ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

DETERMINANTS OF AGRICULTURAL EXPORT IN ETHIOPIA

BY

TULU BELAY

JANUARY 2020

ADDIS ABABA, ETHIOPIA

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A THESIS SUBMITTED TO ST. MARY'S UNIVERSITY COLLEGE, SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTER OF ART IN DEVELOPMENT ECONOMICS

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STATEMENT OF AUTHOR

I, **Tulu Belay,** hereby declare that a research entitled **"Determinants of Agricultural Export in Ethiopia"** submitted by me for the award of the degree of Master of art in Development Economics of St. Mary's University, is original work and it hasn't been presented for the award of any other Degree, Diploma, Fellowship or other similar titles of any other university or institution.

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ENDORSEMENT

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

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Advisor Signature

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ACRONYMS

ADF	Augmented Dickey-Fuller
AERC	African Economic Research Consortium
AGOA	African Growth and Opportunity Act
CAADP	Comprehensive Africa Agricultural Development Program
COMESA	Common Market for Easter and Southern Africa
CSA	Central statically agency
EPRDF	Ethiopian People's Revolutionary Democratic Front
ERA	Ethiopian Road Authority
EU	European Union
FTA	Free Trade Areas
GSP	Generalized System of Preference
LDC	Least Developing Country
NBE	National Bank of Ethiopia
NEPAD	New Partnership for Africa's Development
REER	Real effective exchange rate
SIDA	Swedish International Development Agency
SNNPR	Southern Nations, Nationalities, and Peoples' Region
SSA	Sub Sahara African
UNCTAD	United Nations Conference on Trade and Development
VAR	Vector Auto Regressive

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ABSTRACT

Despite massive potential of agricultural production than other sub-Saharan countries, Ethiopia's share in total world exports is still very low, amounting to 0.01% in 2010 (WTO, 2011). Ethiopia's agricultural export performance has typically been portrayed as poor compared with other sub -Saharan African countries. According to IMF, 2017 Ethiopia has a small export base its exports-to-GDP ratio in 2015 was the fifth lowest in the world highly concentrated in primary products. The major objective of this research is to investigate factors that determine the Ethiopia's agricultural export performance in the period 1983/84-2017/18. The study has reviewed agricultural export performance and examines the long run and short run determinants of agricultural export performance of the country. The long run and short run estimates are investigated using co-integration and error correction approaches respectively. The data is collected from NBE, ERA, CSA World Bank website, UNCTADSTAT and IMF and World Economic Outlook Website. The findings of the study revealed that in the long run agricultural export performance has found to be positively influenced by Inflation, foreign direct investment real effective exchange rate, trade openness, infrastructural development and fertilizer input. In the short run inflation and foreign direct investment have statically insignificant effects on the performance of agricultural export. All of the rest variables have statically significant impact on the agricultural export performance of the country. Maintaining high and sustainable economic growth, improvements in infrastructural facilities and increasing fertilizer import, and maintaining conducive and stable exchange rate policies as well as working to reduce trade restriction mechanism should due emphasis so as to improve Ethiopia's export performance.

Keywords: *Ethiopia, Agricultural Export Performance, Co-integration and the Error Correction Model*

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Export is considered as one of the very important accelerators of growth. The economics literature supports the contention that development requires economic growth to alleviate poverty, and greater access to world markets is perceived as a necessary condition for more rapid growth. For example, using cross-sectional regression, Agosin (2007) finds that export diversification has a stronger effect on per capita income growth.

Evident from its high share in GDP, the prospects of the agricultural sector heavily influence economic development in most countries in Sub-Saharan Africa. Its productivity growth does contribute to the reduction of poverty in areas where most of the workforce is still engaged in agriculture. The agricultural sector has a pivotal role in employment in SSA, employing more than half of the total workforce. While its importance to the rural population is well documented, recent surveys suggest that agriculture is also the primary source of livelihood for 10% to 25% of urban households.

National census data indicates that the number of people employed primarily in agriculture has increased over time (Yeboah and Jayne, 2015). It is the single most important economic activity in SSA and it remains key to achieving the poverty targets of the MDGs in Africa. According to NEPAD (2003) for most countries in SSA, agriculture contributes an average of 30% -60% of GDP and about 30% of the values of Agricultural exports. However, trade liberalization and tariff barriers have been just some of the areas that have been detrimental to African farmers. Structural adjustment, policies and trade conditions have resulted in the collapse of agricultural support institutions, the elimination of subsidies and reduction in tariffs for most African countries.

On the other hand, if we look at the case of European and American farmers, it is completely different from that of African farmers. That means these farmers are highly subsidized by their governments. That is why these highly subsidized European and American farmers undermine the African farmers both in domestic and agricultural export markets leaving African farmers unable to compete in the global market.

In terms of agricultural trade, statistics show that the share in world agricultural exports of SSA declined from 8% in early 1960s to 2% in the early 2000 and SSA has fallen from a net food exporter to a net food importer (Hag blade et al., 2004). Based on agricultural trade balance, there is an increasing dependence on agricultural imports, with imported food replacing traditional food. Agricultural imports are growing at faster rates than agricultural exports (M. Obwona and E. Chirwa 2018).

As records reveal, the agricultural sector in Ethiopia is the mainstay of the country's economy, contributing 41.4% of the country's gross domestic product (GDP), 83.9% of the total exports, and 80% of all employment in the country (Matousa, Todob, &Mojoc, 2013). Put in perspective, Ethiopia's key agricultural sector has grown at an annual rate of about 10% over the past decade; much faster than population growth.

Apart from a population of around 100 million people positioning Ethiopia as potentially one of Africa's largest domestic markets, the above sectors are equally suitable for the fast-growing Agricultural export market. By virtue of being a COMESA member, bringing together 19 countries with a total population of 400 million, Ethiopia also has preferential market access to these countries.

In general, despite Ethiopia's comparative advantage due to cheap labor and favorable climate relatively for these primary agricultural commodities Agricultural export like other SSA countries as Alwang and Siegel (1994) identified, the country's Agricultural export performance is not satisfactory though improvement is there. There are various factors affecting or determining Agricultural export performance of the country in general and agricultural export in particular. For example, according to Mouze (2005), price policy instruments such as real exchange rate devaluation and institutional factors significantly affect agricultural export of the country. Obviously, there are also various factors affecting Ethiopia's agricultural export apart from the ones sited by Mouze.

Hence, a closer look at the major factors determining the agricultural export of the country theoretically and empirically is indispensable in order to help the country to experience or achieve a sustainable growth in Agricultural exports.

1.2 Statement of the Problem

Agricultural export is one of the very important accelerators of growth in SSA (sub-Sahara African) countries. The economics literature supports the contention that development requires economic growth to alleviate poverty, and greater access to world markets is perceived as a necessary condition for more rapid growth. Like in the case of many developing countries, Ethiopia's Agricultural export has been limited to few primary products, which are mainly agricultural commodities.

According to the World Bank (2009), the share of Ethiopia's manufactures Agricultural export in the total Agricultural export is only 9.0 percent (implying primary agricultural commodity to be 91 per cent) Ethiopian agriculture remains an important source of economic growth that not only contributes 39 percent of the country's Gross Domestic Product (GDP) but also employs 73 percent of the population. It is also extending its leading role in Agricultural export performance by contributing over 75 percent of the 2.91 billion USD that the country has secured in the 2016/17 fiscal year. Despite its pivotal role for national economy and peoples' livelihoods, quality gaps challenged the agricultural export performance.

Moreover, the share of agriculture to total export proceeds increased consistently from about 63% in 2002/3 to 82% in 2008/9, though it slightly declined to 71% in 2010/11 and then it showed an increment starting from 2014/15 to 2016/17 by contributing 73% of share. In contrast to this, the share of non-agricultural goods (merchandise goods and gold) was, largely, constant during the same period with a slight increase since 2008/9-2016/17. (NBE 2016/17)

Even if there is improvement in Agricultural exports since recent years, it is not as such satisfactory regard as the country's comparative advantages in Agricultural exporting several agricultural commodities, in raw forms as well as in processed forms (Berhanu 2003). According to IMF, 2017 Ethiopia has a small export base its exports-to-GDP ratio in 2015 was the fifth lowest in the world highly concentrated in primary products. This raises two risks:

i. Ethiopia lacks the export diversification needed to raise growth through a broad base of production technologies, spreading risk and reducing aggregate output volatility; and
ii. Primary products are vulnerable to global price volatility and weather-related shocks. The GTP II aims to increase both the level and diversification of Agricultural exports to support resilient growth.

According to World Bank Report Consistent, overvaluation of the country's real exchange rate has contributed to poor export performance. According to the IMF report in 2009/10 and 2010 /11 around 30 percent, the real exchange rate of the country was overvalued. This has affected the Agricultural export performance of the country, also the type of the nation's export items, which is primarily dominated by "unprocessed and undifferentiated" agricultural products, made it susceptible to the fluctuations of the prices of these commodities in the international market. Many experts and IMF officially advices, monetary and fiscal policy should aim to keep inflation low and the exchange rate policy should support a nominal exchange rate that is competitive, accordingly Ethiopia's central bank devalued the Ethiopian birr by 15 percent on October,2017, its first such move in seven years to boost lagging exports. Still there is no a clear-cut reason for the poor performance of Ethiopia agricultural export performance.

So far, just there are many studies such as, Wondaferahu (2013) Determinants of export performance in Ethiopia. Tigist (2015) also done on impact of selected agricultural export in Ethiopian. Samuel (2012) conducted the study on the factors affecting agricultural export. Yet there is no comprehensive empirical study which determines factors affecting agricultural performance that includes all important variables like Real Effective Exchange Rate, inflation, Trade Openness, foreign direct investment, infrastructure and fertilizer input.

The above researchers have tried to identify the major factors affecting Agricultural export performance in Ethiopia. However, there are many macroeconomic variables including inflation and Real exchange rate, which were not address in their studies. Therefore, this study tries to fill this gap and empirically analyze the selected macroeconomic determinants of Agricultural export performance in Ethiopia over time for the period 1983 – 2018.

1.3 Research Questions

There are many macroeconomic factors affecting agricultural export in Ethiopia. Therefore, this study focuses on the macroeconomic determinants of agricultural export, which includes foreign direct investment, fertilizer input, inflation, trade openness, real effective exchange rate, and paved road; for this reason, the following questions should be address.

- What are the major agricultural export determinants in Ethiopia?
- Which macroeconomic variable or variables more strong for performance of agricultural export in Ethiopia?

- To what extent these macroeconomic variables affect the performance of agricultural export in Ethiopia.
- Is there a long run relationship between agricultural export and the selected variable?

1.4 Research Objective

1.4.1 General Objective

The Main objective of this study is to investigate factors that determine the agricultural export performance of the country.

1.4.2 Specific Objectives

- Investigating the relative importance of major factors that determine agricultural export performance of the country.
- To assess the trend of agricultural exports performance of Ethiopia over time.
- To identify the macroeconomic variables those have long run and short run relationships with export performance.
- To Examine the long run determinants and short run dynamics of agricultural export performance of the country

1.5 Research Hypothesis

The study needs to put the expected results or hypothesis on the impact of explanatory variables on determinants of agricultural export in Ethiopia. Therefore, this study develops the following alternative hypotheses:

$H_{1:}$ Foreign Direct Investment has positive significant effect agricultural export

$H_{2:}$ Fertilizer Input has positive significant effect agricultural export

$H_{3:}$ Inflation has positive significant effect agricultural export

$H_{4:}$ Trade Openness has positive significant effect agricultural export

$H_{5:}$ Real Effective Exchange Rate has positive significant effect agricultural export

H6: Paved Road has positive significant effect agricultural export

1.6 Significance of the Study

The study is significant in identifying the major determinants that affect the agricultural export of the country by bringing empirical evidence through econometric analysis of twenty years' time series data. In addition, the study is also significant in that it incorporates additional important variables which determining the agricultural export performance of the country which have not been incorporated in other previous or recent studies including the study by mouze (2005), Birhanu (2005), lemlem (2008) and Samuel Tekeste (2012). Furthermore, the study fills the time gap uses very recent data for empirical analysis. In general, identifying the determinants of agricultural export Performance will help to provide information to the policy makers to enable them come up with the appropriate policy to enhance the growth of the Agricultural export earnings and the economy as a whole and will help broaden the understanding of determinants of agricultural export , which will use full for policy formulation.

1.7 Scope and Limitations of the study

This study is limited to the period between 1983-2018 (Derg and EPRDF regime), which covered thirty-five years of time-series data on macroeconomic variable that can determine the performance of agricultural export. The study used data for the stated period due to lack of adequate data in the period before on some agricultural export commodity. For this study, the overall agricultural export performance of the country is considered. This is because it is vital to focus on leading and major agricultural export commodities in Ethiopia in terms of volume and total revenue. The study was limited by non-availability of data on some variables such as domestic consumption of agricultural commodities in Ethiopia

1.8 Organization of the Study

The study will be organized into five chapters; the first chapter is an introduction which gives a background of the research paper, the research problem and scope and other basic issues of the paper, the second chapter deals with the literature review which includes related theoretical, empirical and conceptual literature reviews.

The third chapter deals with the Methodology of the study that includes, Research Design, Data Source, Model specification and methods of data collection and Methods of Data Analysis described in detail in chapter three.

The fourth chapter presents analysis and presentation. This section of the research paper concerned on analysis and interpretation, which shows and explains the descriptive analysis, descriptive statistics, goodness test, among identified variables. Finally, in chapter five, the main findings of the study are summarized and the chapter discusses some important recommendations.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1. Introduction

This chapter reviews the issues regarding Agricultural export and agricultural export determinants in particular provide an insight into the area of the study. In this chapter, the theoretical, empirical and conceptual literature that focuses on the research objectives is reviewed hereunder.

2.2. Theoretical Review

2.2.1. An Overview of Agricultural Export

Exports- are the goods and services produced in one country and purchased by residents of another country. It does not matter what the good or service is. It does not matter how it sent. It may ship, sent by email, or carried in personal luggage on a plane. If it is produced domestically and sold to someone in a foreign country, it is an export. Exports are one component of international trade.

Theoretical underpinnings of exports have evolved from David Ricardo's comparative advantage in 1817 to the new trade theories. According to the theory of comparative advantage, there is still basis for trade between two nations even if a nation has absolute disadvantage in the production of both commodities if the nation with absolute disadvantage specializes in the production of the commodity in which its absolute disadvantage is smallest. The commodity in which its absolute disadvantage is smallest is the commodity of the country's comparative advantage. Hence, the nation will specialize in the production and Agricultural export of that commodity (Salvatore, 2009).

The Heckscher-Ohlin model made popular in 1933 isolates the differences in resource endowments among nations as the basis for trade. Since nations are endowed differently with natural resources in terms of types and quantity, the theory places emphasis in a nation Agricultural exporting a commodity whose production uses cheap and abundant inputs and will import the commodity whose production requires the intensive use of a nation's limited and costly inputs. Therefore, according to the Heckscher-Ohlin theory, if a nation is labor abundant, it should specialize in the export of the commodity that is labor intensive. Again, if a

nation is classified as capital abundant, it should specialize in the Agricultural export of the commodity whose production utilizes capital-intensive techniques (Salvatore, 2013).

According to Fungaza (2004), the amount of Agricultural export s a country makes (supply capacity) depends on the size of the sector that is Agricultural exporting a given commodity (measured by the varieties of the commodity produced), the prices received by the producer (producer price) and domestic transport costs.

Fungaza (2004) also stresses the role of country size in influencing the volume of Agricultural export s. The Gross Domestic Product measures country size (GDP) as well as the population of a particular country. Country size shows how big the market of the country that is Agricultural exporting a given commodity. If the importing country's Gross Domestic Product is large enough, that will have an effect on the total quantity of imports that it will make. The higher the Gross Domestic Product, the more likely it is to import more of a commodity. The size of a country is related to the price of Agricultural exports. The larger is a country's Gross Domestic Product, the more likely it is to influence the price of a commodity that it Agricultural export s since the price reflects the costs that go into the production and Agricultural export of a commodity. These costs are directly link to institutions or policies that are in place in the exporting country. Besides country size, foreign market access also influences the supply capacity of a country. If a country has better access to international markets, its expected returns from export activities will be higher hence, it will increase the volume of its exports. Better foreign market access can also increase the volume of export s by attracting resources from abroad through foreign direct investment or through migration of labor hence increasing productivity.

On the contrary, Redding and Venables (2004) argue that supply capacity and foreign market access are negatively related. If the export sector is to expand, it will demand more of factors of production. With this increase in demand on factors of production such as labor, the price of labor (wage rate) increases. This increase in the cost of production will be reflecting in the producer price. The higher is the producer price, the lower will be the demand of a nation's agricultural exports hence the negative relationship between foreign market access and supply capacity. An increase in foreign market access will lead to a less than proportionate increase in the volume

of export s and subsequently a lower supply capacity. This also implies that supply capacity is inelastic with respect to foreign market access (Redding and Venables, 2004).

2.2.2. Ethiopian Agricultural Export

According to ATA report of 2017/18 Agriculture plays an important role in Ethiopia's political, economic and social development. It forms one of the largest components of the Ethiopian economy, contributing 34% of the country's gross domestic product (GDP) and 71% of employment. Crop production makes up 72% percent of the total agricultural GDP, whereas livestock accounts for 20% and other areas contribute 8.6%. Cereals (such as wheat, maize, teff, sorghum, and millet), comprise the biggest share of crop production as principal staples. 32 million tons of grains were produced by smallholder farmers in the 2009 EFY season alone. In addition, vegetables, fruits, root crops, pulses, oilseeds, and spices are grown widely.

Ethiopia also has the largest livestock population in Africa with an estimated 60 million cattle, 61 million sheep and goats, 57 million poultry, and a combined 12 million donkeys, horses, mules, and camels. Honey production is practiced extensively: Ethiopia is the biggest honey producer in Africa and the 10th largest producer globally.

Agricultural products remain the largest contributor to export earnings, accounting for over 75% of total Agricultural export earnings. In 2009 EFY alone the sector generated 2.18 billion USD in Agricultural export s. Coffee, sesame, fruits, vegetables, and leather are among Ethiopia's top Agricultural export s. Although many commodities (such as pulses, oilseeds, meat, and live animals) are Agricultural exported in raw form or with minimal processing, the advent of carefully planned Integrated Agro-Industrial Parks means that Ethiopia will soon earn considerably more from value-added products.

According to NBE (2016/17) total merchandise export (including electricity) increased by 1.4 percent year-on-year due to higher export earnings from coffee (22.2 percent), pulses (20.5 percent), chat (4.0 percent), fruit and vegetables (4.5 percent), meat & meat product (2.3 percent), electricity (133.0 percent) and other export items (33.4 percent). Thus, the ratio of merchandise export to GDP declined to 3.6 percent from 4.1 percent a year ago.

Agricultural export earnings from coffee increased owing to 7.5 percent rise in international price and 13.6 percent increase in export volume. As a result, the share of coffee in total merchandise

export rose to 30.4 percent from 25.2 percent a year ago. Receipts from oilseeds declined by 26.4 percent and reached USD 351 million because of 3.7 percent drop in international price and 23.6 percent decrease in export volume. Hence, the share of oilseeds in total merchandise export was down to 12.1 percent. Likewise, gold generated USD 208.8 million, about 28.2 percent lower than last year because of a 30.4 percent slowdown in volume, despite a 3.2 percent growth in international price. As a result, the share of gold in total merchandise export stood at 7.2 percent.

Revenue from chat export increased by 4.0 percent as export volume rose by 3.9 percent despite 0.1 percent decline in international price. Hence, the share of chat export in total merchandise export went up to 9.4 percent. In contrast, revenue from export of live-animals declined by 54.2 percent because of a significant (53.6 percent) drop in export volume and 1.3 percent fall in international price. Therefore, the share of live-animals in total merchandise export earnings decreased to 2.3 from 5.2 percent a year ago.

Agricultural export earnings from leather & leather products decreased by 1.1 percent due to a 1.6 percent fall in Agricultural export volume. Despite 0.5 percent rise in international price. Consequently, the share of leather & leather products in total export revenue stood at 3.9 percent.

Earnings from pulses increased by 20.5 percent to USD 279.9 million due to 4.6 percent rise in export volume and 15.1 percent increase in price. Thus, the share of pulses in total merchandise export revenue increased to 9.6 percent from 8.1percent a year earlier.

Conversely, export proceeds from flower went down by 3.0 percent as both export volume and international price fell by 2.5 and 0.5 percent, respectively. Hence, the share of flower in total export earnings decreased to 7.5 percent from 7.9 percent last year same period.

Receipts from meat & meat products showed a 2.3 percent annual growth mainly because of a 3.2 percent increase in export volume despite a 0.8 percent decline in price. As a result, the share of meat & meat products in total merchandise export earnings stood at 3.4 percent.

Agricultural export earnings from fruits and vegetables increased by 4.5 percent vis-à-vis last year same period due to 6.9 percent rise in export volume in contrast to 2.2 percent decline in international price. Thus, the share of fruits and vegetables in total merchandise export earnings reached 1.9 percent during the review period.

Table 2.1 Values of Major Agricultural export Items

Commodities	2014/15		2015/16		2016/17		Percentage change	
	A	%Share	B	%Share	C	%Share	B/A	C/B
Coffee	780.5	25.8	722.7	25.2	883.2	30.4	-7.4	22.2
Oilseeds	510.1	16.9	477.2	16.6	351.0	12.1	-6.4	-26.4
Lather &Lather Products	131.6	4.4	115.3	4	114.0	3.9	-12.4	-1.1
Pulses	219.9	7.3	232.4	8.1	279.9	9.6	5.7	20.5
Meat & Meat Products	92.8	3.1	96.4	3.4	98.7	3.4	3.9	2.3
Fruits & Vegetables	47.6	1.6	53.7	1.9	56.1	1.9	12.9	4.5
Live Animals	148.5	4.9	147.8	5.2	67.6	2.3	-0.5	-54.2
Chat	272.4	9	262.5	9.2	273.0	9.4	-3.7	4.0
Gold	318.7	10.6	290.7	10.1	208.8	7.2	-8.8	-28.2
Flower	203.1	6.7	225.3	7.9	218.5	7.5	10.9	-3.0
Electricity	42.6	1.4	31.5	1.1	73.4	2.5	-26.2	133.0
Others	25.4	8.3	212.3	7.4	283.2	9.7	-15.6	33.4
Total Agricultural export	3019.3	100	2867.7	100	2907.5	100	-5.0	1.4
Total Agricultural export Excluding Electricity	2976.5		2836.3		2834.11		-4.7	-0.1

Source: Ethiopian revenue and Custom Authority

Similar to that of SSA countries, Table 2.1 above illustrate that Ethiopia's Agricultural export is highly dependent on agriculture, which is why agriculture is widely regarded as the backbone of Ethiopian economy. It plays a key role both in the development of the nation as well as in the wellbeing of its people. Its contribution to the national economy can be seen from different aspects. For instance, its contribution as a source of food and raw materials, its contribution to GDP, export earnings and so on.

According to Wikipedia free.com, agriculture accounted for 46.3% of GDP, 83.9% of Agricultural export s, and 80% of the labor force in 2006/2007, compared to 44.9%,76.9% and 80% in 2002/2003, and agriculture remains the Ethiopian economy's most important sector.

Ethiopia has great agricultural potential because of its vast areas of fertile land, diverse climate, generally adequate rainfall, and large labor pool. Despite this potential, however, Ethiopian agriculture has remained underdeveloped. Because of drought, which has repeatedly affected the country since the early 1970s, a poor economic base (low productivity, weak infrastructure, and low level of technology), and overpopulation, the agricultural sector has performed poorly. For instance, according to the World Bank between 1980 and 1987 agricultural production dropped at an annual rate of 2.1 percent, while the population grew at an annual rate of 2.4 percent. Consequently, the country faced a tragic famine that resulted in the death of nearly 1 million people from 1984 to 1986.

Generally speaking despite its enormous benefits to the country's economy, agricultural sector has passed through many problems and challenges. For instance, during the imperial period, the development of the agricultural sector was retarded by a number of factors, including tenancy and land reform problems, the Government's neglect of the agricultural sector (agriculture received less than 2 percent of budget allocations even though the vast majority of the population depended on agriculture), low productivity, and lack of technological development.

Similar to that of imperial regime agricultural productivity also continued to decline during the Derg regime also. According to the World Bank, agricultural production increased at an average annual rate of 0.6 percent between 1973 and 1980 but then decreased at an average annual rate of 2.1 percent between 1980 and 1987. During the same period (1973–87), population increased at an average annual rate of 2.6 percent (2.4percent for 1980-87).

The poor performance of agriculture during Derg was related to several factors. including drought, a government policy of controlling prices and restriction on free movement of agricultural products from surplus to deficit areas, the unstable political climate, the dislocation of the rural community caused by resettlement, Villagization and conscription of young farmers to meet military obligations, land tenure difficulties and the problem of land fragmentation, the lack of resources such as farm equipment, better seeds, and fertilizers, and the overall low level of technology. President Mengistu's 1990 decision to allow free movement of goods, to lift price controls, and to provide farmers with security of tenure was designed to reverse the decline in Ethiopia's agricultural sector. There was much debate as to whether or not these reforms were

genuine and how effectively they could be implemented. Nonetheless, agricultural output rose by an estimated 3% in1990-91, almost certainly in response to the relaxation of government regulation. This modest increase, however, was not enough to offset a general decrease in GDP.

On the other hand according to Economy@ethiopianembassy.org, since the new Ethiopian Government made agriculture its primary priority in 1991, Ethiopia has developed and implemented its Agricultural Development Led-Industrialization (ADLI)strategy and the key concept underlying ADLI is an Agricultural export -led development strategy aimed at promoting economic growth in Ethiopia while coordinating agricultural and industrial development. In other words, what the report tried to address is that following trade liberalization by the government and the government's strong commitment in creating conducive environment especially for private sector has benefited export sector and its growth in general.

In addition to the above things, the new government of Ethiopia also facilitated the inflow of foreign investment by providing various incentives following its recognition regarding the need of huge and large capital investments in order to exploit the countries resources and making agricultural sector the key contributor for the development of Ethiopia. Ethiopia has also a tremendous potential for investment in agro processing and many of her agricultural products can be Agricultural exported without being processed, while others can be processed before they are brought to domestic and foreign markets. Finally, even though the government tries to encourage the Agricultural export of agricultural products, the Agricultural export of processed products has got a priority which involves and stimulates the growth and expansion of agro-processing sector.

2.3. Empirical Literature Review

There are a vast amount of literatures on determinants of export performance. Because of the role, that exports play in the growth of many economies. Studies that have been done on determinants of export performance have received widespread attention from policy makers and many researchers around the world in different period of time differed on their approach in terms of variables used or their methods of analysis. This section will therefore review some of the studies that have been conducted on determinants of agricultural export performance.

2.3.1. Empirical Literature Review- General

Many studies have been conducted to identify the determinants of agricultural export all over the world. Under This part I tried to review some of their findings.

Shane (2008) examined factors that affected growth of agricultural export s of the United States of America (USA) for the period 1970 to 2006 and employed a similar approach used by Tura (2002) although the weighted real GDP was found by only subtracting export s of the importing country and did not include the relative prices as well. The findings revealed that the real GDP of the importing country was the most important factor that affected the growth of agricultural export s of the USA. A one percent increase in the real income of the importing country led to an increase in the volume of U SA agricultural export s by 0.75 percent implying that USA agricultural exports are inelastic with respect to the trading partner's income. He therefore concluded that the real income of the importing country is the most important factor that affects a country's Agricultural exports. On the other hand, he found a negative and significant relationship between the real exchange rate and the volume of Agricultural export s. A decrease in the exchange rate by one percent against the currencies of the trading partners increased USA agricultural export s by 0.51 percent.

Helga (2005) on the other hand found that the GDP of the exporting country does not affect its exports in the case of Iceland. Using a simultaneous equation framework, Sharma (2001) investigated the determinants of Indian exports using annual time series data. The main variables used were relative prices and exchange rate and domestic relative prices. His findings were that a fall in export prices increased demand for Indian export s while appreciation of the Indian rupee against major currencies of the trading partners had a negative impact on Indian agricultural export volumes. On the other hand, a fall in domestic prices relative to world prices had a positive effect on agricultural exports.

However, foreign direct investment and infrastructural development had no effect on India's exports. Kannan (2013) on the other hand found that world price and world population had a positive and significant impact on the volume of agricultural export s in India. Tien (2009) also found that Vietnam's GDP growth rate positively affected the growth of its Agricultural export s although the coefficient of GDP was less than unit implying that exports were in elastic with respect to GDP.

In a study to analyze the determinants of agricultural export s in Nigeria, particularly on cocoa and rubber, Abolagba et al. (2010) used Ordinary Least Squares regression (OLS) to analyze determinants of Nigeria's two agricultural export s; cocoa and rubber during the period 1970 to 2005. The findings revealed that for both crops, the main determinants of agricultural export growth were domestic or supply side factors. For rubber Agricultural export s, he found that domestic output of rubber, interest rate; domestic producer price and domestic consumption were important determinants of rubber Agricultural export s in Nigeria. On the demand side, the real exchange rate was found to have a significant impact on export volumes of rubber. For cocoa, only supply side factors such as domestic consumption and rainfall were found to have a positive effect on Agricultural export volumes.

V.O. Okoruwa, G.O. Ogundare and S.A. Yusuf (2003) on their effort to identify Determinants of traditional agricultural export s in Nigeria using an application of co-integration and correction model, concluded that the domestic output and population growth rate were the most significant factors influencing agricultural export s in the importing countries.

Hatab (2010) applied to examine factors that affect growth of Egyptian agricultural export s found that the GDP per capita significantly and negatively affected the volume of its Agricultural export s and concluded that this may be due to the increase in consumption and demand of the domestically produced goods thereby leaving only a small amount available for Agricultural export purposes. However, Egyptian Agricultural exports were highly responsive to changes in its GDP and exchange rate.

On the study of determinants of three agricultural exports (cocoa, coffee and banana) from Cameroon between 1971/72 and 1995/1996 AERC African Economic Research Consortium Research Paper 120(2002) using ordinary least squares (OLS) estimation procedure indicate the following: the response of Agricultural export supply of all the crops to relative price changes is positive, but fairly significant. This can be attributed to the price constraining nature of the international markets for these commodities. Changes in the nature of the road network positively affect the agricultural export supply of cocoa, coffee and banana. More credit to crop Agricultural exporters has a significant and positive influence on the Agricultural export supply of all the crops. Equally, rainfall's influence on the growth of the three commodities is positive, but significant only for cocoa and coffee.

Majed and Ahmad (2006) examined the internal determinants of Agricultural export performance using annual panel data covering the period 1970 to 2004 for 75 countries. They found that Agricultural export performance can be explained by factors such as official development assistance, indirect taxes, national savings and total labor force. On the contrary, foreign direct investment was found not to have a significant impact on Agricultural export volumes. Kingu (2014) applied Co-integration and Error Correction model using time series data for the period 1970 to 2010. The findings revealed that cotton Agricultural export earnings were mostly determined by real exchange rate.

Using co-integration and error correction approaches, M. wansakilwa etal. (2013) investigated the growth and competitiveness of flower Agricultural export s for Zambia to major trading partners; Netherlands, United Kingdom and Germany for the period 1990 to 2010. The variables of interest were analyzed within the confines of the demand and supply framework. On the demand side, flower production, agricultural export credit and real exchange rate found to have a significant impact on flower exports. Population of importing countries, real GDP of the importing country, world price and real exchange rate had a significant impact on flower Agricultural export s.

Tewelde Medhin and Mbai (2013) used the extended gravity model that included variables such as the Gross Domestic Product of Namibia, the Gross Domestic Product per capita of Namibia, exchange rates and dummy variables if the trading partner belonged to any regional organization. The focus of the study was to identify alternative markets for fresh beef, goat and sheep Agricultural export s of Namibia. His findings revealed that Gross Domestic Product per capita was found to be positively related and significant in Southern and West Africa for fresh beef. Fresh beef was found significant in all cases while goat and sheep meat was only significant in East Africa. In Asian markets, per capita income was found to be significant and highly elastic, making these markets attractive Agricultural export destinations.

2.3.2. Empirical Literature Review- Ethiopia

In an effort to investigate factors that determine the export performance of Ethiopia, Anagaw and Demissie (2012) used econometric model such as the Johansen co-integration and error correction approaches for the period 1970-2011. The findings of the study revealed that in the short-run, the growth of Ethiopia's export s could only be explained by openness of the current year. However,

in the long-run, factors such as openness, private credit as a ratio of Gross Domestic Product (a proxy for financial development) significantly affected Ethiopia's exports. Real Gross Domestic Product of Ethiopia and infrastructural development were found to have a significant and positive effect on the agricultural export volumes. On the demand side, the real Gross Domestic Product of the trading partner and the real effective exchange rate were found to have a positive effect on Ethiopia's agricultural exports. Ethiopia's exports were more elastic to its real GDP (1.7) while they were found to be inelastic with respect to the rest of the other variables.

Wondaferaw Mulugeta (2013) using Johansson co-integration and Vector Error Correction approaches to investigate factors that determine the export performance of the country by using an econometric model for the period 1970/71-2010/11. The findings of the study revealed that in the long run Agricultural export performance has found to be positively influenced by real effective exchange rate, openness, RGDP of home country, infrastructural development

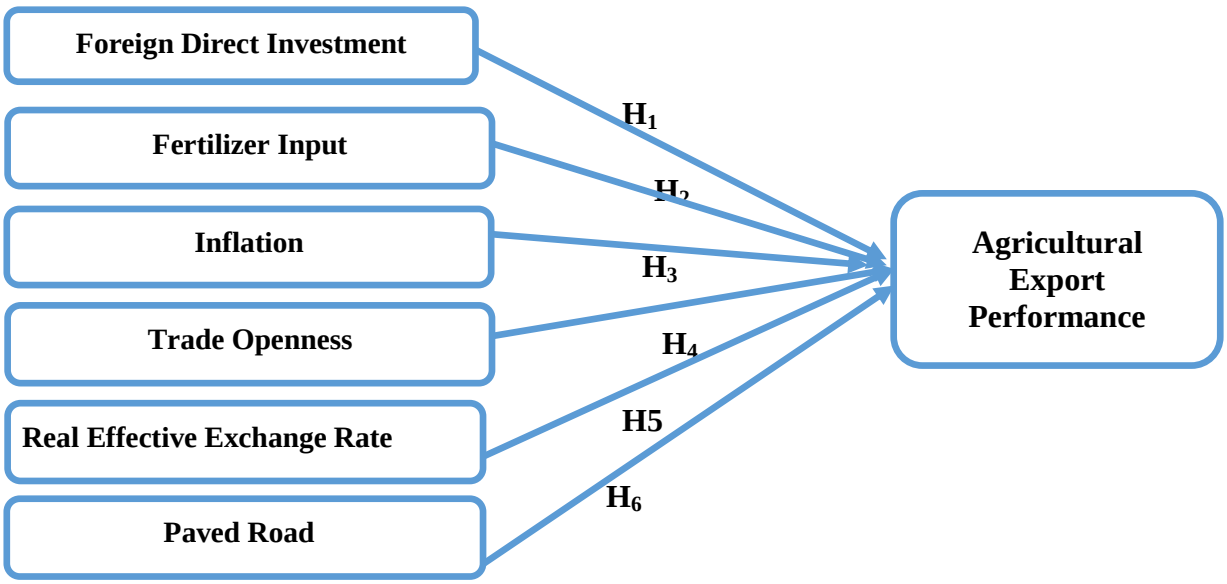
Negussie Zeray and Ashebir Demie (2016) conducted a study on agricultural food Agricultural export performance in Ethiopia for Natural resource, Agricultural Development and Food security International Research Network (NAF-IRN).Applying co-integration and error correction approaches to test the relationship of food Agricultural export supply and other variables revealed that food export supply of Ethiopia is affected by openness of the country for international trade in the long run. Whereas the domestic national income, rural population, Urban population, Agricultural land, overall investment and the domestic inflation affects the food Agricultural export supply of Ethiopia both in the short run and long run operation.

Samuel Tekeste (2012) also shows determinants of agricultural export in Ethiopia using co integration and error correction approaches. in the regression analysis concluded that out of the variables significantly affected agricultural export both in the long run and short run; terms of trade, world price, fertilizer input import over a period and kilometers of paved roads affected agricultural export positively. Domestic price was also insignificant like in the case of long run. However, except these two variables other variables were found to significantly affect the agricultural export performance of the country.

2.4. Conceptual Framework of the Study

Factors that affect growth of agricultural exports can place into two broad categories; demand factors and supply factors. Supply factors are those push factors that give a country impetus to Agricultural export goods and services. They are factors that directly affect the production ability of a country. They include among many other variables; Foreign Direct Investment (FDI) and Real Interest Rates (RIR). For instance, higher interest rates would increase the cost of borrowing thereby limiting the production capacity and subsequently volume of exports of the agricultural exporting country (imports of the importing country). The existing government policies such as public expenditure on infrastructural development and taxation of the agricultural sector would give further impetus to increase production and hence the volume of agricultural exports.

On the other hand, Demand factors are those exogenous factors that pull a foreign country to import goods and services from another country. Higher incomes for instance increase the purchasing power of the importing country and this implies that they will increase their imports of goods and services. Figure below illustrates the relationship between supply factors and how they affect the volume of agricultural exports.



CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

In this chapter, the research methodology used is discussed briefly. It describes the research approach, research design/type, sampling design, source of the data, data collection method, data collection instrument, method of data analysis, validity and reliability, and research ethics followed.

3.2. Research Approach and Design

3.2.1. Research Approach

There are three basic types of research approaches; quantitative, qualitative, and mixed approach. Quantitative research approach is based on the philosophy of post positivism worldview. It is also reductionist in that the intent is to reduce the ideas into a small, discrete set of ideas to test, such as the variables that constitute hypotheses and research questions. In addition, quantitative approach uses statistical methods in describing patterns of behavior and generalizing findings from samples to population of interest, and employs strategies of inquiry such as experiments and surveys (Creswell 2003,).

Hence, by taking the research objectives and questions into considerations, quantitative research approach was used. A quantitative research approach was used, as it is suitable to test relationships using the hypothesis and research questions (Zikmund, 2003).

3.2.2. Research Design

The research design is the overall strategy that the researcher choose to integrate the different components of the study in a coherent and logical way, thereby, ensuring you will effectively address the research problem;. It constitutes the blueprint for the collection, measurement and analysis of data. This study implements longitudinal research design identifying the determinants of agricultural export performance in Ethiopian economy using time serious data.

3.3. Data Type, Sources and Data Collection Method

Time series data have been used in this study. The data set has been collected from National Bank of Ethiopia, Ethiopian Revenue and Custom Authority, Ethiopian Roads Authority, CSA, World Bank website, UNCTADSTAT and IMF World Economic Outlook Website.

For analyzing the country's determinants of agricultural export performance, the Agricultural export equation in this study has been estimated using time series data for the period 1983-2018 and the time series data that used in this study are Agricultural export of Agricultural goods valued in US dollar.

3.4. Econometric Model Specification

Hence, the study signifies Ethiopia's agricultural export performance as a function of real effective exchange rate, and openness, infrastructural development, fertilizer input. The model that has been used in this paper is thus the adopted Goldstein and Khan (1985) imperfect substitution model, which is expressed as follows:

AGEX = f (REER, OPEN, ROAD, INF, FERT, FDI)

Next, we convert into equation forms

$$AGREX_t = \beta_0 + \beta_1 OPEN_t + \beta_2 REER_t + \beta_3 FERT_t + \beta_4 ROAD_t + \beta_5 INF_t + \beta_6 FDI_t + \varepsilon_t$$

Thus to determine Ethiopia's agricultural export performance, a log-linear form agricultural export determination model is employed incorporating the supply related variables. The model is adopted from Samuel Tekeste (2012) in estimating determinants of agricultural export in Ethiopia and Wondaferahu Mulugeta (2013) in estimating determinants of Agricultural export performance in Ethiopia was used similar model. In contrast, however, the model includes inflation and FDI. Therefore, the regression equation is given by:

$$Ln\ AGREX_t = \beta_0 + \beta_1 lnOPEN_t + \beta_2 lnREER_t + \beta_3 lnFERT_t + \beta_4 lnROAD_t + \beta_5 lnINF_t + \beta_6 lnFDI_t + \varepsilon_t$$

Where;

AGREXt = Agricultural export earnings at time t in log linear form is the dependent variable.

OPEN = exports plus imports as a percentage of GDP, a proxy for degree of openness in log linear form

INF = Inflation in log linear form

FERT = Fertilizer input during a period in log linear form

FDI = Foreign direct investment during a period in log linear form

REER = Real Effective Exchange Rate in log linear form (which is found by trade weighted Birr/foreign currency*foreign price index/domestic price index)

ROAD = Kilometers of paved roads which is a proxy of transportation infrastructure.

ε = Error terms

3.5. Definition of Variables

3.5.1 Dependent Variable

Agricultural exports are the agricultural output produced in one country and purchased by residents of another country. It doesn't matter what the good is. It doesn't matter how it is sent. It can be shipped, or carried in personal luggage on a plane. If it is produced domestically and sold to someone in a foreign country, it is an export.

3.5.2 Independent Variables

Trade Openness

Trade Openness is the sum of imports and Agricultural export s normalized by GDP. As definition indicates, openness can affect Agricultural export s as it promotes the efficient allocation of resources, factor accumulation, technology diffusion, and knowledge spillovers. According to Kuroda (2006), Asia has been a showcase of economic performance where an outward trade policy takes a central role (Trejos and Barboza, 2015). Other explanations regarding the Singer-Prebisch thesis, however, suggest that trade openness might have a negative impact on growth (Tekin, 2012a, bTekin, 2012aTekin, 2012b). Spilimbergo (2000) presents a model in which trade between an advanced country and a less developed country can reduce long-term growth rates in the developed country.

Mishra (2007) and Lane and Milesi-Ferretti (2008b) state that bilateral equity investment is strongly correlated with underlying patterns of trade. Greater trade liberalization produces antigrowth and pro-growth effects. The neoclassical economists argue that Agricultural export growth is the main driver of economic growth (Helpman and Krugman, 1985; Hye et al., 2013).

Real effective exchange rate (REER)

The price of one currency in terms of another is called exchange rate. Exchange rates play a central role in international trade because they allow the computation of the relative prices of goods and services produced in different countries thereby allowing the comparison of those prices across countries. Changes in exchange rates are described either as depreciations or appreciations. There are two indicators to measure exchange rate changes. These are Nominal Effective Exchange Rate (NEER) and Real Effective Exchange Rate (REER).

REER is the real effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.
An increase in REER implies that exports become more expensive and imports become cheaper; therefore, an increase indicates a loss in trade competitiveness.

Infrastructure

Infrastructure is one of the major non-price factors, which affects or constrains Agricultural exports especially in least developing countries. Of the factors that boost production as well as Agricultural export supply of commodities, infrastructural facilities come at the forefront. Its development is a key element of countries ability to produce and move goods. Weak infrastructure is a major impediment to trade, competitiveness and sustainable development in most African countries, particularly land -locked and Small Island countries. It reduces the return to trade and economic activity and hinders growth prospects of a given country.

According to Eyayu T (2011), internal physical infrastructural facilities of a given country can be proxy by indexes such as percentage of paved roads out of the total road; number of fixed and mobile telephone subscribers (per 1000 people); number of internet subscribers (per 1000 people), freight of air transport (in mill ton-km) and so on. In this study, the impact of infrastructure is captured by kilometers of total paved roads. Since the availability of road creates marketing opportunities in the international market and also the absence of such facilities does not

bring the desired agricultural export performance of the country, therefore, we expect the sign of this variable to be positive.

Fertilizer input

Fertilizer is the ingredient, which increases the productivity of agricultural products. When fertilizer import increases, its consumption will also increase which in turn increases the productivity and hence increases Agricultural export supply of the country. Hence, we expect the sign of the coefficient of fertilizer input import to be positive Samuel T. (2012).

Inflation

Inflation is a situation of rising prices in the economy. A more exact definition of inflation is a sustained increase in the general price level in an economy. Inflation means an increase in the cost of living as the price of goods and services rise. The rate of inflation measures the annual percentage change in the general price level.

Inflation is measured by consumer prices (monthly %). Inflation as measured by the consumer price index reflects the percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals.

According to the aggregate demand curve, when the price level is higher, the real GDP demanded is lower. One of the explanations given is a consequence of the Mundell-Fleming model: "As the price level drops, interest rates fall, domestic investment in foreign countries increases, the real exchange rate depreciates, net Agricultural export s increases, and aggregate demand increases." Therefore, this seems to suggest that increased inflation means more imports and fewer Agricultural export s. However, increased inflation should also increase the exchange rate (currency depreciation). If you can trade foreign currency for more domestic currency, then Agricultural export s should increase and (conversely) imports should decrease.

According to Asian Journal of Economics, Business and Accounting (2017) inflation has a significant positive long run relationship with total Agricultural exports.

3.5.1. Stationary and Non-Stationary Series

The standard classical methods of estimation that are used in the applied econometric work are based on a set of assumptions one of which is the stationarty of the variables. A variable is said to be covariance (weakly) stationary if the mean and the variances of the variable are constant over time.

In addition, the covariance between two periods depends only on the gap between the periods not the actual time at which this covariance is considered. Whereas a non-stationary series has a different mean at different points in time and its variance, increases with the sample size (Debel G. 2002).

According to Madala (1992), a time series is said to be strictly stationary if the joint distribution of any set of N observations Y_1, Y_2------Y_t is the same as the joint distribution of Y_{1+k}, $Y_{2+k,}$ …Y_{t+k} for all N and K. The distribution of Y_t is independent of time and thus it is not only the mean and the variance that is constant but also all higher values of t are independent of t. In time series analysis, most encountered series are in fact non -stationary. Contrary to the situation of stationary process which fluctuates around their mean, the reversion to a fixed value rarely occurs for non-stationary process. If a non-stationary time series is regressed on one or more non-stationary time series, the results are prone to spurious regression problems. This is a situation where results obtained suggest there are statistically significant relationships between the variables in the regression model when in fact all that is obtained is evidence of contemporary correlations rather than meaningful causal relations (J. Gudeta, 2010).

Therefore, it is necessary to check whether the variables included in the model are stationary or not before going to the next step which is regression analysis.

Testing for Unit-Roots

Unit-roots are important to detect the stationarity of time -series data. To test if the series, used have unit-roots the researcher applies a test based on the work of Fuller (1976) and Dickey and Fuller (1979, 1981). The Augmented Dickey-Fuller test is a similar but modified version of the Dickey-Fuller test which is used when error term is not a white noise. While testing for stationarity, if a variable becomes stationary at level, then it is said to be integrated of

order zero, I (0). In addition, if the variable is stationary at its first difference, it is said to be integrated of order one I (1). Similarly, if a variable can be transformed to stationary series by differencing n times, then it is integrated of order n, I (n) (Verbeck, 2004).

3.5.2. Co-integration and the Error Correction Model

Once the order of integration of the non-stationary variables has been determined and of variables is found to be non-stationary the next step is Co-integration. The test for co-integration is to check for the existence of co -integrating relationships between non-stationary explanatory variables, are co -integrated, if they have a linear combination of their data series that is stationary even though the individual series are non-stationary. In other words, we want to test for the stationary of the linear combinations of these variables. The theory of co-integration addresses the issue of integrating short-run dynamics with long run equilibrium. Two I (1) series are said to be co-integrated if there exists a linear combination of the series which is stationary. Suppose that Y_t is I(1) and X_t is also I(1), then Y_t and X_t are said to be co-integrated if there exists a β such that $Y_t - \beta X_t$ is I(0). In that case, the regression equation $Y_t = \beta X_t + U_t$ makes sense because Y_t and X_t don't drift too far apart from each other over time (Madala, 1992). In general, if X_t and Y_t are co-integrated, that means there is a long-run relationship between them and furthermore, the short-run dynamics can be described by the error correction model (ECM).

Regarding the test for the existence of co-integration, there are a number of methods for testing it. Among these the Engle Granger two step residual based procedures and the Johansen test are the major ones used by many researchers. Therefore, in this paper, the co-integration test carried out is Engle Granger two-step procedures. This model first estimates the relationship between the variables by ordinary least square (OLS) and test for stationary of the error term. If the error term is found to be stationary then the variables are co-integrated. In economic terms, variables will be co -integrated if they have a long term equilibrium relationship between them (Maddala,1992).

CHAPTER FOUR: RESULTS AND DISCUSSIONS

This section of the study concerned on analysis and interpretation of econometric analysis. The econometric analysis begins by the necessary tests such as stationary tests, Co-integration test and diagnostic tests. After both the long run and short run models are estimated using OLS and Error Correction respectively. After estimation has been made, the interpretation and discussion are continued based on the model results of Eviews 10.

4.1 Estimation Technique

Many macroeconomic time series are not stationary at levels and are most adequately represented by first differences. Non-stationarity of time series data has often been regarded as a problem in empirical analysis. Working with non-stationary variables lead to spurious regression results, from which further inference is meaningless. Thus, it is better to distinguish between stationary and non-stationary variables. Harris (1995:15) noted "… a data series is said to be stationary if its error term has zero mean, constant variance, and the covariance between any two-time periods depends only on the distance or lag between the two periods and not on the actual time at which it is computed."

Hence, the first step in time series econometric analysis is to carry out unit root test on the variables of interest. The test examines whether the data series is stationary or not. To conduct the test, the conventional Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) test has been used with and without a trend. Since the actual data generating process is not known a priori, the test of determining the orders of integration of the variables has conducted first by including a constant only and then both a constant and a trend. The ADF test is based on the regressions run in the following forms.

$$\Delta Y_t = \alpha_1 + \beta Y_{t-1} + \mu_t \text{---------- 4.1}$$

$$\Delta Y_t = \alpha_1 + \alpha_{2t} + \beta Y_{t-1} + \mu_t \text{---------- 4.2}$$

Where, t is the time or trend variable. Equation (4.1) adds a drift, and equation (4.2) introduces both a drift and a time trend. In each case the null hypothesis is that $\beta = 0$, that is, there is a unit root. The null hypothesis (H_0) is thus a series contains a unit-root (non-stationary) against the alternative hypothesis (H_1) stationary (deterministic trend).

4.1.1 Result of Unit Roots Tests

The first task before any meaningful regression in time serious analysis is to test the existence of unit roots in the variables and establishing their order of integration. Because the variables used in the analysis need to be stationary and/or should be co integrated in order to infer a meaningful relationship from the regression.

All the variables used in the estimation process are tested using Augmented-Dickey Fuller test statistic and the results are presented in table 1 below.

Table 1: ADF Test at First Difference Level

Variables	ADF	t-statics at 5% level	Prob.	Result
lnAGREX	3.469836	2.954021	0.0154	Stationary
lnFDI	3.783750	2.981038	0.0084	Stationary
lnFERT	7.886700	2.954021	0.0000	Stationary
lnINFL	8.020495	2.957110	0.0000	Stationary
lnOPNE	3.505667	2.967767	0.0151	Stationary
lnREER	5.010174	2.960411	0.0003	Stationary
lnROAD	2.955947	2.971853	0.0517	Stationary

The result of ADF test at level of first difference showed in Table above clearly indicates that all variables are stationary at level of first difference (the null hypothesis of a unit root is rejected for all variables with a drift term). Hence, they are regarded as integrated of order one or I(1).Because, if a time serious is differentiated at once and the differentiated series is stationary, then the original serious is termed as integrated of order one (Gujarati, 2004).

DETERMINING THE OPTIMAL LAG LENGTH (p) FOR THE MODEL

According to the Table 3 below, the lags (p) of VAR model, AIC criterion the lags (p) and other criterion the order of VAR is 2. All criterions gave the same results, so the lag (p) of 2 was used in the model as the order of VAR. Then the Johansen (1988) test of was applied and results are shown in the following table. Following the unit root tests and lag length section co-integration test was carried out using Eviews10 using the Johansen (1988) co-integration method.

Table 2: Lag Length Selection of the Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1809.208	NA	4.69e+40	113.5130	113.8336	113.6193
1	-1617.441	287.6511	6.74e+36	104.5900	107.1551	105.4403
2	-1521.201	102.2551*	5.69e+35*	101.6375*	106.4470*	103.2317*

Note:* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

4.1.2 Johansen Co-integration Test

Engle and Granger (1987) defined Co-integration as a condition where two or more variables are associated to form equilibrium relationships over the period of time. Even though the individual time series are not stationary, a linear combination of these variables could be stationary (i.e. they may be co-integrated). If these variables are co-integrated, then they have a stable relationship and cannot move "too far" away from each other.

There are two common methods for testing co-integration and estimating the relationship among co-integrated variables. These are the Engle and Granger (1987) two-step procedure and the Johansen's (1988) maximum likelihood methods. The Johansen procedure takes care of the above shortcomings by assuming that there are multiple co-integrating vectors.

Thus, testing for co-integration using the multivariate VAR approach developed by Johansen (1988) is necessary because failure to capture the existence of more than one co-integrating vector yields misleading long-run coefficients. In which case, the estimated parameters of the long run coefficient would only be a linear combination of the parameters of the two or more co-integrating long-run relationship (Harris, 1995). Thus, an unrestricted VAR can be formulating to

estimate the long run relationship among jointly endogenous variables. Here table 4.4 below indicates the Johansen co-integration test of the model

Table 3: Johansen co-integration Test

Null hypothesis	Eigen values	Maximum Eigen values			Trace Statistics		
		Johansen's Test	Critical Value (0.05)	Prob**	Johansen's Test	Critical Value (0.05)	Prob**
None *	0.985088	130.3731	46.23142	0.0000	335.2620	125.6154	0.0000
At most 1 *	0.926210	80.80256	40.07757	0.0000	204.8889	95.75366	0.0000
At most 2 *	0.858490	60.61693	33.87687	0.0000	124.0863	69.81889	0.0000
At most 3 *	0.611412	29.30231	27.58434	0.0298	63.46941	47.85613	0.0009
At most 4 *	0.532444	23.56731	21.13162	0.0223	34.16709	29.79707	0.0147
At most 5	0.287959	10.52821	14.26460	0.1795	10.59978	15.49471	0.2373
At most 6	0.002306	0.071567	3.841466	0.7891	0.071567	3.841466	0.7891

Note: * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values

The maximum value was greater than critical value at zero co-integrating vectors for both trace test and Maximum-Eigen value test. Thus, the above table shows that the null hypothesis of no co-integration is rejected at the conventional level 5% and this indicated the existence of one co-integrating relationship. The study concludes that there exists a relationship among the proposed variables in the long run. (i.e Trace test and maximum Eigen value test indicates that there are 5 co-integrating vector at level of 5%). All the variables are co-integrated of order one having the long run relationship.

The co-integration regression so far considers only the long-run property of the model, and does not deal with the short-run dynamics explicitly. Obviously, a good time series modeling should describe both short-run dynamics and the long-run equilibrium simultaneously.

Finally, whether the long run parameters are obtained using the Johansen co-integration analysis, the Johansen (1988) Vector Error Correction Model (VECM) has been estimated. Diagnosis tests

on the estimation technique should also be performed at each stage of reduction to check parameter consistency.

4.2 Long run Estimation and error correction models

4.2.1 Long run Estimation

After co-integration test has been conducted and its presence is confirmed, the next task is to estimate the long run relationship between Ethiopian Agricultural export performance and it determinants LS estimation method.

Table 4: Result of the Estimated Long Run Model

Variables	Coefficient	Std error	t-Statistic	P-value
C	-20536.31	3607.732	-5.692306	0.0000
LNFDI	-1.880279	0.747576	-2.515169	0.0179
LNFERT	1.319289	0.799149	1.650866	0.0099
LNINF	7.798559	71.20414	0.109524	0.0136
LNOPNE	46.13202	9.921261	4.649814	0.0001
LNREER	64.50309	17.09630	3.772927	0.0008
LNROAD	3.721777	0.919137	4.049207	0.0004

- Number of observation =35
- R-squared = 0.971850
- Adjusted R-squared = 0.965818
- F-statistic = 161.1108
- Prob (F-statistic) = 0.0000
- Durbin-Watson (DW) = 1.767996

The results of residual diagnostic tests such as Breush-Pagan-Godfrey test for heteroscedasticity(Annex V), Breush-Godfrey LM Test for serial correlation (Annex VI), and Jarque-Bera testfor normality (Annex VII), Ramsey test for model specification (VIII) CUSUM stability test Annex (IX) are reported (i.e all tests did not detect the problem of serial correlation, heteroscedasticity, non-normality and model misspecification & no stability.)

In the estimation of long-run model, foreign direct investment shows negative coefficient (unexpected sign) and has significant effect in a long run on performance of agricultural export. Fertilizer input, trade openness, real effective exchange rate, inflation rate and infrastructure (paved road) have positive and significantly affect the performance of Ethiopian agricultural export and showed expected signs.

As it can see from t-ratios and probabilities (table above) except inflation rate, all other variables (i.e foreign direct investment, fertilizer input, openness, real effective exchange rate and kilometers of paved road) are significantly affected the agricultural export performance in the long run. Having already obtained the long-run model and estimated the coefficients, the next step will be estimation of coefficients of the short-run dynamics that have important policy implications.

4.3 The Short Run Error Correction Model

Hence, an error correction model will be estimated that incorporates the short term interactions and the speed of adjustment towards long run equilibrium. So the error correction model has been estimated using the OLS technique and the results are summarized in table 5 below.

Table 5: Result of the Error Correction Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	734.2646	825.9587	0.888985	0.0836
D(LNAGREX(-1))	0.440540	0.185914	2.369589	0.0270
D(LNFDI(-1))	-0.544935	0.608063	-0.896183	0.3799
D(LNFERT(-1))	5.525588	0.499309	-1.052630	0.0039
D(LNINF(-1))	-71.50458	42.56979	-1.679702	0.1072
D(LNOPNE(-1))	3.837685	11.62195	0.330210	0.0444
D(LNREER(-1))	67.84100	19.44208	3.489390	0.0021
D(LNROAD(-1))	1.945371	1.535051	1.267301	0.0183
D(ECM(-1))	0.777094	0.189826	1.986524	0.0496

Number of observation = 31 after adjustments

- R-squared = 0.879551
- F-statistic = 3.790623
- Prob. (F-statistic) = 0.005185

- Adjusted R-squared = 0.726660
- Durbin-Watson (DW) = 1.923778

Similar to the case of long run model, the results of various diagnostic tests such as Breush-Pagan-Godfrey test for heteroskedasticity Annex(**X**), Breush-Godfrey LM Test for serial correlation Annex (**XI**), Jarque-Bera test for normality Annex (**XII**), and Ramsey's general test of model misspecification Annex (**XIII**) are all tests and did not detect any problem.

From the estimation results of the short run error correction model the coefficient of the error correction term is significant and has large magnitude (0.777094). Its magnitude indicates that deviation from the long run equilibrium is adjusted fairly quickly where 77.7% of the disequilibrium is removed each period.

The result of R^2 is also 0.72666 which reveals that 72.7% of Ethiopian agricultural export performance is determined by the explanatory variables included in the model and other determinants which are not included in the model account only 27.3% in determining it.

Furthermore, F-statistic is significant with a probability of 0.005185 which implies that the model fit. Additionally, estimate of the short run model show that fertilizer input, real effective exchange rate, trade openness and kilometers of paved road are indicating that the variables significantly affect the agricultural export performance of Ethiopia in the short run and showed positive sign.

Conversely, inflation and foreign direct invest are insignificantly affecting the agricultural export performance of Ethiopia in the short run and the coefficients showed negative sign.

The study reveals that inflation does not affect the performance of agricultural export in Ethiopia in short run. It contradicts with theoretical (theoretically, if inflation occurs in a country domestic exports will become costlier and foreign imports will become cheaper assuming no change in foreign exchange rates following domestic inflation. If demand for domestic exports in foreign countries is elastic, exports may decline following rise in price.) Similarly, foreign imports may rise following decline in import prices due to inflation in domestic country provided demand for imports are elastic.

The other one is regarding the impact of agricultural input use which in this paper is captured by fertilizer import over a period. The result shows that a 1% increase in fertilizer input will lead to 0.05% increase in the agricultural export supply.

The coefficient of trade openness is also positive and significant as expected. That means is liberalized by 1% will lead the agricultural export to increase by 0.38%. As trade openness like free trade area can help exports of LDC.

Looking at real exchange rate, the outcome of its coefficient is significant and positive in sign as expected. It shows that an improvement by 1% in real effective exchange rate will lead to 0.67% increase in the total agricultural export of the country.

Finally the other important explanatory variable is kilometers of paved roads which are a proxy of infrastructural facilities. The figure shows that an increase in the kilometers of paved roads by 1% will increase the agricultural export by a larger magnitude of 1.9%. As it is theoretically known infrastructural facility, especially the expansion of roads network is the key determinant of country's export performance. Generally, inflation and foreign direct investment in a short run doesn't determine the performance of Ethiopia's agricultural export.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1Conclusions

Like many other Sub-Saharan African countries, Ethiopia has for long been dependent on primary commodities to meet its foreign exchange earnings. However, foreign exchange earnings attained from these traditional products which are mainly agricultural commodities could not match with the highly increasing demand. This paper analyzed Ethiopia's agricultural export performance for the period 1983/84 - 2017/18. The study used secondary data collected from National Bank of Ethiopia, Ethiopian Revenue and Custom Authority, Ethiopian Roads Authority, CSA, World Bank website, UNCTADSTAT and IMF World Economic Outlook Website. In this study agricultural export was used as dependent variable and foreign direct investment, trade openness, fertilizer input, real effective exchange rate, inflation rate and infrastructure (variables expected to affect agricultural export performance of the country) are used as explanatory variables.

Accordingly, the first task was estimation using OLS technique to test the relationship between agricultural export performance and explanatory variables. Pre-estimation tests of the statistical behavior of the variables using Augmented Dickey Fuller test for the presence of unit root showed that all the variables except inflation and infrastructure were non-stationary at level. However, all the variables were stationary at first difference. Thus, they are regarded as integrated of order one. The next step was cointegration test which helps us to know the presence of long run relationship between the dependent variable and the explanatory variables. After cointegration test was conducted using Engle Granger procedure and its presence was confirmed, since the error correction term is significant and negative in sign as expected, the long run equation was estimated and according to the result all the variables were found significantly affect the agricultural export performance of the country. But, the sign coefficient of variable foreign direct investment was found negative (different from what already expected). This might be due to the fact that when foreign direct investment increases, domestic absorption of primary goods will increase (they may processed to manufacturing good) which in turn diminishes agricultural exports.

Next, the Error Correction Model (ECM) was estimated to show the short run relationship between the dependent and explanatory variables. Accordingly, the regression result shows that

inflation and foreign direct invest are insignificantly affecting the agricultural export performance of Ethiopia in the short run and the coefficients showed negative sign.

That means in the short run these variables have no impact on the agricultural export performance of Ethiopia. On the other hand except these two explanatory variables all other variables such as real effective exchange rate, trade openness and kilometers of paved road and fertilizer input import over a period were found to affect the dependent variable significantly and positively as already anticipated.

5.2 Recommendations

The empirical result suggests that an increase in the country's real effective exchange rate cause a gain in competitiveness of that country. Thus, a conducive and stable exchange rate policy has to be ensured. That is government has to control up rising movement of domestic price and allow further nominal depreciation of local currency in longer run in order to encourage more agricultural export.

As inflation also significantly affects the performance of agricultural export in Ethiopia government have to manage the rate of inflation through adopting appropriate policies to encourage export earnings.

The conclusion also reveals that government should work more with the major trading partners on trade openness to liberalize its trade and succeed its aspiration to join WTO. This can be done through bilateral and multilateral trade agreements by reduction of tariff and other trade restriction mechanisms or forming FTA (free trade areas) to maintain agricultural export growth.

In promoting Ethiopian agricultural export the role of maintaining transport infrastructure development facilities is crucial. Thus, it needs investment in infrastructural development. This pertains in particular improvements of the main roads that connect the production areas and central markets. Thus it needs more investment to improve the role of the sector for agricultural export growth. That is the empirical finding has policy implication that needs encouragement of credit to cash crop producers, tax-free agricultural input import, training supports on agricultural export, institutions that support agricultural export to increase quality agricultural output export.

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Annexes

Annex I: Unit Root test at level

Null Hypothesis: LNAGREX has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.231694	0.9246
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNFDI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.594748	0.1039
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNFERT has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.866460	0.0621
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNINF has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-6.202542	0.0000
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNOPNE has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.761736	0.8150
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNREER has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.942594	0.7602
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNROAD has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.727938	0.0089
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Annex II: Unit Root Test at level of first difference

Null Hypothesis: D(LNAGREX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.279316	0.0241
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNFDI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.074117	0.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNFERT) has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.663038	0.0935
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNINF) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-5.935993	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNOPNE) has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.201160	0.0302
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNREER) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.089159	0.0002
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNROAD) has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.955947	0.0517
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Annex III: long run Estimation

Dependent Variable: LNAGREX
Method: Least Squares
Date: 02/01/20 Time: 16:09
Sample: 1983 2017
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-20536.31	3607.732	-5.692306	0.0000
LNFDI	-1.880279	0.747576	-2.515169	0.0179
LNFERT	1.319289	0.799149	1.650866	0.0099
LNINF	7.798559	71.20414	0.109524	0.0136
LNOPNE	46.13202	9.921261	4.649814	0.0001
LNREER	64.50309	17.09630	3.772927	0.0008
LNROAD	3.721777	0.919137	4.049207	0.0004

R-squared	0.971850	Mean dependent var	19551.48
Adjusted R-squared	0.965818	S.D. dependent var	21228.57
S.E. of regression	3924.838	Akaike info criterion	19.56489
Sum squared resid	4.31E+08	Schwarz criterion	19.87596
Log likelihood	-335.3857	Hannan-Quinn criter.	19.67228
F-statistic	161.1108	Durbin-Watson stat	1.767996
Prob(F-statistic)	0.000000		

Annex IV: Co-integration test

Date: 01/01/20 Time: 20:16

Sample (adjusted): 1985 2017

Included observations: 33 after adjustments

Trend assumption: Linear deterministic trend
Series: LNAGREX LNFDI LNFERT LNINF LNOPNE LNREER LNROAD

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.910654	316.3520	125.6154	0.0000
At most 1 *	0.884866	236.6492	95.75366	0.0000

At most 2 *	0.847878	165.3145	69.81889	0.0000
At most 3 *	0.832522	103.1732	47.85613	0.0000
At most 4 *	0.653600	44.20544	29.79707	0.0006
At most 5	0.240676	9.220157	15.49471	0.3454
At most 6	0.004064	0.134369	3.841466	0.7139

Trace test indicates 5 cointegratingeqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.910654	79.70281	46.23142	0.0000
At most 1 *	0.884866	71.33468	40.07757	0.0000
At most 2 *	0.847878	62.14137	33.87687	0.0000
At most 3 *	0.832522	58.96773	27.58434	0.0000
At most 4 *	0.653600	34.98528	21.13162	0.0003
At most 5	0.240676	9.085788	14.26460	0.2791
At most 6	0.004064	0.134369	3.841466	0.7139

Max-eigenvalue test indicates 5 cointegratingeqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Annex V: Breusch-Pagan-Godfrey Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.451720	Prob. F(6,28)	0.8376
Obs*R-squared	3.088904	Prob. Chi-Square(6)	0.7976
Scaled explained SS	4.373162	Prob. Chi-Square(6)	0.6263

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 01/01/20 Time: 20:49
Sample: 1983 2017
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10835647	24615924	0.440189	0.6632
LNFDI	-3335.462	3988.163	-0.836340	0.4100
LNFERT	-1693.793	4870.155	-0.347790	0.7306
LNINF	146481.2	411616.0	0.355869	0.7246
LNOPNE	34345.14	58737.31	0.584724	0.5634
LNREER	-62522.32	98068.34	-0.637538	0.5290
LNROAD	1357.486	5257.812	0.258185	0.7982

R-squared	0.088254	Mean dependent var	11764752
Adjusted R-squared	-0.107120	S.D. dependent var	25107180
S.E. of regression	26417713	Akaike info criterion	37.19382
Sum squared resid	1.95E+16	Schwarz criterion	37.50489
Log likelihood	-643.8919	Hannan-Quinn criter.	37.30121
F-statistic	0.451720	Durbin-Watson stat	2.229738
Prob(F-statistic)	0.837556		

Ho: Homoskedasticity

H1: Heteroskedasticity

Thus, we accept the null hypothesis of constant variance or homoskedastic.

Annex VI: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.647374	Prob. F(2,26)	0.5316
Obs*R-squared	1.660253	Prob. Chi-Square(2)	0.4360

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 01/01/20 Time: 20:55
Sample: 1983 2017
Included observations: 35
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1126.217	3782.196	0.297768	0.7682
LNFDI	0.273819	0.645914	0.423925	0.6751
LNFERT	0.027256	0.767515	0.035513	0.9719
LNINF	10.88243	62.51840	0.174068	0.8632
LNOPNE	-3.542233	9.399698	-0.376845	0.7093
LNREER	-4.766309	15.31479	-0.311223	0.7581
LNROAD	-0.077791	0.814935	-0.095457	0.9247
RESID(-1)	0.076690	0.226185	0.339058	0.7373
RESID(-2)	0.244725	0.218179	1.121668	0.2723

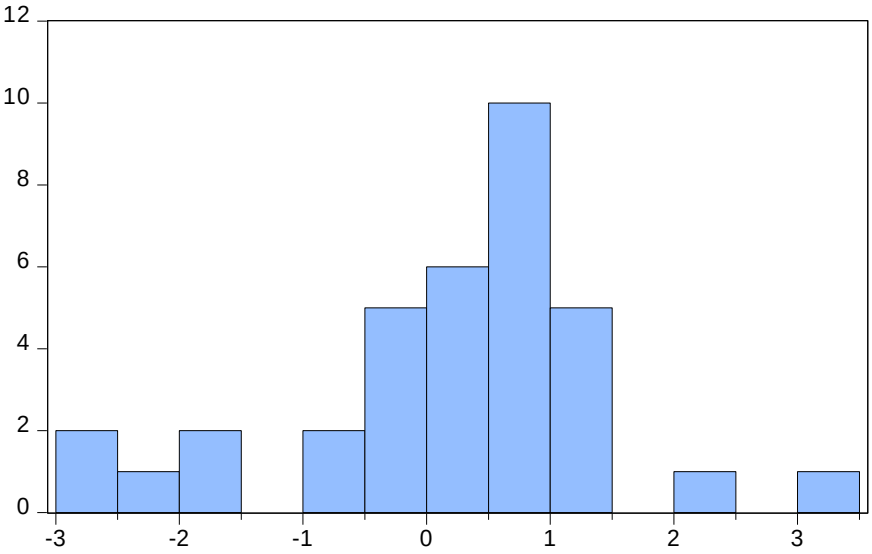
R-squared	0.047436	Mean dependent var	-6.29E-12
Adjusted R-squared	-0.245661	S.D. dependent var	3480.054
S.E. of regression	3884.059	Akaike info criterion	19.58418
Sum squared resid	3.92E+08	Schwarz criterion	19.98413
Log likelihood	-333.7232	Hannan-Quinn criter.	19.72225
F-statistic	0.161844	Durbin-Watson stat	1.972832
Prob(F-statistic)	0.994182		

Ho: No serial correlation

H1: Serial correlation

Therefore, we fail to reject the null hypothesis.

Annex VII: Normality test



Series: Residuals	
Sample 1983 2017	
Observations 35	
Mean	0.220443
Median	0.473361
Maximum	3.083763
Minimum	-2.708161
Std. Dev.	1.281321
Skewness	-0.568155
Kurtosis	3.583725
Jarque-Bera	2.379902
Probability	0.304236

Annex VIII: Ramsey test for model specification

Ramsey RESET Test
Equation: UNTITLED
Specification: LNAGREX C LNFDI LNFERT LNINF LNOPNE LNREER LNROAD
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	2.177049	27	0.7384
F-statistic	4.739541	(1, 27)	0.7684
Likelihood ratio	5.660424	1	0.7174

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	61487452	1	61487452
Restricted SSR	4.12E+08	28	14705940
Unrestricted SSR	3.50E+08	27	12973291

LR test summary:

	Value
Restricted LogL	-334.5737
Unrestricted LogL	-331.7435

Unrestricted Test Equation:
Dependent Variable: LNAGREX
Method: Least Squares
Date: 01/01/20 Time: 23:26
Sample: 1 35
Included observations: 35

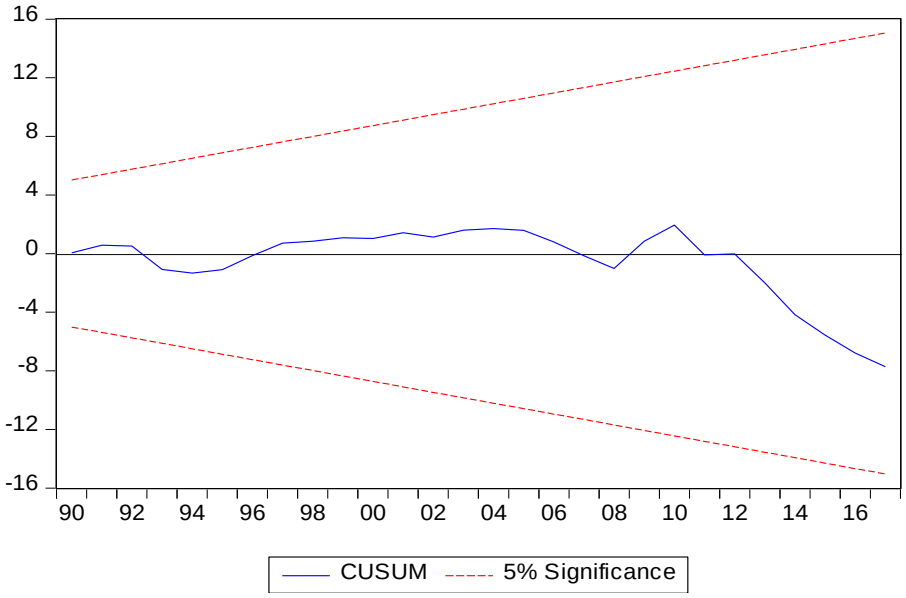
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-29638.74	5721.514	-5.180226	0.7684
LNFDI	-3.188188	0.800749	-3.981509	0.7405
LNFERT	2.335128	0.751860	3.105801	0.7044
LNINF	-148.4533	66.88698	-2.219465	0.6350
LNOPNE	62.04148	10.01590	6.194298	0.7543
LNREER	88.36168	16.12631	5.479348	0.8877
LNROAD	5.290277	1.103216	4.795322	0.7231
FITTED^2	-6.90E-06	3.17E-06	-2.177049	0.7384

R-squared	0.977139	Mean dependent var	19551.48
Adjusted R-squared	0.971212	S.D. dependent var	21228.57
S.E. of regression	3601.846	Akaike info criterion	19.41391
Sum squared resid	3.50E+08	Schwarz criterion	19.76942
Log likelihood	-331.7435	Hannan-Quinn criter.	19.53663
F-statistic	164.8650	Durbin-Watson stat	1.899346
Prob(F-statistic)	0.000000		

Ho: Model specified correctly

H1: Model specified incorrectly

Annex IX: Stability Test



Annex X: Short Run Estimation Output

Dependent Variable: D(LNAGREX)
Method: Least Squares
Date: 01/02/20 Time: 05:42
Sample (adjusted): 1987 2017
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	734.2646	825.9587	0.888985	0.3836
D(LNAGREX(-1))	0.440540	0.185914	2.369589	0.0270
D(LNFDI(-1))	-0.544935	0.608063	-0.896183	0.3799
D(LNFERT(-1))	-0.525588	0.499309	-1.052630	0.0039
D(LNINF(-1))	-71.50458	42.56979	-1.679702	0.1072
D(LNOPNE(-1))	3.837685	11.62195	0.330210	0.7444
D(LNREER(-1))	67.84100	19.44208	3.489390	0.0021
D(LNROAD(-1))	1.945371	1.535051	1.267301	0.2183
D(ECM(-1))	0.677094	0.189826	1.986524	0.0596

R-squared	0.879551	Mean dependent var	1593.005
Adjusted R-squared	0.726660	S.D. dependent var	4771.308
S.E. of regression	3612.797	Akaike info criterion	19.46005
Sum squared resid	2.87E+08	Schwarz criterion	19.87637
Log likelihood	-292.6308	Hannan-Quinn criter.	19.59576
F-statistic	3.790623	Durbin-Watson stat	1.923778
Prob(F-statistic)	0.005185		

Diagnostic tests for estimated short run equation

Annex XI: Test for heteroskedasticty

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.326136	Prob. F(8,22)	0.2822
Obs*R-squared	10.08559	Prob. Chi-Square(8)	0.2591
Scaled explained SS	8.132583	Prob. Chi-Square(8)	0.4206

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 01/02/20 Time: 05:44
Sample: 1987 2017
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6224218.	3694810.	1.684584	0.1062
D(LNAGREX(-1))	-324.9414	831.6598	-0.390714	0.6998
D(LNFDI(-1))	-2972.903	2720.082	-1.092946	0.2862
D(LNFERT(-1))	-1663.611	2233.590	-0.744815	0.4643
D(LNINF(-1))	-417108.2	190430.0	-2.190350	0.0394
D(LNOPNE(-1))	47133.50	51989.16	0.906603	0.3744
D(LNREER(-1))	24722.00	86971.38	0.284254	0.7789
D(LNROAD(-1))	10824.05	6866.832	1.576281	0.1292
D(ECM(-1))	1685.552	849.1605	1.984963	0.0598

R-squared	0.325341	Mean dependent var	9262922.
Adjusted R-squared	0.080011	S.D. dependent var	16849458
S.E. of regression	16161335	Akaike info criterion	36.27184
Sum squared resid	5.75E+15	Schwarz criterion	36.68816
Log likelihood	-553.2135	Hannan-Quinn criter.	36.40755
F-statistic	1.326136	Durbin-Watson stat	1.429859
Prob(F-statistic)	0.282235		

Annex XII: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

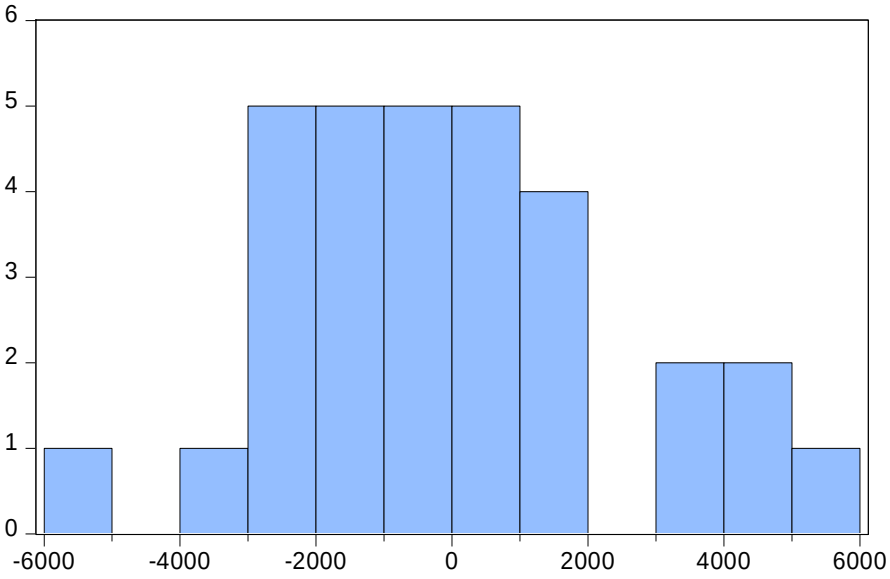
F-statistic	2.798441	Prob. F(2,20)	0.0848
Obs*R-squared	6.778299	Prob. Chi-Square(2)	0.0637

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 01/02/20 Time: 05:48
Sample: 1987 2017
Included observations: 31
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	439.0858	790.6785	0.555328	0.5848
D(LNAGREX(-1))	-0.440377	0.254184	-1.732515	0.0986
D(LNFDI(-1))	-0.040346	0.581411	-0.069393	0.9454
D(LNFERT(-1))	-0.089096	0.472545	-0.188545	0.8523
D(LNINF(-1))	-3.286405	41.59602	-0.079008	0.9378
D(LNOPNE(-1))	-7.885810	11.31780	-0.696762	0.4940
D(LNREER(-1))	-6.652628	18.37943	-0.361961	0.7212
D(LNROAD(-1))	0.578986	1.461401	0.396186	0.6962
D(ECM(-1))	0.154258	0.369492	0.417488	0.6808
RESID(-1)	0.440712	0.434733	1.013752	0.3228
RESID(-2)	0.678821	0.414526	1.637585	0.1171

R-squared	0.218655	Mean dependent var	2.79E-13
Adjusted R-squared	-0.172018	S.D. dependent var	3093.814
S.E. of regression	3349.356	Akaike info criterion	19.34235
Sum squared resid	2.24E+08	Schwarz criterion	19.85118
Log likelihood	-288.8064	Hannan-Quinn criter.	19.50821
F-statistic	0.559688	Durbin-Watson stat	1.865615
Prob(F-statistic)	0.826888		

Annex XIII: Breusch-Godfrey Serial Correlation LM Test



Series: Residuals
Sample 1987 2017
Observations 31

Mean	2.93e-13
Median	-247.9729
Maximum	5894.075
Minimum	-5047.541
Std. Dev.	2595.557
Skewness	0.447104
Kurtosis	2.726180
Jarque-Bera	1.129671
Probability	0.568454

Annex XIV: Ramsey test for model specification

Ramsey RESET Test
Equation: UNTITLED
Specification: D(LNAGREX) C D(LNAGREX(-1)) D(LNFDI(-1)) D(LNFERT(-1)) D(LNINF(-1)) D(LNOPNE(-1)) D(LNREER(-1)) D(LNROAD(-1))

Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.965862	21	0.0627
F-statistic	3.864612	(1, 21)	0.0627
Likelihood ratio	5.236617	1	0.0221

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	44630720	1	44630720
Restricted SSR	2.87E+08	22	13052299
Unrestricted SSR	2.43E+08	21	11548565

LR test summary:

	Value
Restricted LogL	-292.6308
Unrestricted LogL	-290.0125

Unrestricted Test Equation:
Dependent Variable: D(LNAGREX)
Method: Least Squares
Date: 01/02/20 Time: 05:58
Sample: 1987 2017
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.46783	857.7996	0.022695	0.9821
D(LNAGREX(-1))	0.323447	0.184742	1.750804	0.0946
D(LNFDI(-1))	-0.070729	0.620750	-0.113941	0.9104
D(LNFERT(-1))	-0.384020	0.475156	-0.808198	0.4280
D(LNINF(-1))	-56.69065	40.74547	-1.391336	0.1787
D(LNOPNE(-1))	1.801329	10.98097	0.164041	0.8713
D(LNREER(-1))	105.1730	26.36421	3.989233	0.0007
D(LNROAD(-1))	1.501704	1.461451	1.027543	0.3159
D(ECM(-1))	0.345513	0.179278	1.927245	0.0676
FITTED^2	7.81E-05	3.98E-05	1.965862	0.0627

R-squared	0.644900	Mean dependent var	1593.005
Adjusted R-squared	0.492714	S.D. dependent var	4771.308
S.E. of regression	3398.318	Akaike info criterion	19.35565
Sum squared resid	2.43E+08	Schwarz criterion	19.81822
Log likelihood	-290.0125	Hannan-Quinn criter.	19.50643
F-statistic	4.237577	Durbin-Watson stat	1.417479
Prob(F-statistic)	0.003060		