as it was indicated by Gebreyesus (2015). By the same talking, the effect of preferential/regional trading agreements seems not to matter in some cases like Antonucci and Manzocchi (2005) while it affects trade flows positively on the basis of research findings by Batra (2004), Simwaka (2006), Bassiere and Schnatz (2006) and Sejdini and Kraja (2014). Apart from this, the previous studies were failed to incorporate the effect of some important variables like Contact-Intensive Money (CIM[8]) which would serve as a proxy for financial/institutional development in the country (Thursson, 2008) where our study has incorporated it. Secondly, unlike to the previous studies, our study is intended to take the

[8] *Contract-Intensive Money (CIM) refers to ratio of non-currency money to total money supply, i.e.,* $CIM = {}^{M_2 - C}/_{M_2}$, *where* M_2 *represents broad money in the country and C refers to cash/currency held outside banks (Clague et al, 1999, p. 188).*

aggregate agricultural export of Ethiopia as the previous studies focused only on total trade flows or total exports or only few items using the gravity model. More specifically, they do not take all the agricultural export items into consideration while they attempt to figure out the export potential of some selected agricultural items like coffee and oilseeds[9]. Finally, by combining the theoretical insights with the empirical evidence of the literature sources we have gone through, we have noticed that the previous studies suffer from model misspecification where studies like Hailegiorgis (2011); Wondaferahu (2013) and Hassen (2015) who have made emphasis to some selected agricultural export items mainly coffee and oilseeds have used modelling approaches apart from gravity model. In this regard, the VAR and ECM[10] approaches used by the aforementioned authors fails to enjoy the best qualities of panel data while the gravity model takes advantage of those qualities. In addition to this, studies utilized the gravity model suffers from problems of misspecification. In this regard, applications that employed cross-sectional data are the most affected (Egger, 2002). This is due to the fact that cross-sections consider only a point in time. Among such studies Batra (2004) and Simwaka (2006) are the major ones. Other studies that makes use of panel data (like Kebede, 2011; Michael, 2011; and Abdulaziz, 2013) can also suffer from the crisis of misspecification as they mainly focus on static nature of the model or dataset used, which ignores the role for dynamic effects in trade (Bun and Klaassen, 2002). Besides, the focus of attention for all the studies undertaken in Ethiopia was about analyzing the determinants of exports. None of the studies have tried to evaluate the case with a particular emphasis to agricultural export items as developing countries in general and Ethiopia in particular exports mainly agricultural primary

[9] *See for example studies by Kebede (2011); Hailegiorgis (2011); Wondaferahu (2013); Abdulaziz (2013); Gebreyesus (2015); and Hassen (2015).*

[10] *Error Correction Model*

products and they were focused on the static nature of bilateral trade flows. The fact however indicates that the flow of trade between nations is usually persistent (Harris and Matyas, 1998; Egger, 1999; and Anderson and Wincoop, 2003) in the sense that countries with a history of trading with one another-whether for affiliations related to politics, policies or other factors-generally continue doing so (Eichengreen and Irwin, 1996). On the top of this, firms from exporting countries usually develop distribution channels which caused costs to be sunk and (or) customers of the trading pairs being accustomed with each other's products which contributes for trade persistency that justifies our approach to use dynamic gravity model.

CHAPTER III: OVERVIEW OF ETHIOPIAN ECONOMY

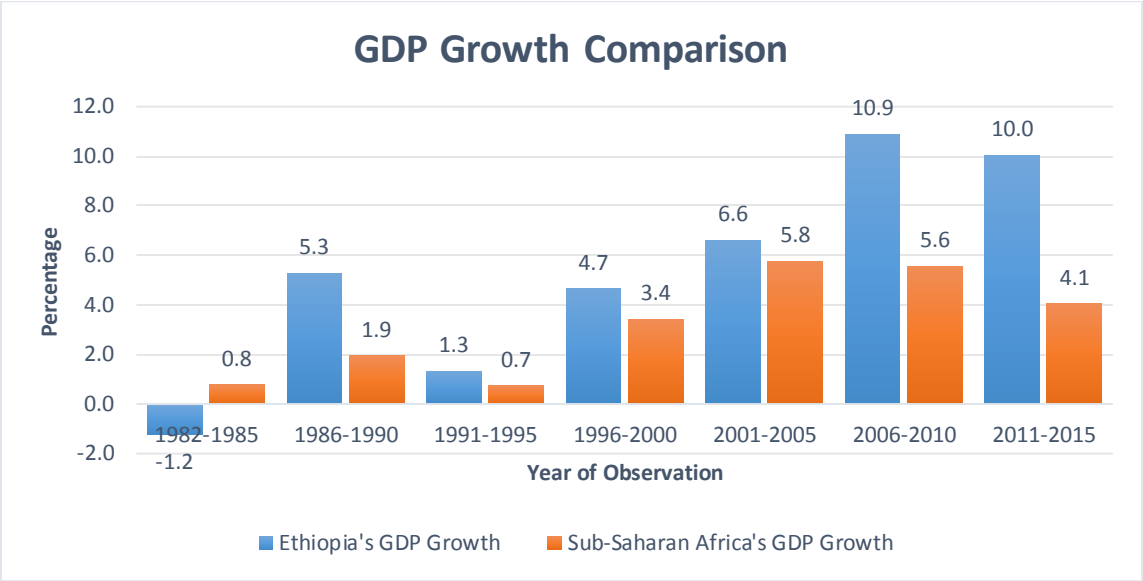
3.1. Introduction

Ethiopia has been known for its political unrest in the past 5 decades and the economy as well suffered a lot as three different regimes with different economic management system have been witnessed (Alemayehu, 2011). This part of the study is to make an overall brief call to the Ethiopian economy with a particular emphasis on the external sector mainly on agriculture.

3.2. Structural Overview of Ethiopian Economy

Statistically speaking, Ethiopia is the second-most populous country in Sub-Saharan Africa with a population of 97.0 million, and population growth rate of 2.5% in 2014 (World Bank, 2014). The country's per capita income of $550 is substantially lower than the regional average GDP per capita of $691 (Ministry of Finance and Economic Development (MoFED), 2015). The Ethiopian economy has experienced strong and broad based growth over the past decade, averaging 10.8% per year in 2003/04 - 2013/14 compared to the regional average of 5.0% (Ibid). According to the World Bank (2016), Ethiopia was the 12th fastest growing economy in the world, and if this historic growth continues, it could become a middle-income country in just 12 years. The government aspires to reach middle income status over the next decade. These progresses of the country however are likely to face challenges including sustaining the steady path of price stability, improving export competitiveness and increasing pressure on the financial sector (UNDP, 2015). The average GDP growth comparison of Ethiopia with sub-Saharan Africa has been presented below.

Figure 3. 1: Ethiopia's GDP Growth Comparison Against Sub-Saharan African Countries



Source: Author's Own Computation using data from WDI, 2016

Looking at the above figure illustrates that; Ethiopia has experienced strong economic growth in recent years with real GDP growth at or near double digit levels since 2006. Except for the periods 1982-1986, Ethiopia has consistently outperformed most other countries in Sub-Saharan Africa and expanded much faster than the continent-wide average (Figure 3.1) not to forget that the country still faces some structural weaknesses that present significant challenges in the medium term (African Development Bank, 2010).

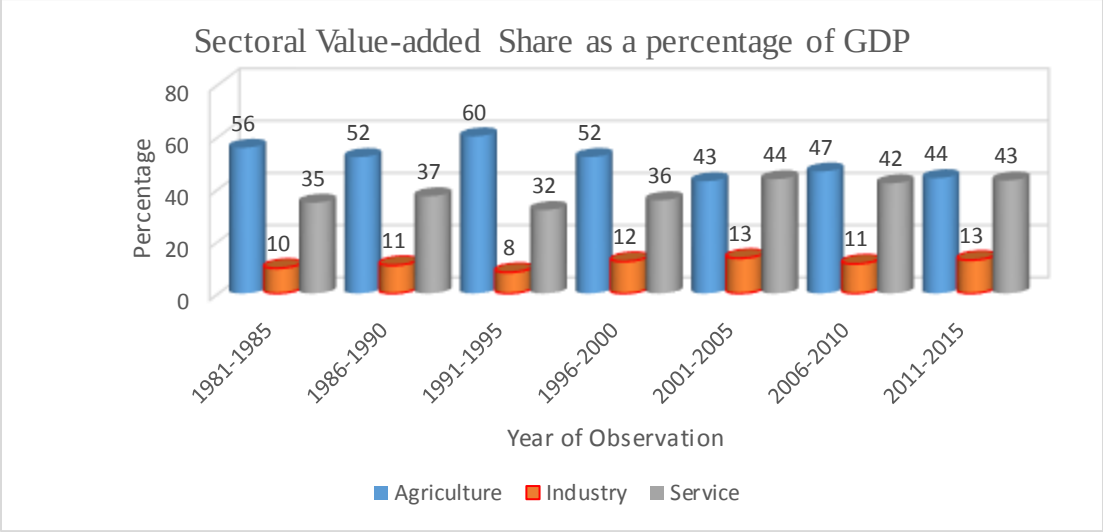
The economy of Ethiopia has been exposed to three different economic management systems practiced by three different regimes in the country with all having their own prons and cons. As a result, the country has been suffering from vicious cycle of poverty[11]. A socialist economic system came to power following the collapse of the Imperial regime in 1974 and the

[11]*Vicious circle is a situation in which one problem causes another problem that then causes the first problem again, so that the whole process is going to be repeated (Todaro and Smith, 2012).*

regime completely shifted the economic system from the infant market oriented environment to a total control of almost all economic activities at the hands of the state. After seventeen or so years of a centrally planned economic arrangement there was again a shift to a somewhat market friendly environment in 1992 where many sectors of the economy were open up for the private sector.

Through all the regimes, agriculture; industry and service sectors were the major productive sectors of the economy contributing to the country's GDP growth, employment opportunity to the poor and foreign exchange earnings. Though there are certain ups and downs, agriculture makes the paramount contribution despite the fact that it is very suspicious to the vagaries of nature (Alemayehu, 2011). The figure below depicts sectoral share of the economy in the past few years.

Figure 3. 2: Trends in Share of Major Sectoral Components in GDP (%)

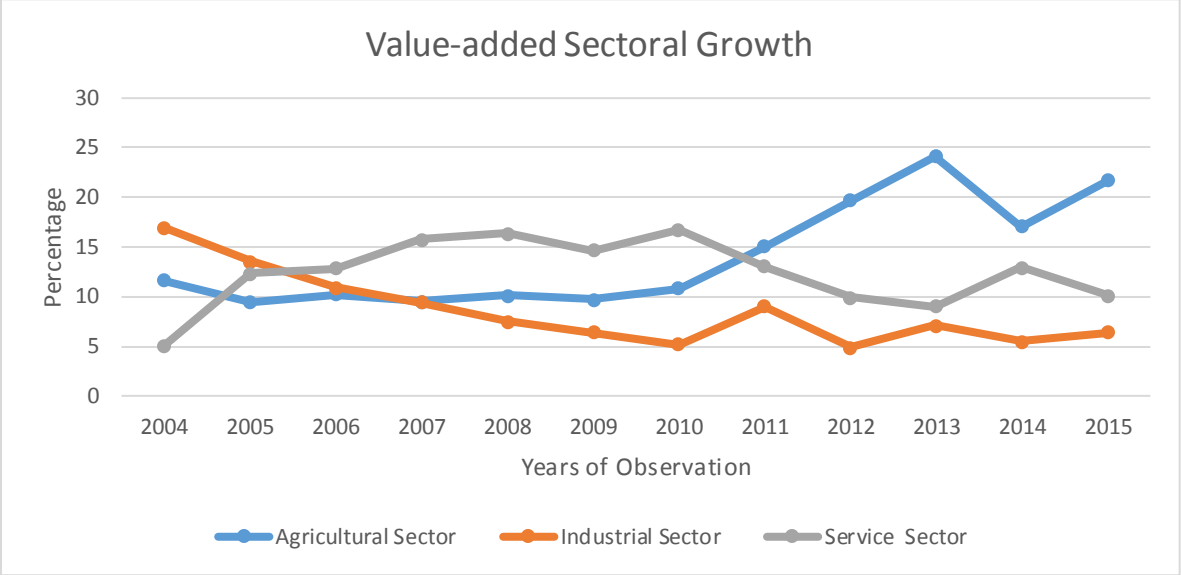


Source: Author's Own Computation using data from WDI.

Sectoral employment as a percentage of the total employment for the respective sectors of agriculture, industry and service has been noticed to be 89.3%, 2.3% and 7.6 % in 1994 while this number has been changed to 79.3%, 6.6% and 13% by 2015 (World Bank, 2016). In line with this fact, structurally, the agricultural sector has been dominating the significant share of the country's GDP though the service sector has slowly taken over the lead from agriculture in the recent periods. The manufacturing sector is still in its infancy stage which do not have a significant change in the last 3 years. More specifically, the respective shares of agriculture and service sectors were about 55% and 35% in 1995 while this has been changed to 41% and 43% by the year 2015 which shows that the service sector has maintained modest increments over the years in terms of value added as agriculture's share declines. This however has been highly criticized by intellectuals as it is really hard to sustain its growth path for an economy which is highly service based. This criticism is even convincing as the service sector do not really create its own output rather it serves as an intermediate to convert the outputs produced by the other sectors. The inter-sectoral linkage between agriculture and other sectors, mainly with industry as well is too weak in the country which indicates that the agricultural sector is not strongly feeding the manufacturing sector.

The growth perspective of the sectoral classification as well has managed to register a significant improvement though there were periods of poor performances too. The period after EPRDF government took power specifically are known for good performances though there are a lot of things to be improved (UNDP, 2015).

Figure 3. 3: Sectoral Value-added Growth (2004-2015)



Source: Author's Own Computation using IMF (2016) and IMF (2016) databases.

The above figure illustrates that the sectoral value added growth is erratic though the growth of agricultural sector outshines over the others especially during the first Growth and Transformation Plan (GTP I). Among other things, the due emphasis given to agricultural sector during the First Growth and Transformation Plan (GTP I) can be cited for this unique performance.

3.3.External Trade in Ethiopia

With a view to strengthen industrialization and transform the economy to a socialist system, Ethiopia has restricted its international trade until the coming of EPRDF in 1991/92. Among the major ways of restriction; administratively kept fixed exchange rate, an exorbitant tariff rate and trade licensing were used to control imports (Alemayehu, 2002). None of these

policies however were able to bring the expected level of GDP growth and failed to rescue the balance of payment from its deterioration (Alemayehu, 2015).

Broadly Speaking, international trade which involves the exchange of capital, goods, and services across international borders, represents a significant share of gross domestic product. Likewise, the contribution of international trade to Ethiopia's GDP is highly considerable though the foreign trade of Ethiopia is dependent upon few agricultural commodities (Yohannes and Emmanuel, 2012). More specifically, the trade openness[12] measure shows that trade was about 50% of GDP in the years 2005 and 2006 (see table 3.1) despite the fact that its share is erratic overtime which confirms one stylized fact of developing countries like Ethiopia. In this regard, this fluctuation might be due to the smallness (price taking) nature of the country in the international market emanating from supply rigidity, less variety and vulnerability (to external shocks) of export products.

[12] *Trade openness is a standard measure of an economy's openness in the international trade, that is, the sum of the shares of exports and imports in GDP:* $(Export + Import)/_{GDP}$ *(Carbaugh, 2009)*

Table 3. 1: Trends of Ethiopia's Trade in Goods and Services (1995-2015).

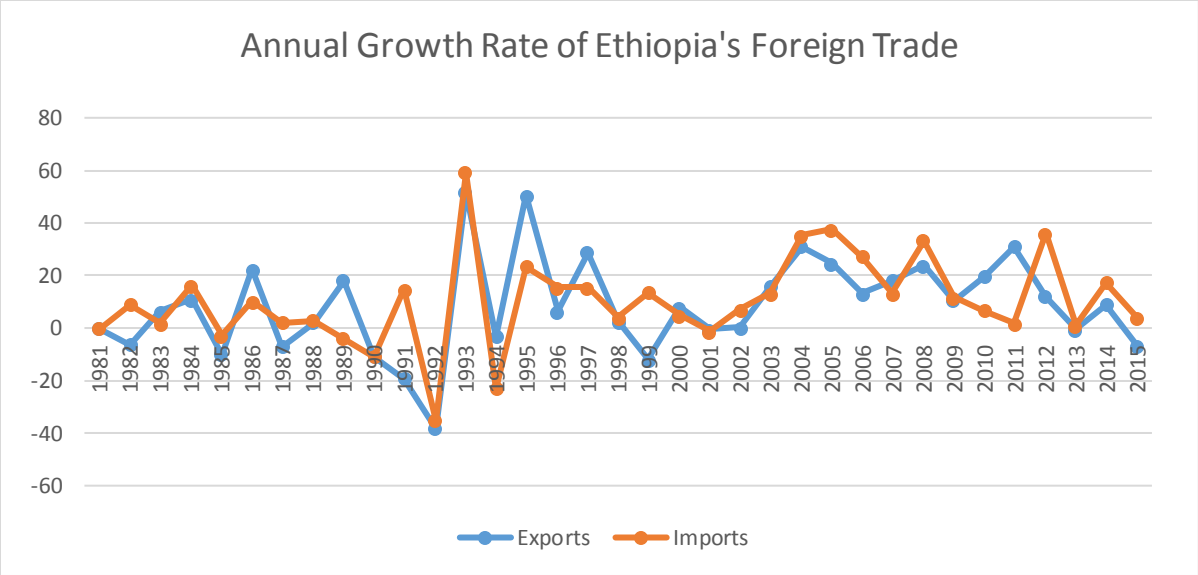
Year	Value of Trade (In Millions of USD)			Growth of Trade (%)			Share of Trade in GDP (%)
	Export	Import	Total Trade	Export	Import	Total Trade	
1995	736.92	1,196.07	1,932.99	-	-	-	25.22
1996	785.86	1,380.89	2,166.75	0.07	0.15	0.12	25.30
1997	1,010.47	1,588.49	2,598.96	0.29	0.15	0.20	30.27
1998	1,038.49	1,654.92	2,693.41	0.03	0.04	0.04	34.41
1999	917.87	1,881.57	2,799.44	-0.12	0.14	0.04	36.19
2000	984.27	1,960.73	2,945.00	0.07	0.04	0.05	35.71
2001	980.17	1,938.02	2,918.19	0.00	-0.01	-0.01	35.41
2002	981.82	2,072.37	3,054.19	0.00	0.07	0.05	38.92
2003	1,139.43	2,345.63	3,485.06	0.16	0.13	0.14	40.43
2004	1,497.96	3,174.43	4,672.39	0.31	0.35	0.34	46.09
2005	1,857.98	4,365.68	6,223.66	0.24	0.38	0.33	50.20
2006	2,104.89	5,547.32	7,652.21	0.13	0.27	0.23	50.09
2007	2,441.56	6,143.38	8,584.94	0.16	0.11	0.12	44.44
2008	2,949.98	7,976.29	10,926.27	0.21	0.30	0.27	42.25
2009	2,832.97	8,013.79	10,846.76	-0.04	0.00	-0.01	39.19
2010	4,070.65	9,912.73	13,983.38	0.44	0.24	0.29	46.71
2011	5,331.87	10,079.83	15,411.70	0.31	0.02	0.10	48.23
2012	5,962.72	13,699.49	19,662.21	0.12	0.36	0.28	45.40
2013	5,934.33	13,812.28	19,746.61	0.00	0.01	0.00	41.55
2014	6,474.17	16,182.86	22,657.03	0.09	0.17	0.15	40.74
2015	6,047.45	16,827.89	22,875.34	-0.07	0.04	0.01	37.17

Source: Compiled from World Bank (2016) Database.

Taking the year where a significant trade liberalization policy has been implemented in the country (1995) as a benchmark, the share of foreign trade to Ethiopia's GDP ranges between 25.22 and 50.2 percent. The growth of Ethiopia's foreign trade overtime as well has always been positive except for the years 2001 and 2009 though an erratic nature has always been its main feature. Total trade share to GDP for the last three-years of GTP I (2013-2015) has been noticed to be declining which might be due to the existing rent seeking behaviors and slow performance in supporting the trade registration and licensing system with the newly introduced uniforfm and harmonized trade registration and licensing system (FDRE GTP II, 2016).

Similarly, the growth of both export and import trades were highly volatile (see Figure 3.4) in the past 34 years (1982-2015) where the growth rate ranges from -38.4 to 31.13 and -35.29 to 37.56 for export and import trade respectively.

Figure 3. 4: Growth rate of Ethiopia's Foreign Trade (1982-2015)



Source: Author's Own Computation using IMF (2016) database.

Despite the fact that, Ethiopia's foreign trade has a paramount share of the country's GDP, the export items are mainly dominated by few agricultural products where coffee, oilseeds, leather and leather products, pulses, fruits and vegetables, live animals, chat and gold are the major ones (ERCA Trade Statistics, 2016; NBE, 2015). According to the NBE's 2014/15 report, the aforementioned export items jointly covers 80% of the total export earnings by the year 2014/15 (See Table 3.2).

Table 3. 2: Ethiopia's Major Export Commodities and their Share (2010/11-2014/15)

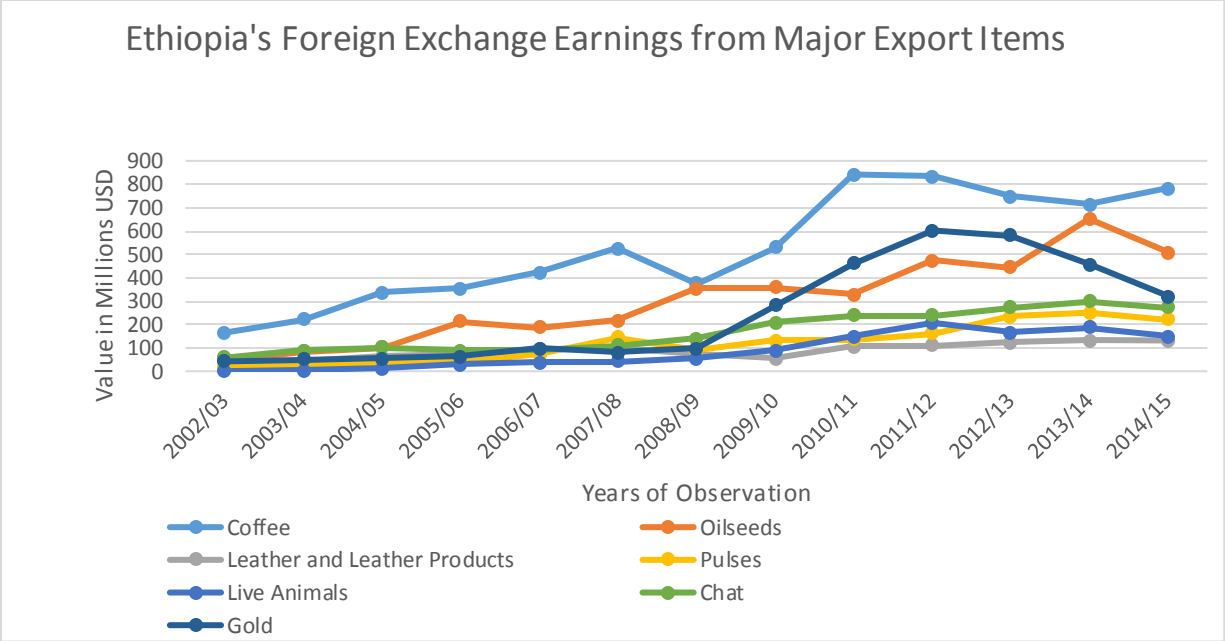
In millions of USD

S.N	Export Items	2010/11		2011/12		2012/13		2013/14		2014/15	
		Value	% Share	Value	% Share	Value	% Share	Value	% Share	Value	% Share
1.	Coffee	841.8	30.64	833.1	26.43	746.6	23.96	714.4	21.65	780.5	25.85
2.	Oilseeds	326.6	11.89	472.3	14.98	443.5	14.23	651.9	19.76	510.1	16.89
3.	Leather and Leather Products	103.8	3.78	109.9	3.49	121.1	3.89	129.8	3.93	131.6	4.36
4.	Pulses	137.9	5.02	159.7	5.07	233.3	7.49	250.7	7.60	219.9	7.28
5.	Meat and Meat Products	63.3	2.30	78.8	2.50	74.3	2.38	74.6	2.26	92.8	3.07
6.	Fruits and Vegetables	31.5	1.15	44.9	1.42	43.9	1.41	45.9	1.39	47.6	1.58
7.	Live Animals	147.9	5.38	207.1	6.57	166.4	5.34	186.7	5.66	148.5	4.92
8.	Chat	238.3	8.67	240.3	7.62	271.3	8.71	297.3	9.01	272.4	9.02
9.	Gold	461.7	16.81	602.4	19.11	578.8	18.58	456.2	13.82	318.7	10.55
10.	Flower	175.3	6.38	197	6.25	186.7	5.99	199.7	6.05	203.1	6.73
11.	Electricity	0	0.00	0	0.00	34.6	1.11	45.3	1.37	42.8	1.42
12.	Others	219.1	7.98	207.1	6.57	215.4	6.91	247.4	7.50	251.4	8.33
	Total	2,747	100	3,153	100	3,116	100	3,300	100	3,019	100

Source: National Bank of Ethiopia (2014/15).

Moreover, the joint report by the NBE and ERCA trade statistics shows that coffee, oilseeds, leather and leather products, chat and gold were registered to be the major export items of Ethiopia for the years between 1995-2015. More specifically, export earnings from coffee, oilseeds and leather and leather products contributed more than half (53%) of the total earnings in the periods between 2002/03-2014/15. This clearly indicates that Ethiopia's export trade is highly dependent on a limited variety of agricultural commodities. The reports added that there seems to be slight improvements in the degree of diversification as some other products like flower, live animals and pulses become significant export items (ERCA Trade Statistics, 2016) as the share of coffee declines over time continuously.

Figure 3. 5: Foreign Exchange Earnings of Major Export Items (2002/03-2014/15)



Source: Computations based on NBE (2014/15) Report.

The dominant contribution of Coffee export to the country's total export earning has been confirmed in all the years under consideration followed by oil seeds and gold. Some other comments are also in order about data in figure 3.5. There seems to be a continuous decline in export earnings from coffee and gold during the first Growth and Transformation Plan (GTP I).

Coming to the import side, the 2014/15 report of the NBE indicates that the major import items of the country are capital goods, consumer goods, semi-finished goods, fuel (petroleum) and raw-materials in order of their share where each item individually accounts for 41.8%, 27.4%, 15.7%, 12.4% and 1% respectively for the report year. As one could see from table 3-3, the share of these items has been maintained for most of the periods in the last five years.

Table 3. 3: Major Import Items of Ethiopia and their Share

In millions of USD

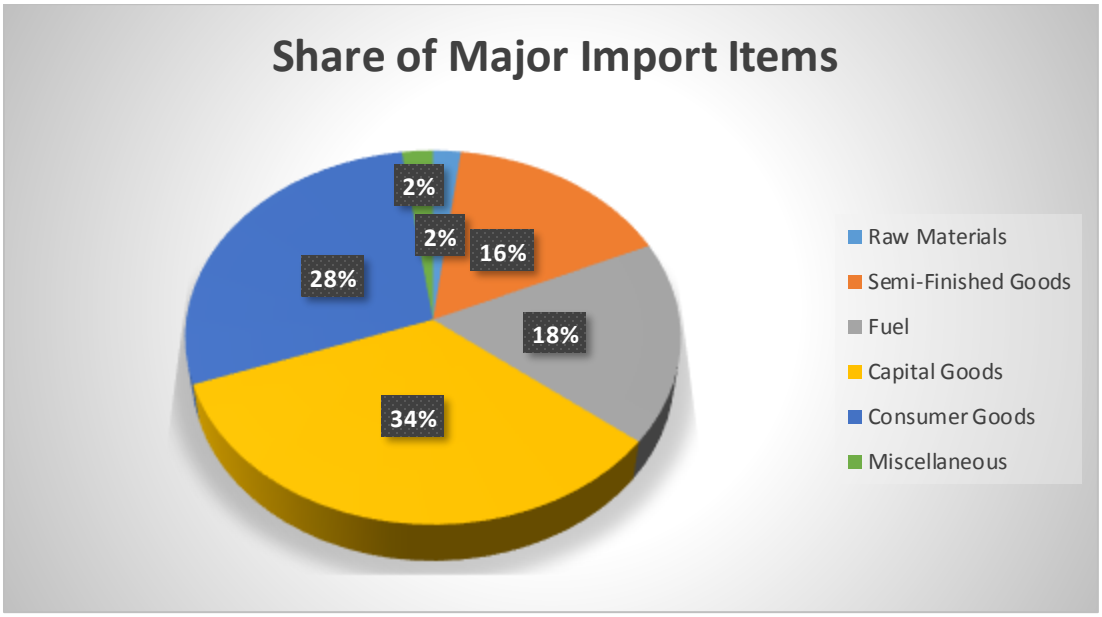
S.N	Import Items	2010/11		2011/12		2012/13		2013/14		2014/15	
		Value	% Share	Value	% Share	Value	% Share	Value	% Share	Value	% Share
1	Raw Materials	183.7	2.23	199.7	1.81	146	1.27	166.6	1.21	170.5	1.04
2	Semi-Finished Goods	1228	14.88	1957.2	17.69	1898	16.56	2231.7	16.28	2578.4	15.67
3	Fuel	1659.3	20.10	2124.8	19.21	2174.9	18.98	2573.1	18.76	2040.9	12.40
4	Capital Goods	2757	33.40	2961.7	26.78	3825.1	33.38	4845.5	35.34	6882.3	41.82
5	Consumer Goods	2294.8	27.80	3531.7	31.93	3206	27.97	3694.6	26.94	4510.9	27.41
6	Miscellaneous	130.5	1.58	286.3	2.59	210.7	1.84	200.9	1.47	275.6	1.67
	Total	8253.3	100	11061.4	100	11460.7	100	13712.4	100	16458.6	100

Source: National Bank of Ethiopia Annual Reports.

One can simply comment based on table 3.3. The country's import of consumable goods is second in share and even the first in 2011/12 which simply mean that the country is importing those products that would not have any value addition in Ethiopia and exporting jobs out.

The amass import nature as well illustrates the fact that the share of capital goods import exceeds the other for the periods between 2002/03 -2014/15 (see figure 3-6).

Figure 3. 6: Accumulated Share of Major Import Items (2002/03-2014/15)



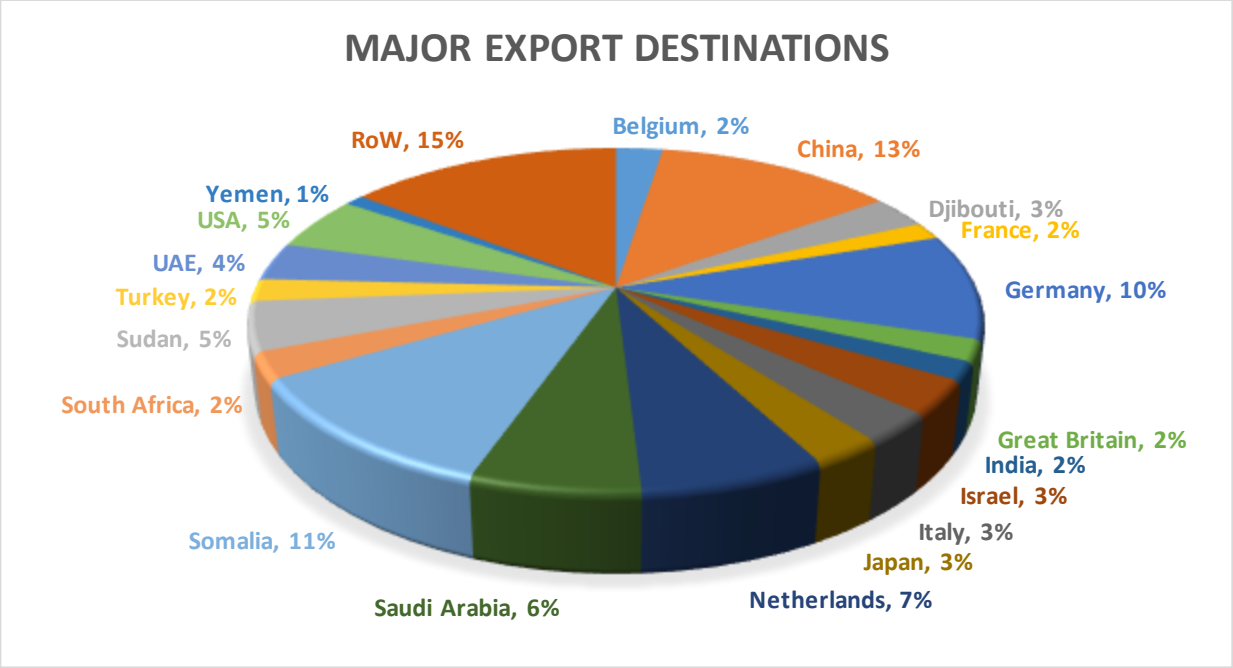
Source: Autor's Own computation used NBE (2002/03-2014/15) Reports.

From the above figure, one can simply figure out the following facts. The first fact would be related with the limited nature of the country's import items where the absence of diversification is not a real problem as for exports since aforementioned product categories are so broad that various goods are suppressed in each category. Capital goods, for example, incorporate a variety of machineries, vehicles, aircrafts, computers and so forth. This arises from the very fact that the international market is full of supply as far as the country resolves its foreign exchange constraint as it has been the major challenge for almost all the periods of

the last 5 decades (Lensink, 1995; Dorosh et al, 2009 and Keatinge, 2014). Secondly, one major stylized fact about developing countries including Ethiopia which says that 'developing countries tend to be capital importers' has been confirmed as figure 3.6 shows that the country's import of capital goods is higher than other import materials in almost all the periods. This also implies that the country imports less of raw materials as it has been illustrated by figure 3.6.

Referring to the top export destination of Ethiopia, the country's majorities are located in Asia which have taken on average 38.4% of the export followed by countries of Europe with 33.6% and African countries with an average of 20.2% for the year 2014/15. During the same period, the next regions are America and Oceania countries with a respective average of 7% and 0.8% (NBE, 2014/15).

Figure 3. 7: Ethiopia's Major Export Destinations (2010-2015)

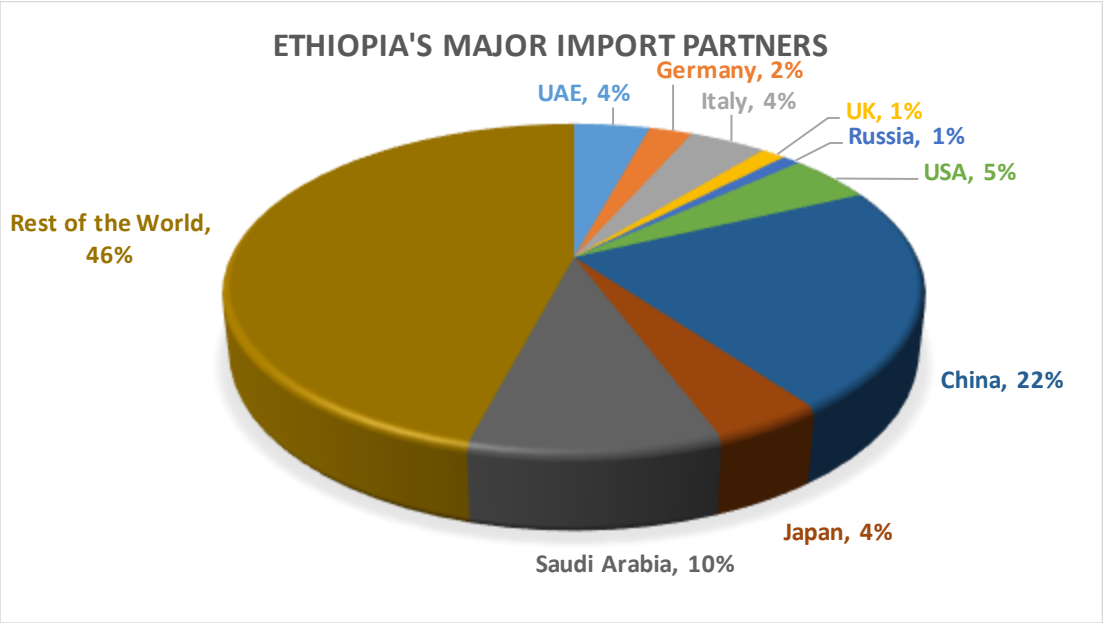


Source: Autor's Own Computation using ERCA (2010-2015) Trade Statistics.

As it is illustrated in Figure 3.7 for the periods under consideration, China has been the main destination of Ethiopia's total exports. Likewise, Somalia, Germany, Netherlands, Saudi Arabia, Sudan, USA, United Arab Emirates, Djibouti, Israel, Italy and Japan are among the major destinations of Ethiopia's export in their descending order of share as these countries aggregately represents about 73% of the country's total export during 2010-2015. This would mean about trade structure of the country where Ethiopia's exports have some degree of concentration among limited number of destinations.

As far as Ethiopia's import origin continents are concerned, about 70.3 percent were from Asia, 19.5 percent were from Europe, 5.4 percent were from America and only 4.7 percent originated from Africa during the period 2014/15 (NBE, 2014/15). By the same year under consideration, out of the total imports from Asian countries, the largest part originates from four countries: China (38.3%), India (6.7%), Saudi Arabia (5.1%), and Kuwait (4.5%). On Europe's side, Italy, Turkey, Germany, the Netherlands and United Kingdom accounts for 3.1%, 2.5%, 2.1%, 1.6% and 1.3% respectively. By the same talking, Morocco (30.2%), Egypt (22.8%), South Africa (19.4) and Sudan (17.4%) constituted about 89.8% of imports from Africa countries, whereas the United States takes the lion share of imports from the Americas (Ibid).

Figure 3. 8: Ethiopia's Major Import Partners (1994/95-2014/15)



Source: Autor's Own computation using NBE (2014/15) Report.

Speaking of aggregate terms, China and Saudi Arabia has been the front runners followed by USA, Italy, Japan, United Arab Emirates, Germany, United Kingdom and Russian Federation in their order of importance for the periods 1994/95-2014/15.

Unlike to the export destinations (see figure 3.7), the highest share of rest of the world in the above figure (46%) indicates that the sources of Ethiopia's imports were relatively diversified.

3.4.Contribution and Performance of the Agricultural Sector

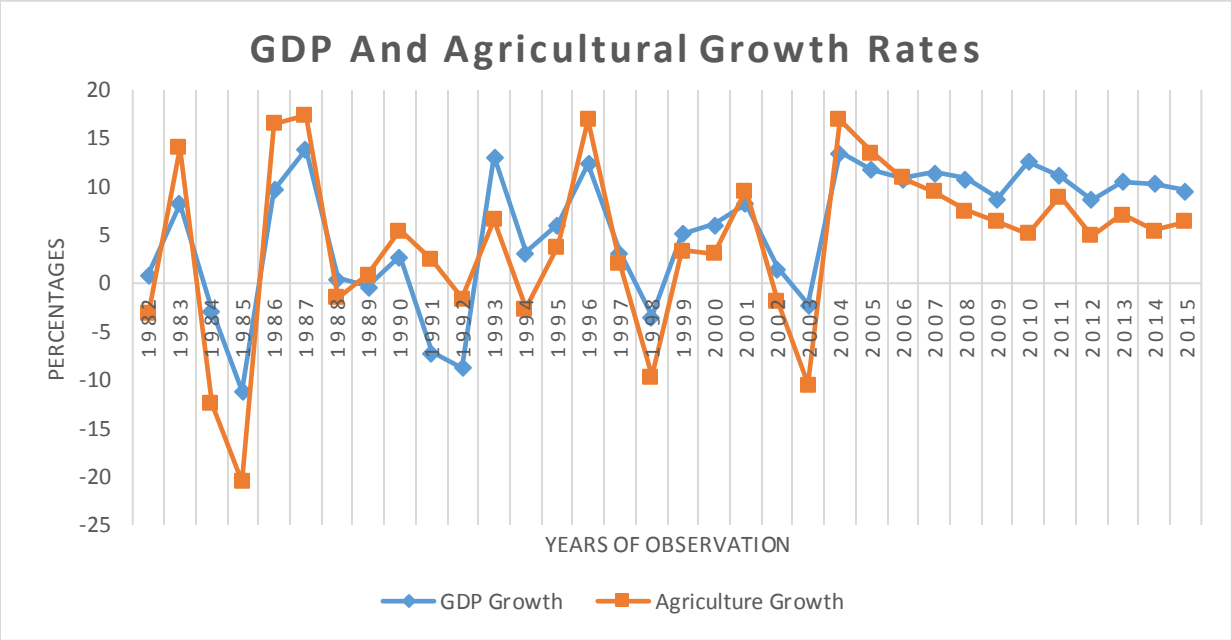
With the existence of fortunate and/or unfortunate reasons including favorable weather and good rainfall, strengthened agricultural extension services, better access to agricultural inputs, improved access to market and pursue of enhanced policy and advocacy, the agricultural sector in Ethiopia has been the backbone of the economy and it implies that the overall economic

performance of the country is largely determined by what happens in the agricultural sector.

Though the performance differs, agriculture employs more than 85 percent of the population, 80 percent of export earnings and contributes nearly half to GDP in all the three regimes that has been ruling the country for the last 7 decades.

With regard to the role of agriculture towards the economic growth performance of the country, the sector continuously supported the economy in all of its impressive and meager performances. The figure below illustrates the contributions for the last 34 years (1982-2015).

Figure 3. 9: Ethiopia's GDP and Agriculture Growth Rates (1982-2015)



Source: Computation using World Bank (2016) database.

There are two major facts that emerges from figure 3.9. The first one is that, the figure shows the rhythmic co-movement of GDP and agricultural sector growth which clearly confirms the very fact that Ethiopia's economy is highly dependent on the rain-feed agriculture. The second

fact on the other hand is the erratic nature of both agriculture and GDP growth as they are highly suspicious to the vagaries of nature in the sense that GDP registers the highest figure when there is good rain and the lowest comes otherwise (Alemyehu, 2011). In this regard, the major challenge for Ethiopia is to sustain its current growth rate while ensuring that growth is also dynamic as agriculture still remains the country's largest source of growth.

Coming to agricultural sector's contribution to the countries overall export earnings, agricultural export items including coffee, oilseeds, pulses, flowers, and fruits and vegetables aggregately generated around 2.4 billion worth of USD which takes 79.7 percent share of the total country's export earnings (NBE, 2014/15). It has been also reflected by the figure below.

Figure 3. 10: Total and Agricultural Export Earnings (2002-03/2014/15)

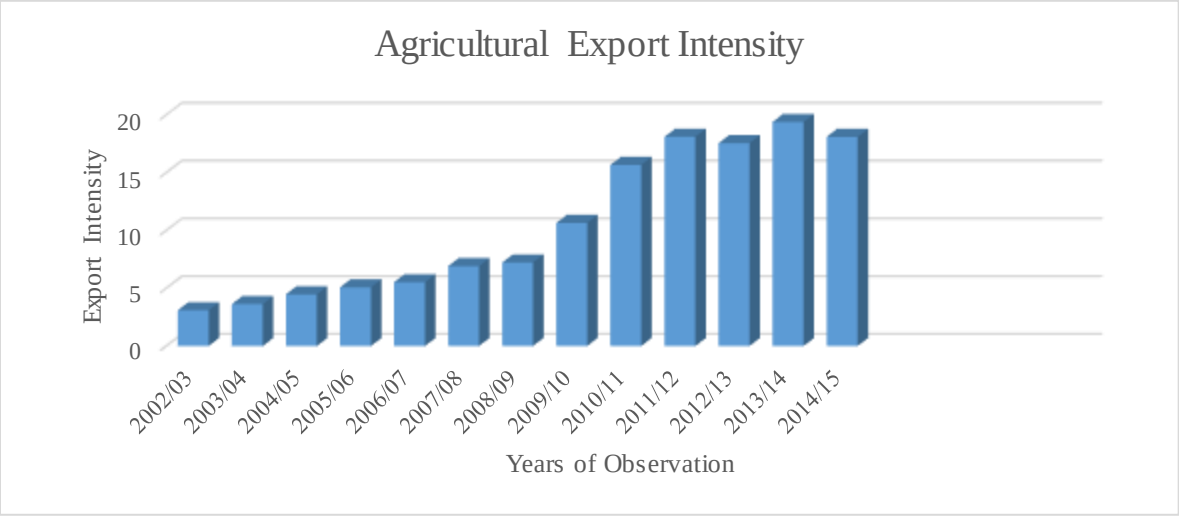
Source: Autor's Own Computation using data from NBE (2014/15).

Export earnings from agricultural sector, as it is indicated by the above figure is relatively stable with a progressive growth trend and the total export earnings is highly dependent on the

agricultural sector.

Notwithstanding the role of agriculture to the country's export earnings, evaluating the export performance of the sector itself however has been noticed to be poor (see figure 3.11). Agricultural export intensity[13] has been below 10 percent before 2009/10 which shows the country's poor involvement in the agricultural export trade implying that the large mass agricultural production in the country is not commercialized enough.

Figure 3. 11: Foreign Exchange Earnings of Major Export Items (2002/03-2014/15)



Source: Autor's Own Computation Using IMF (2016), WB (2016) and NBE (2014/15) databases.

With the understanding that export intensity is the most widely used measure of export performance (Sousa, 2004; Forte and Reis, 2015; Udah et al, 2015), the contribution of agriculture towards the total export of the country as well reflects that progresses has been registered during the first Growth and Transformation Plan (GTP I).

[13] *Agricultural Export Intensity refers to total agricultural export earnings divided by the total agricultural output (Sousa, 2004)*

CHAPTER IV: METHODOLOGY

4.1.Model Specification

With the aim to achieve the objective of the study and in search of better results, our study has employed a dynamic gravity model approach based on a panel data of sample countries. Broadly speaking panel data have several advantages in terms of being able to allow researchers handle more realistic models than simple cross-section or time series data sets (Verbeek, 2008) and it allows us to test and relax the assumptions that are implicit in cross sectional analysis (Maddala and Lahiri, 2009). Indeed, they incorporate both cross-section and time dimensions over the same units of observation. Such an approach not only increases the degree of freedom, but also monitors unobservable trading-pair individual effects, gives more informative data, more variability and less collinearity among variables (Verbeek, 2008; Gujarati and Porter, 2009; Park, 2011).

The gravity model of trade got its origin from Newton's theory of gravity which postulates that the gravitational force between two objects (F_{ij}) is directly proportional to each of their masses, and inversely proportional to the square of the distance between them.

$$F_{ij} = G\frac{M_i M_j}{D_{ij}^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.1)$$

Where G represents a gravitational constant, $M_{i(j)}$ is mass of the two objects i(j) while D_{ij} is the distance between the two objects.

By taking the above theory of gravity as a benchmark, Tinbergen (1962) proposed a more or less similar gravity model to analyze the international trade flows between countries where the standard gravity model of trade is formulated as follows:

$$T_{ij} = G\frac{M_i^{\alpha} M_j^{\beta}}{D_{ij}^{\gamma}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.2)$$

Where T_{ij} is the volume of trade between two countries 'i' and 'j' measured in monetary value, $M_{i(j)}$ represents relevant economic size of country 'i(j)' and $D_{ij}$is distance between the countries 'i' and 'j' (usually measured between center to center).

The model states that bilateral trade flows are directly proportional to the product of the economic size (GDP or GNI or Population) of country 'i' and 'j' and inversely proportional to the distance between the two countries. The simplest form of the standard gravity model appears in the following form:

$$T_{ij} = \beta_0 \frac{Y_i^{\beta_1} Y_j^{\beta_2}}{D_{ij}^{\beta_3}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.3)$$

Where T_{ij} is the bilateral trade flows (exports plus imports) between country i and j, $Y_{i(j)}$ represents GDP or GNI or population of country i(j), D_{ij} is to refer distance between country i and j and $\beta_0$refers to the constant of proportionality.

Taking the natural logarithm of equation 3 yields:

$$\ln T_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln D_{ij} \ldots\ldots\ldots\ldots\ldots\ldots (4.4)$$

Having the above logarithmic formulation of the standard gravity model in mind, this study is based on the augmented gravity model in the sense that additional variables other than economic mass measures and distance are included to get a better explanation of Ethiopia's agricultural export flows to Asia, Europe, Africa and North America. The augmented gravity model used under this study is based on the formulations used by Batra (2004), Antonucci and Manzocchi (2005), Thuresson (2008), Kebede (2011) and Hailegiorgis (2011) where the model

incorporates population size, trade freedom index and contract intensive money as the additional variables in the basic model. Gravity models that are used to estimate trade potentials need to include only the most natural determinants of trade as explanatory variables, leaving artificial variables to explain the difference between predicted and observed flows (Armstrong, 2007). Thus, the final augmented model to be estimated in this study is specified as follows:

$$\ln AEXP_{ij,t} = \beta_0 + \beta_1 \ln AEXP_{ij,t-1} + \beta_2 \ln POP_{it} + \beta_3 \ln POP_{jt} + \beta_4 \ln TFI_{it} + \beta_5 \ln TFI_{jt} + \beta_6 \ln CIM_{it} + \beta_7 \ln CIM_{jt} + \beta_8 \ln D_{ijt} + \varepsilon_{ijt} \dots\dots\dots\dots\dots (4.5)$$

Variables are defined as follows: β_0 refers to constant of proportionality, $\beta_1, \beta_2, \dots \beta_8$ are the parameters to be estimated where they are elasticities, $AEXP_{ij,t}$ *and* $AEXP_{ij,t-1}$ are the value of bilateral agricultural exports of Ethiopia to importing country at time t and t-1 respectively, $POP_{i\ (j),t}$ represents population of exporting and importing countries at time t, $CIM_{i(j),t}$ shows the level of contract enforcement in country i and j at time t, $TFI_{i(j),t}$ indicates the trade freedom index of exporting and importing countries, $D_{ij,t}$ is the distance between Addis Ababa and the capital city of importing country j, ε_{ij} refers to the composite error term which constitutes a country pair individual effect (μ_{it}) and idiosyncratic error term (v_{it}) and 'ln' is the Natural logarithm.

4.2.Description of Variables and Expected sign of Coefficients

4.2.1. Dependent Variable

Agricultural Bilateral Export of Ethiopia ($\boldsymbol{AEXP_{ij}}$): The bilateral export of Ethiopia in the regression model represents the flow of Ethiopia's agricultural export items to its major trading

partners in Europe, Asia, Africa and North America. With the interest of estimating a dynamic gravity model, lagged values of this variable are incorporated as an explanatory variable where only the first lag instead of searching for the optimal lag length has been considered following the advice suggested by Egger (2002).

4.2.2. Independent Variables

Population Size ($POP_{i(j)}$): Population represents both the production capacity and import demands of both exporting and importing countries. Based on various literatures, the impact of population size on Ethiopia's agricultural export flow is expected to be inconclusive (Abu et al, 2010). On the one hand, higher population means Ethiopia have the potential to boost her exportable productions without an increase in cost of production (especially labour cost) using the larger population on hand as a basic resource (economies of scale). The counter argument comes from the situation where large size population leads in to higher consumption which might be to the expense of the country's export (absorption effect). The same argument works for the importing country as well. Thus, the sign of β_2 and β_3 are inconclusive as it depends on which effect (either absorption or economies of scale effect) is dominant.

Trade Freedom Index ($TFI_{i(j)}$): trade freedom index as calculated by Heritage Foundation taking both tariff and non-tariff barriers into consideration is used as a proxy to country's trade policy. On the basis of the calculation, the index ranges from 0 to 100 where the two extreme cases indicate autarky and perfectly free trade respectively. Accordingly, the coefficient of the index is expected to be positive as higher trade freedom implies more involvement of the country under consideration in to international trade (Kebede, 2011).

Contract-Intensive Money ($CIM_{i(j)}$): property rights together with contract enforcements are key factors for a country's productivity and growth (Clague et al, 1999 and Thuresson, 2008). This arises from the fact that contract enforcement condition affects the different types of money and credit used in trade in the sense that more of currency or money held in banks are used in international trade which is a reflection of the existing contract enforcement in the country. More specifically, firms engaged in international trade prefers to held their money in cash/currency if they feel that contracts are not secure which gives them little guarantee that their money is not safe in the financial institutions. On the other hand, firms and individuals are more likely to hold their money in bank deposits which are more convenient and safe when contracts are upheld.

As far as measurement of contract enforcement is concerned, Clague et al (1999) suggested Contract-Intensive Money (CIM) as an objective measure. CIM is defined as the ratio of non-currency money to total money supply i.e., $CIM = \frac{(M_2 - C)}{M_2}$, where M_2 represents broad money in the country and C refers to cash/currency held outside banks (Clague et al, 1999). The value of CIM ranges from 0 to 1, the higher the value represents use of more non-currency money or existence of high level of contract enforcement and vice versa. For those economies with a better financial development and economic agents having good access of these institutions, existence of contract enforcement makes it easier for countries and firms to use non-currency money which will facilitate international trade. On the other hand, the rural part of most developing economies like Ethiopia demands more of cash/currency to supply surplus agricultural products for export as higher CIM reduces the amount of cash money circulating in the economy which is mostly preferred by farmers/agricultural product producers due to the limited financial access in their area. On the top of this, CIM also serves as a proxy to financial

sector development (Clague et al, 1999). On the basis of this and the aforementioned facts, the coefficient of CIM for the exporting country is expected to be negative while we presume a positive sign to the importing countries as the countries taken under consideration are in a better financial development status as high level of contract enforcement encourages more trade for the importing countries.

Distance (D_{ij}): Distance refers to the distance between the capital city of Ethiopia, Addis Ababa, and its trading partners' capital cities measured in kilometer. The physical distance between countries is expected to increase the trade costs which are modelled as "iceberg" costs, that is, only a fraction of the good shipped arrives to destination, the rest having melted in transit. Apart from this, distance is a proxy for synchronization costs, time elapsed during shipment, transaction costs and cultural distance (Batra, 2004). On the basis of this understanding, a negative sign of the coefficient on of distance is expected in our model.

However, defining distance is problematic as it is time invariant which wouldn't be a problem for cross sectional analysis unlike to panel data cases where time dimension is introduced in the analysis (Karagoz and Saray, 2010; Hailegiorgis, 2011). Various approaches have been suggested in the literatures to overcome the problem and make distance a varying variable over time. Our study used the frequently used approach which is calculating the weighted distance between exporting and importing countries as it was used by Karagoz and Saray (2010) and Hailegiorgis (2011). The weighted definition of distance is defined as follows:

$$WD_{ij} = \frac{(D_{ij} * GDP_{it})}{\sum GDP_{it}} \dots\dots\dots\dots\dots\dots\dots\dots (4.6)$$

Where WD_{ij} is the weighted distance between country i and j capital cities; D_{ij} is the geographical distance between country i and j; GDP_{it} represents GDP of the exporting country (Ethiopia) at time t; and $\sum GDP_{it}$ is the sum of all GDPs of Ethiopia over the study period (1995-2015).

4.3.Nature and Sources of Data

The study took a total of 38 countries (list of countries is given by Appendix 1) selected on the basis of their strong trade relation with Ethiopia in terms of absorbing Ethiopia's agricultural export items. The 38 countries aggregately take around 89% share of Ethiopia's Agricultural export items over the study period, 1995-2015 (IMF, 2016; ERCA, 2016). The total number of observation (1*21*38) being 798 seems moderately high which implies that our study has covered significant share of Ethiopia's agricultural export. As indicated in the conceptual definition part of the literature review, the values of bilateral exports of Ethiopia for cereals and crops, coffee, tea, chat, oilseeds, pulses, livestock products, fruits and vegetables and flowers to all the 38 countries over the study period (1995-2015) are taken into consideration where the period 1995 has been chosen with the understanding that a significant trade liberalization had been taken in that particular period.

For a powerful enough and trust worthy result, the required data were collected from different sources. The International Monetary Fund's Direction of Trade Statistics (DOTS) have been the major source of the values of aggregate exports of Ethiopia to the importing countries. The corresponding values of agricultural export products on the other hand have been obtained from Ethiopian Revenue and Customs Authority's Trade Statistics.

Data on many of the variables including GDP (in thousand USD) and Population size (in millions) were collected from World Development Indicators of the World Bank and World Economic Outlook Databases respectively. Contract intensive money data has been accessed from International Monetary Fund's International Finance Statistics and Countries Central Banks while data on trade freedom index was obtained from the Index of Economic Freedom of the Heritage Foundation. Finally, data on distance (in kilometers) between Addis Ababa (capital city of Ethiopia, country 'i') and other capital cities of country 'j' (as the crow flies/direct by air) were collected from the respective Indonesian and Great Circle Mapper Websites: www.indo.com/distance and www.gcmap.com/dist.

4.4.Estimation Procedures

Broadly speaking, Pooled OLS; fixed effect and random effect estimators are biased and inconsistent with the presence of a lagged dependent variable as an explanatory variable and autocorrelation in the error term, measurement error in the regressors, and simultaneity or endogeneity of regressors (Vebeek, 2004). In situations where the lagged value of the dependent variable is included as an explanatory variable and the unobserved panel data effects are correlated with the lagged dependent variable, just like the case in our dynamic gravity model, Pooled OLS; fixed effect and random effect models results in inconsistent estimators (Stata13). There is, unfortunately, no perfect solution to this problem. An instrumental-variable technique developed by Hausman and Taylor (1981) can be used; alternatively, one can use the Generalized Method of Moments (GMM) estimation developed by Arellano and Bond (1991) where lagged levels are used as instruments for current differences as the procedure is described below.

Cameron and Trivedi (2005) suggested that, the use of instrumental variables is a standard to handle existence of endogenous/lagged dependent variable regressors. More importantly, system GMM provides the most efficient estimator based on the moment condition that the error term (U_{it}) and the instrument variables (Z_{it}) are uncorrelated i.e., $E(U_{it}\ Z_{it}) = 0, t = 1, \dots, T$.

The general framework for an individual-specific effect panel data dynamic model is expressed as an autoregressive model of order p (AR(p)) as follows:

$$Y_{it} = \gamma Y_{i,t-1} + \cdots + \gamma Y_{i,t-p} + X'_{it}\beta + \alpha_i + \varepsilon_{it}, i = 1, \dots, N \quad t = 1, \dots, T \dots\dots\dots\dots\dots (4.7)$$

Where α_i is a time invariant individual effect whose treatment may be fixed or random, ε_{it} represents a disturbance term assumed to be uncorrelated with the regressors (X_{it}) and it is assumed that $|\gamma| < 1$. For our case, the general specification of (4.7) reduces to a first-order model as suggested by Egger (2002) and Bun and Klassen (2002).

Had it been in a static gravity model, treating α_i as a fixed effect or a random effect would have been important and Hausman (1978) test helps us to decide between fixed or random effect models. However, the situation under dynamic models like ours is different where $Y_{i,t-1}$ is correlated with α_i which makes OLS, within and random effect estimators inconsistent and inefficient. In this regard, Arellano and Bond (1991) suggested a two-step procedure based on differencing and instrumenting where the first lag of the dependent variable is used as an instrument variable following the advice of Egger (2002).

The first step of their estimation leads to the first differenced model as follows:

$$Y_{it} - Y_{i,t-1} = \gamma(Y_{i,t-1} - Y_{i,t-2}) + \cdots + \gamma(Y_{i,t-p} - Y_{i,t-p-1}) + (X_{it} - X_{it})'\beta + (\varepsilon_{it} - \varepsilon_{it-1}) \quad t = 2, \dots, T$$

$$\Delta Y_{it} = \gamma \Delta Y_{i,t-1} + \cdots + \gamma \Delta Y_{i,t-p} + X\Delta'_{it}\beta + \Delta\varepsilon_{it} \ldots\ldots\ldots\ldots\ldots (4.8)$$

The differenced equation removes the individual effect (α_i) implying that the unfortunate correlation between $Y_{i,t-1}$ and α_i is eliminated.

From equation 4.8, the OLS estimator is inconsistent as $Y_{i,t-1}$ is correlated with ε_{it-1} and hence the regressor($Y_{i,t-1} - Y_{i,t-2}$) is correlated with the error ($\varepsilon_{it} - \varepsilon_{it-1}$). Here, assuming that the errors (ε_{it}) are serially uncorrelated (as its test is being reflected in the econometric test part) the instrumental variable estimator is suggested where $Y_{i,t-2}$ is used to be an instrument for $\Delta Y_{i,t-1}$ and it is a valid instrument as it is correlated with $\Delta Y_{i,t-1}$ but uncorrelated with $\Delta\varepsilon_{it}$.

More efficient estimation as well is also possible using $\Delta Y_{i,t-1}$as instrument variable rather than $Y_{i,t-2}$ (Cameron and Trivedi, 2004). More specifically, we apply the case of system GMM estimator which considers the additional condition that E($\Delta Y_{i,t-1}$, ε_{it}) = 0 and incorporate the levels equation utilizing $\Delta Y_{i,t-1}$ as an instrument (Cameron and Trivedi, 2004). Similar additional moment conditions can be added for endogenous and predetermined variables, whose first differences can be used as instruments.

On the basis of the above model justifications, our estimated gravity equation can be written in the levels and first differenced forms as:

$$\begin{aligned}\ln AEXP_{ij,t} = {} & \beta_0 + \beta_1 \ln AEXP_{ij,t-1} + \beta_2 \ln POP_{it} + \beta_3 \ln POP_{jt} + \beta_4 \ln TFI_{it} + \beta_5 \ln TFI_{jt} \\ & + \beta_6 \ln CIM_{it} + \beta_7 \ln CIM_{jt} + \beta_8 \ln D_{ij} + \varepsilon_{ijt}\end{aligned}$$

$$\begin{aligned}\Delta \ln AEXP_{ij,t} = {} & \beta_0 + \beta_1 \Delta\ln AEXP_{ij,t-1} + \beta_2 \Delta\ln POP_{it} + \beta_3 \Delta \ln POP_{jt} + \beta_4 \Delta\ln TFI_{it} \\ & + \beta_5 \Delta\ln TFI_{jt} + \beta_6 \Delta\ln CIM_{it} + \beta_7 \Delta\ln CIM_{jt} + \beta_8 \Delta\ln D_{ij} \\ & + \Delta\varepsilon_{ijt} \ldots\ldots\ldots\ldots\ldots (4.9)\end{aligned}$$

Equation 4.9 is then estimated to determine the pattern of trade followed by predicting the agricultural export potential of Ethiopia using the coefficients obtained from the latest version of system GMM estimation. The Stata 13 computer software has been utilized to estimate our model.

4.5.Econometric Tests

4.5.1. Tests of Serial Autocorrelation

One of the significant contribution made by Arellano and Bond (1991) to the existing literature is a test for autocorrelation appropriate for linear GMM regression on panels which is found to be exclusively important when the lags are used as instruments in our model. Up on this understanding, our dynamic gravity model requires that the error term (ε_{ijt}) to be serially uncorrelated (Stata 13).

The situation where ε_{ijt} is serially uncorrelated implies that $\Delta\varepsilon_{ijt}$ are correlated with $\Delta\varepsilon_{ijt-1}$ as the $Cov(\Delta\varepsilon_{ijt}, \Delta\varepsilon_{ijt-1}) = Cov(\varepsilon_{ijt} - \varepsilon_{ijt-1}, \varepsilon_{ijt-1} - \varepsilon_{ijt-2}) = -Cov(\varepsilon_{ijt}, \varepsilon_{ijt-2}) \neq 0$. As a result, $\Delta\varepsilon_{ijt}$ will not be correlated with $\Delta\varepsilon_{ijt-k}$ for all $k \geq 2$. In this regard, our test for serial autocorrelation that $\Delta\varepsilon_{ijt}$ are correlated/uncorrelated with $\Delta\varepsilon_{ijt-k}$ for all $k \geq 2$ has been carried out by Arellano-Bond serial autocorrelation test where the result (as indicated in Appendix 7.1) shows the presence of no serial correlation in the first-differenced errors as desired.

4.5.2. Test of Overidentifying Restrictions

Under GMM estimation, if there are 's' instruments and only 'm' parameters to estimate, then panel GMM estimations leaves (s-m) overidentifying restrictions. This test is undertaken with the help of Sargan (1958) test under the null hypothesis that the Overidentifying restrictions are valid. Upon the test, we could conclude that some of the instruments are correlated with the error term and hence are exogenous if the Overidentifying restriction is larger than the Overidentifying moment conditions. However, the Sargan test have an asymptotic chi squared distribution only for homoscedastic error terms and a one-step Sargan test over rejects in the presence of heteroscedasticity. Although performing the Sargan test after two-step estimator is an alternative, there is also a tendency to underreject in the presence of heteroscedasticity.

Upon the problems of the two extreme cases, we have used the extended version of the system GMM estimators developed by Roodman (2006) which enables us to perform the Sargan (1958) test of overidentifying restrictions when robust standard errors are specified. The result indicates that overidentifying conditions/ instruments used in our model are valid.

4.5.3. Endogeneity Test

The economic size measure (population) has been treated as exogenous variables in our gravity equation (equation 4.9). There exists however an empirical and theoretical support that trade can also have impact on income. The possibility of endogeneity of these variables therefore cannot be denied and the apparently significant effect of income on trade could be suspected which might lead into a misleading regression result. As a response to this problem, a GMM system estimation using the lagged levels and first differences of the endogenous variables are used as instruments. We found that instrumental variable technique does not alter the

coefficients on any of the variables to any significant extent, implying thereby that the endogeneity of income does not lead to any significant distortion of the initially postulated relationship in the gravity model.

4.5.4. Multicollinearity Test

Simple correlation using Klein's rule of thumb has been applied to test multicollinearity of our model. As per this understanding, the simple correlations between the independent variables of our model has been noticed to be small (see Appendix 7.3) and the auxiliary regressions for Klein's rule do not indicate multicollinearity which implies that multicollinearity is not a problem in our specification of the dynamic gravity model. In this regard, those variables with a possibility to have series multicollinearity problem with population especially GDP per capita and GDP of countries were taken out of the model and there were no significant changes in coefficients as well as signs of the explanatory variables included in our model.

CHAPTER V: RESULTS AND DISCUSSION

5.1.Estimation Result

Though they are not recommended models to dynamic panel data analysis, panel data estimation results using Pooled OLS, Random effect and Fixed effect models as reflected by Appendix 4, 5 and 6 respectively indicates that population of exporting country (Ethiopia), Ethiopia's trade openness index and contract intensive money variables of Ethiopia were found to be significant as it is also the case under GMM estimation technique.

Equation 4.9 has been estimated using System GMM technique where a total of 38 trading partner countries over the period 1995-2015 were taken into consideration and the dataset used was strongly balanced. The estimated result using system GMM indicates that many of the variables were significant and consistent with both theory and previous findings which confirms robustness of GMM compared to Pooled OLS, random effect and fixed effect models.

The descriptive summery statistics presented on Appendix 2 reflects how the variables were distributed across their respective mean and variance. As presented in tale 5.1 below, we note that overall, the variables in our model are jointly significant as the Wald test statistic is computed to be 1511.63 with a p-value of zero at 1% significance level.

As it can be clearly seen from Table 5.1, the lagged agricultural export, economic size measures (Population), trade freedom index, contract intensive money and distance variables were statistically significant in determining the agricultural export trend of Ethiopia. The effect of importing countries trade freedom index and contract intensive money indexes were found to be statistically insignificant.

The positive coefficient of the lagged agricultural export variable which is significant at 1% significance level confirms validity of the dynamic nature of our gravity model over static models as it is also theoretically appealing that previously established trade relationship is expected to pave the way for exports to a particular destination in subsequent years. The coefficient (0.59) indicates that, a one-percent increase/decrease in previous year's agricultural export boosts/lessens the current agricultural export by 0.59 percent, ceteris paribus.

Agricultural export of Ethiopia is also found to be more elastic to the changes in population of the exporting country as its positive coefficient (3.46) is significant at 1% level. This indicates that, the economies of scale outweigh the absorption effect which seems realistic as the large mass population of the country is engaged in agricultural activities. On the basis of this result, ceteris paribus, a 1% increase/decrease in Ethiopia's population will lead to a more than proportionate (3.46) increase/decrease in agricultural export value. The statistically significant negative coefficient (0.47) of importing countries population on the other hand is consistent with the findings of Gebreyesus (2015) which confirms that absorption effect exceeds the economies of scale effect. This is statistically appealing as many of the countries taken into consideration are known to be producers of manufactured products and they produce less of agricultural products and even the produced agricultural products are usually consumed by their population or processed to manufactured ones rather than being exported as a primary agricultural product.

A statistically significant positive coefficient of exporting country's trade freedom index as well shows how a 1% improvement in trade freedom in Ethiopia encourages agricultural export by 0.74 percent as expected, ceteris paribus.

Table 5. 1: Estimation Result of the Model

Dependent Variable: Log of Ethiopia's Agricultural Export to Trading Partners (Lnaexpijt)			
Explanatory Variables	**Coefficient**	**z-ratio**	**p-value**
$LnAEXPi_{jt}$ (one period lag agr. Export)	0.591***(0.295)	20.04	0.000
$LnPOP_{it}$	3.457***(0.712)	4.86	0.000
$LnPOP_{jt}$	-0.469***(0.093)	-5.02	0.000
$LnTFI_{it}$	0.742***(0.162)	4.58	0.000
$LnTFI_{jt}$	-0.125(0.207)	-0.60	0.547
$LnCIM_{it}$	-4.094***(0.832)	-4.92	0.000
$LnCIM_{jt}$	-0.046(0.242)	-0.19	0.849
LnD_{jt}	-0.246**(0.115)	-2.14	0.033
Constant	-50.548***(12.334)	-4.10	0.000
Sargan Test of Overidentifying restrictions	Chi2 (208) = 33.6956	Prob > Chi2 = 0.3701	
Arellano-Bond Test for Autocorrelation	AR(1): Z = -3.443 AR(2): Z = -0.877	Prob > Z = 0.0006 Prob > Z = 0.3806	
No. of Observation	38 Countries X 21 Years = 798 Observations		

Notes: *Standard errors are in parenthesis, whereas, *** and * represents significance at 1% and 10% level of significance respectively.*

The other important variable found to be significant in having a negative impact on Ethiopia's agricultural export is the contract intensive money variable. The estimation result is in line with our priori expectation reflecting that a 1 percent increase in contract intensive money of the exporting country reduces agricultural export of the country by 4.09 percent, ceteris paribus. The concept behind arises from the very fact that higher contract intensive money implies that less cash/currency will be circulated in the hands of the community engaged in agricultural item production and collection of those items for export. Cash/currency plays a significant role in facilitating transactions for those economies with a limited financial access to the citizens where the situation is more important in the rural parts of Ethiopia (Atsbaha, 2010; Diao, 2010; Tessema, 2015). Therefore, the negative effect of exporting country's CIM

is not a surprise as the lesser cash/currency in the hands of the people slays the possibility of producing and bringing together those agricultural products for export.

Finally, the effect of distance has been consistent with our priori expectation and literatures as its negative coefficient is significant at 5% implying that distance as a proxy for costs of international trade has a discouraging effect towards Ethiopia's agricultural export. More specifically, other things being constant, agricultural export flow of Ethiopia declines by 0.25 percent if the relative distance with the trading partners increases by 1 percent.

5.2.Ethiopia's Agricultural Export Potential

The gravity model is not only useful to identify the major determinants of Ethiopia's agricultural export, but is can also be utilized to predict the future export potential of the country. Once the coefficients of the dynamic gravity model are estimated, predicting Ethiopia's agricultural export potential comes into the picture. The estimated model result of equation 4.9 as given below is used for the purpose.

$$\ln AEXP_{ij,t} = -50.548 + 0.591 \ln AEXP_{ij,t-1} + 3.457 \ln POP_{it} - 0.469 \ln POP_{jt} + 0.742 \ln TFI_{it} - 0.125 \ln TFI_{jt} - 4.094 \ln CIM_{it} - 0.046 \ln CIM_{jt} - 0.246 \ln D_{ij} \dots\dots\dots\dots\dots (5.1)$$

Using the coefficients of equation 5.1, two possible approaches are used to predict the agricultural export trade potential of Ethiopia (Jacob et al, 2001; Rahman, 2003; Batra, 2004; Kaur and Nanda, 2011; Gebreyesus, 2011). The first approach utilizes ratio indicators of potential and actual exports i.e., $(^{PAE}/_{\mathrm{AAE}})$ to analyze the future agricultural export direction of Ethiopia. A greater than unity ratio indicates that, there is a future potential expansion of agricultural export of Ethiopia with the respective destination. The second approach as well is

based on the difference between potential and actual agricultural export (PAE − AAE) for each trading partner where a positive difference illustrates existence of unexploited agricultural export potential. For both cases, Logarithmic values are converted to USD units using $e^{lnaexpijt}$. Based on the values of the difference and ratio using the average of potential and actual export trades over the study period, all the 38 trading partner countries are placed under two categories-those with which potential for agricultural export is untapped (see Table 5.2) and those with Ethiopia's agricultural export exceeds its potential (see Table 5.3).

Table 5.2 reports that Ethiopia has a maximum agricultural export potential with Djibouti (USD 202.67 million), Israel (USD 16.25 million), United Arab Emirates (USD 10.65 million) Singapore (USD 6.24 million), Yemen (USD 6.16 million), Switzerland (USD 6.12) not to forget existence of similar untapped export potential in Greece, Norway, Finland, Sweden, Romania, Kenya, Austria, Taiwan, Malesia, South Africa, Thailand and Australia over the period 1995-2015. Ratio of potential agricultural export to actual agricultural export indicates that, through appropriate export promotion policy, Ethiopia has a potential to expand its agricultural export earning with a more than double by exporting to Djibouti, Singapore, Switzerland, Greece, Norway, Finland and Romania. It is also noted that, European countries are the major potential destination to Ethiopia's agricultural export. Moreover, it has been noticed that Ethiopia didn't even use distance/proximity opportunities to export more agricultural products towards Djibouti and Yemen.

Table 5. 2: List of Countries with a Future Potential to Ethiopia's Agricultural Export

SN	Trading Partner Country	Potential Agricultural Export (PAE) in Million USD	Actual Agricultural Export (AAE) in Million USD	Potential Indicators	
				PAE/AAE	$PAE - AAE$
1.	Djibouti	254.37	51.70	4.92	202.67
2.	Israel	43.30	27.05	1.60	16.25
3.	UAE	40.42	29.77	1.36	10.65
4.	Singapore	8.69	2.45	3.55	6.24
5.	Yemen	22.04	15.88	1.39	6.16
6.	Switzerland	11.34	5.22	2.17	6.12
7.	Greece	10.86	5.18	2.10	5.69
8.	Norway	7.88	2.25	3.50	5.62
9.	Finland	7.83	2.38	3.29	5.45
10.	Sweden	12.30	8.07	1.52	4.22
11.	Romania	3.73	1.61	2.31	2.12
12.	Kenya	5.99	3.88	1.54	2.11
13.	Austria	29.87	28.53	1.05	1.35
14.	Taiwan	2.25	1.15	1.95	1.10
15.	Malesia	2.88	2.01	1.43	0.87
16.	South Africa	3.62	3.24	1.12	0.38
17.	Thailand	1.72	1.61	1.07	0.12
18.	Australia	4.95	4.91	1.01	0.04

Source: Actual Agricultural Export from ERCA (2016) Database while the rest is author's own computation

Ethiopia's agricultural export for about 20 countries including the major economies of Russia, Canada, United States, Saudi Arabia, Germany, China, Spain, United Kingdom, Italy and Japan has surpassed its potential. But it does not necessarily mean that trade with these countries is less important rather it has to be interpreted in the way that further expansion of agricultural export to the aforementioned trading partners is not a priority. Agricultural export potential to some African countries mainly Sudan and Egypt as well has been exhausted which seems reasonable as these African countries themselves are more of agricultural exporters, transportation cost is relatively small and there exists cultural similarity between Ethiopia and those countries. Therefore, Ethiopia do not need to invest resources to promote more

agricultural export to trading partners listed under Table 5.3 rather more efforts has to be exerted to maintain the good trading relationship.

Table 5. 3: List of Countries Ethiopia's Agricultural Export Passed its Potential

SN	Trading Partner Country	Potential Agricultural Export (PAE)	Actual Agricultural Export (AAE)	Potential Indicators	
				$PAE/_{AAE}$	$PAE - AAE$
1.	Spain	4.46	4.73	0.94	-0.28
2.	Canada	4.78	5.28	0.91	-0.50
3.	Poland	1.31	1.89	0.69	-0.58
4.	Russia	2.25	4.28	0.53	-2.03
5.	South Korea	3.78	6.07	0.62	-2.29
6.	Belgium	26.20	28.52	0.92	-2.32
7.	Sudan	31.20	37.35	0.84	-6.14
8.	Turkey	7.60	14.10	0.54	-6.50
9.	India	1.45	8.14	0.18	-6.69
10.	Pakistan	3.83	10.71	0.36	-6.88
11.	Egypt	8.73	16.15	0.54	-7.42
12.	France	9.47	21.45	0.44	-11.98
13.	United Kingdom	9.91	22.59	0.44	-12.67
14.	Italy	14.21	35.71	0.40	-21.50
15.	Netherlands	31.85	62.63	0.51	-30.78
16.	Saudi Arabia	42.15	81.15	0.52	-39.00
17.	USA	6.37	51.02	0.12	-44.66
18.	Japan	9.71	54.66	0.18	-44.95
19.	China	4.31	69.40	0.06	-65.09
20.	Germany	24.16	124.89	0.19	-100.73

Source: Actual Agricultural Export from ERCA (2016) Database while the rest is author's own computation

CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

6.1.Conclusion

The international trade literature with a particular emphasis on application of gravity models had identified various determinant factors for bilateral trade between economies. The literatures on developing countries in general and Ethiopia in particular however are mainly focused on aggregate export despite the fact that developing countries are mainly primary/agricultural product exporters. Besides, the effect of some determinant variables like population is inconclusive as the effect differs both in magnitude, sign and significance.

In this study, an attempt has been made to analyze the major determinants of Ethiopia's agricultural export through panel data dynamic gravity model approach. Predicting agricultural export potential had also get a due emphasis in the study. The data over the study period (1995-2015) for Ethiopia and all the 38 trading partner countries are obtained from different sources mainly from World Bank, International Monetary Fund, Heritage Foundation, Great Circle Mapper and Indonesian Distance websites. The study covers agricultural exports of Ethiopia rather than the aggregate export. An augmented dynamic panel data gravity model has been specified taking into account the persistence nature of export trade. In search of more sensible results, system GMM estimator that uses the lagged dependent variable as an instrument has been applied as it allows the persistence nature of trade and is fund to be more efficient than other estimators used for similar purposes.

The descriptive part of the study revealed that the agriculture sector in Ethiopia employs more than 85 percent of the population, 80 percent of export earnings and contributes nearly half to GDP in all the three regimes that has been ruling the country for the last 7 decades. More importantly, the agricultural export items including coffee, oilseeds, pulses, flowers, and fruits and vegetables aggregately generated takes around 79.7 percent share of the total country's

export earnings which makes the issue of explaining the major determinants of the agricultural exports to be an empirical interest.

The empirical results of our study indicate that application of dynamic gravity models is likely to produce consistent results where the lagged agricultural export has a positive and statistically significant effect on current agricultural export flows. The magnitude of the dynamic being 0.59 shows that a one percent positive shock in previous year's agricultural export leads to 0.59 percent increments in current year agricultural exports. The supply side factor as well i.e., Ethiopia's population were found to have positive and significant impact towards agricultural export of Ethiopia. Importing country's population on the other hand has been found to affect Ethiopia's agricultural export flow negatively due to absorption effect. The positive effect of Ethiopia's trade openness measure as well reminds us how reducing both qualitative and quantitative trade restrictions would encourage agricultural export of Ethiopia.

According to our results in this study, Ethiopia's agricultural export trend follows the basic gravity model as bilateral export flows will increase with a reduction in proportion of distance involved. This implies that Ethiopia has to promote agricultural exports to countries with closer proximity.

Another notable result from the dynamic specification is that development of financial sectors and institutional quality improvement of the economy without taking their accessibility to the large mass population engaged in agricultural activities in to consideration is not helping the agricultural sector products to be commercialized in the international market. This is because the higher contract intensive money (more money held in financial institutions and less

cash/currency money in the hands of economic agents) is found to have significant negative impact on Ethiopia's agricultural export.

Regarding export potential, European countries remained to be the dominant future potential destinations of Ethiopia's agricultural export. Specifically, agricultural export potential to countries including Israel, Switzerland, Greece, Norway, Finland, Sweden, Romania and Austria are not yet exploited implying that export promotion towards these economies has to be taken into consideration together with infrastructural development to reduce international trade costs.

6.2.Policy Implication

Based on the findings of our study, the following recommendations are forwarded to Ethiopia on the basis of the understanding that application of dynamic gravity model to Ethiopia's agricultural export are quite supportive to configure policy recommendations targeted to improve performance of Ethiopia's agricultural export in the international market.

First and foremost, the agricultural sector of the economy has to be further strengthened through agricultural extension services and access to agricultural inputs as the sector is the major source of the country's export and the subsequent foreign exchange earnings. Policy makers as well has to make use of the advantage of having large population as it could boost production at a cheap cost of labour. The tendency to rely on few price and income inelastic agricultural export items has to be changed and a step towards diversifying the export items especially from other sectors, mainly cheap labour intensive ones, as well has to be encouraged. More importantly, both horizontal and vertical export diversifications to reduce the narrow

dependency nature of the country's overall export has to be accompanied by infrastructural improvements to reduce transportation and transaction costs.

Secondly, Ethiopia needs to maintain the already established good trading relationships with those economies where the agricultural export potential has already been exhausted. It is also inevitably important to emphasize on European countries as a huge untapped agricultural export has been foreseen in the area. More specifically, export promotion strategies including signing of bilateral trade agreements with individual countries and creating awareness as well as better working environment to make local companies export-oriented and competent in the international market has to be emphasized. In addition to this, establishing labor-intensive manufacturing sectors as well could motivate the agricultural sector and other sectors as there is a possibility to feed each other. On the top of this, searching for new export destination areas, especially from highly developed economies, with a potential to demand Ethiopia's organic agricultural export items has to be take into consideration.

Finally, in relation to the impact of contract intensive money on agricultural export of Ethiopia, the negative association needs to be critically examined as holding more money under the financial institutions has a retarding effect on both production and transactions of agricultural products in rural areas. Specifically, the government has to look for possible ways of improving financial access to the large mass population engaged in agricultural production and/or transaction beyond the attempts to improve operations and trustworthiness of financial institutions in the country. This is because though exporting agricultural products comes at the end, these items has to be first produced at farm level and commercialized to the international market by exporters which implies that reducing all the challenges that could render production

as well as transaction of agricultural products at an individual farm level could finally boost the export performance of the economy.

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APPENDIXES

Appendix 1. List of Partner Countries Considered for the Study

SN	Countries	SN	Countries	SN	Countries
1.	Australia	14.	Italy	27.	South Korea
2.	Austria	15.	Japan	28.	Spain
3.	Belgium	16.	Kenya	29.	Sudan
4.	Canada	17.	Malaysia	30.	Sweden
5.	China	18.	Netherlands	31.	Switzerland
6.	Djibouti	19.	Norway	32.	Taiwan
7.	Egypt	20.	Pakistan	33.	Thailand
8.	Finland	21.	Poland	34.	Turkey
9.	France	22.	Romania	35.	UAE
10.	Germany	23.	Russia	36.	United Kingdom
11.	Greece	24.	Saudi Arabia	37.	USA
12.	India	25.	Singapore	38.	Yemen
13.	Israel	26.	South Africa		

Source: Author's Compilation.

Appendix 2. Summary Statistics of Variables

```
summarize lnaexpijt lnpopit lnpopjt lntfiit lntfijt lncimit lncimjt lndijt

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
   lnaexpijt |       798    15.63108    1.991003   5.089952   19.45565
     lnpopit |       819    18.14843    .1670314   17.86271   18.41457
     lnpopjt |       798    17.23987    1.475975   13.22852   21.04144
     lntfiit |       819    3.965126    .2700967   3.295837   4.228292
     lntfijt |       798     4.24822    .3512373        2.5    4.49981
-------------+--------------------------------------------------------
```

lncimit	819	-.2876986	.0768991	-.5189604	-.1777198
lncimjt	798	-.3620426	.4188467	-2.3	1.61
lndijt	798	5.063311	1.037909	2.230077	7.414712

Source: Author's Calculation.

Appendix 3. System GMM Estimation Results

```
System dynamic panel-data estimation          Number of obs      =       760
Group variable: id                            Number of groups   =        38
Time variable: year
                                              Obs per group:  min =        20
                                                              avg =        20
                                                              max =        20

Number of instruments =    217                Wald chi2(8)       =   1511.63
                                              Prob > chi2        =    0.0000
One-step results
------------------------------------------------------------------------------
   lnaexpijt |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lnaexpijt |
         L1. |    .591043   .0294924    20.04   0.000      .533239    .6488471
             |
     lnpopit |   3.456887   .7117544     4.86   0.000     2.061874      4.8519
     lnpopjt |  -.4687684   .0934315    -5.02   0.000    -.6518907   -.2856461
     lntfiit |   .7424446   .1621784     4.58   0.000     .4245808    1.060308
     lntfijt |  -.1245918   .2069803    -0.60   0.547    -.5302657    .2810821
     lncimit |    -4.0935   .8324931    -4.92   0.000    -5.725157   -2.461844
     lncimjt |  -.0461332   .2422869    -0.19   0.849    -.5210068    .4287405
      lndijt |  -.2457928    .115086    -2.14   0.033    -.4713573   -.0202284
       _cons |  -50.54778   12.33445    -4.10   0.000    -74.72286    -26.3727
------------------------------------------------------------------------------
Instruments for differenced equation
        GMM-type: L(2/.).lnaexpijt
        Standard: D.lnpopit D.lnpopjt D.lntfiit D.lntfijt D.lncimit
                  D.lncimjt D.lndijt
Instruments for level equation
        GMM-type: LD.lnaexpijt
        Standard: _cons
Source: Author's own Computation.
```

Appendix 4. Pooled OLS Estimation Results

```
reg lnaexpijt lnpopit lnpopjt lntfiit lntfijt lncimit lncimjt lndijt

      Source |       SS       df       MS              Number of obs =     798
-------------+------------------------------           F(  7,   790) =   37.63
       Model |  789.967979     7  112.852568            Prob > F      =  0.0000
    Residual |  2369.41322   790  2.99925724            R-squared     =  0.2500
-------------+------------------------------           Adj R-squared =  0.2434
       Total |   3159.3812   797  3.96409185            Root MSE      =  1.7318

------------------------------------------------------------------------------
   lnaexpijt |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lnpopit |   8.213039   .8847986     9.28   0.000     6.476205    9.949874
     lnpopjt |   .2042451   .0472264     4.32   0.000      .111541    .2969493
     lntfiit |   .9944439   .4153904     2.39   0.017     .1790444    1.809843
     lntfijt |   1.076823   .2018257     5.34   0.000     .6806446    1.473001
     lncimit |   -6.01343   1.574252    -3.82   0.000    -9.103642   -2.923218
     lncimjt |   -.274241   .1697725    -1.62   0.107    -.6074997    .0590176
      lndijt |  -.6668965   .1036816    -6.43   0.000    -.8704205   -.4633725
       _cons |  -143.9141   15.82292    -9.10   0.000    -174.9741   -112.8542
------------------------------------------------------------------------------
Source: Author's Own Computation.
```

Appendix 5. Random Effect Estimation Results

```
Random-effects GLS regression                   Number of obs      =       798
Group variable: id                              Number of groups   =        38

R-sq:  within  = 0.3906                         Obs per group: min =        21
       between = 0.0521                                        avg =      21.0
       overall = 0.2107                                        max =        21

                                                Wald chi2(7)       =    484.52
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
   lnaexpijt |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lnpopit |   5.847365   1.073323     5.45   0.000     3.743689     7.95104
     lnpopjt |   .1615182   .1507052     1.07   0.284    -.1338585    .4568949
     lntfiit |   .9359198   .2656864     3.52   0.000     .4151841    1.456656
     lntfijt |   .2703648   .2190192     1.23   0.217     -.158905    .6996345
     lncimit |  -4.300484   1.203077    -3.57   0.000    -6.658472   -1.942495
     lncimjt |  -.0577052   .1512351    -0.38   0.703    -.3541205    .2387101
      lndijt |  -.1476533   .1771282    -0.83   0.405    -.4948182    .1995116
       _cons |  -98.64407   19.19176    -5.14   0.000    -136.2592   -61.02891
-------------+----------------------------------------------------------------
     sigma_u |  1.4025291
     sigma_e |  1.1035317
         rho |  .61763519   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Source: Author's Own Computation.

Appendix 6. Fixed Effect Estimation Results

```
Fixed-effects (within) regression               Number of obs      =       798
Group variable: id                              Number of groups   =        38

R-sq:  within  = 0.3925                         Obs per group: min =        21
       between = 0.0035                                        avg =      21.0
       overall = 0.1002                                        max =        21

                                                F(7,753)           =     69.51
corr(u_i, Xb)  = -0.4027                        Prob > F           =    0.0000

------------------------------------------------------------------------------
   lnaexpijt |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lnpopit |    4.58293   1.252876     3.66   0.000     2.123384    7.042476
     lnpopjt |   .6711243   .4272463     1.57   0.117    -.1676111     1.50986
     lntfiit |   .9310525   .2653384     3.51   0.000     .4101615    1.451943
     lntfijt |   .2342259    .226327     1.03   0.301    -.2100811    .6785329
     lncimit |  -3.576056   1.270191    -2.82   0.005    -6.069593    -1.08252
     lncimjt |  -.0066326   .1547398    -0.04   0.966    -.3104053    .2971402
      lndijt |   .0411071   .2067619     0.20   0.842    -.3647912    .4470055
       _cons |  -85.03814   22.01462    -3.86   0.000    -128.2555   -41.82082
-------------+----------------------------------------------------------------
     sigma_u |  1.7199978
     sigma_e |  1.1035317
         rho |  .70839766   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(37, 753) =    32.23             Prob > F = 0.0000
```

Source: Author's own Computation.

Appendix 7. Econometric Tests of the GMM Model

Appendix 7. 1: Tests for Serial Autocorrelation

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	-3.4431	0.0006
2	-0.8769	0.3806

H0: no autocorrelation

Decision: The null hypothesis cannot be rejected at orders higher than one.

Appendix 7. 2: Tests for Overidentifying Restrictions

Sargan test of Overidentifying restrictions

H0: Overidentifying restrictions are valid

chi2(208) = 33.6956

Prob > chi2 = 0.3701

Decision: We fail to reject the null hypothesis, meaning that our moment conditions (instruments) are valid.

Appendix 7. 3: Tests for Multicollinearity

correlate lnaexpijt lnpopit lnpopjt lntfiit lntfijt lncimit lncimjt lndijt (obs=798)

	lnaexpijt	lnpopit	lnpopjt	lntfiit	lntfijt	lncimit	lncimjt	lndijt
lnaexpijt	1.0000							
lnpopit	0.4225	1.0000						
lnpopjt	0.0676	0.0515	1.0000					
lntfiit	0.3570	0.7917	0.0405	1.0000				
lntfijt	0.1462	0.2142	-0.1119	0.1489	1.0000			
lncimit	0.3046	0.7994	0.0401	0.7950	0.1539	1.0000		
lncimjt	-0.0657	0.1251	-0.0672	0.1721	0.2974	0.2009	1.0000	
lndijt	0.1733	0.6586	0.2821	0.4695	0.4074	0.4168	0.3368	

Source: Author's Calculation.