ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

INSTITUTE OF AGRICULTURE AND DEVELOPMENT STUDIES

DETERMINANTS OF AGRICULTURAL EXPORT PERFORMANCE IN ETHIOPIA

By

Netsant Ayalew

DECEMBER 2016

ADDIS ABABA, ETHIOPIA

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

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

_____ _____

Advisor Signature and Date

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ABSTRACT

The paper has assessed the major determinants of agricultural export performance in Ethiopia for the period 1984-2013. The study fully relays on secondary data that collect from annual reports and publications of Central Statistical Agency in Ethiopia, Ethiopian Ministry of Finance, and Development in Ethiopia, National Bank of Ethiopia, Ethiopian road Authority (ERA), global economy website, trade maps website and the World Bank. The methodology used was empirical test to identify the relationship between agricultural export performance and its main selected determinants. Co-integration and error correction approaches in the regression analysis were used. The results from the co-integration and error correction models bear that fertilizer input, road, domestic price, nominal exchange rate; have a positive relationship with agricultural export performance. On the other hand, terms of trade, world price, and gross domestic product have negative long-run impact. When it comes to gross domestic product, world price, road, and fertilizer input, it was found that they are statistically significant. However, nominal exchange rate, world price, terms of trade proved insignificant. Nominal exchange rate became positive in sign which was unexpected. Terms of trade, world price, road, and gross domestic price became negative in sign, which was unexpected. Based on the findings, it can be concluded that primary agricultural products dominate the Ethiopian export and this can be insensitive for agricultural export performance. It can be also recommended that policy makers should focus on all the determinants of agricultural export performance either price and non-price that directly affected the agricultural export performance of the country.

Keywords: Agricultural export performance, Domestic price, Gross domestic product, Infrastructure, Nominal exchange rate, Terms of trade, world price

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LIST OF ACRONYMS

ADLI	Agricultural Development Led Industrialization
ADF	Augmented Dickey Fuller
AR	Auto regression
CSA	Central Statistics Agency
DF	Dickey Fuller
ECM	Error Correction Model
EPRDF	Ethiopian People's Revolutionary Democratic Front
FAO	Food Agency Organization
GDP	Gross Domestic Product
IMF	International Monetary Fund
MOFA	Ministry of Foreign Affairs
NBE	National Bank of Ethiopia
NEER	Nominal Effective Exchange Rate
OLS	Ordinary Least Squares
REER	Real Effective Exchange Rate
SSA	Sub- Sharan countries
T0T	Terms of Trade
VAR	Vector Autoregressive
WTO	World Trade Organization

CHAPTER ONE
INTRODUCTION

1.1. Background of the Study

In general, Ethiopia is an agrarian-dominated country where more than 85 percent of the population depends on agriculture and rural farming activities. The Agricultural Development Led Industrialization strategy can be visualized as rural-centered and designed to enhance Ethiopia's rural sectors. ADLI played a major role in transforming the agricultural sector of the Ethiopian economy (MOFED report 2014). Trade in agricultural commodities still dominates the export sector and face many challenges. The agricultural sector constitutes a significant part of the whole economy and employs a considerable proportion of the labor force. Furthermore, increasing agricultural export is an indeterminate step towards restoring external balance of payment equilibrium which has been the central part of most economic structural adjustment programs initiated in 1980 and 1990.

According to Samuel (2012), Ethiopia is like sub- Sharan countries the low-income countries extremely relay on agricultural commodity exports for foreign exchange earnings. For illustration, according to Samuel cited data from central statistics agency (CSA,2007/8), its contribution accounts for more than 40% of the total GDP, 70% of foreign currency gain and above 80% of employment creation. In addition, both industry and services are dependent on the performance of agriculture, which provides raw materials, generates foreign currency for the import of essential inputs and food for the fast growing population. However, starting from recent years the share of service sector in the GDP of the country started to exceed that of agriculture. for example, according to National Bank of Ethiopia (NBE Annual Report 2007/08), during this fiscal year, real GDP grew by 11.6%. This high growth rate was achieved for the fifth time in a row (i.e. 11.7% in 2003/04, 12.6 in 2004/05, 11.5 in 2005/06 and 11.5% in 2006/07), which places Ethiopia among the top growing economies in Sub-Saharan Africa (Samuel,2012).

All sectors contributed to this relatively high economic growth with the service sector expanding by 17.0% and contributing about 62.8% to the overall GDP growth. The agriculture and industry

sectors also grew by 7.5% and 10.4% respectively. Furthermore, real GDP is project to grow by 11.2% in 2008/09. In this days the allocate of agriculture in the country's GDP has become less than that of service sector, until now agriculture is the spine of Ethiopia's economy (Samuel, 2012). A grow in agricultural output was expected to stimulate industrial production, including the production of consumer goods, thus establishing a supply link between the rural and urban sector. Like Sub-Saharan African countries, Ethiopia's export is dominated by export of primary commodities which include agricultural products mainly coffee, oilseeds, chat, flower, pulses and live animals (Nega,2013). These agricultural commodities account for almost more than 70 percent of the total export of the country during this fiscal year.

There are various factors affecting or determining export performance of the country in general and agricultural export in particular. 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 as listed above. Hence, a closer look at the major factors determining the agricultural export supply of the country theoretically and empirically is indispensable in order to help the country to experience or achieve a sustainable growth in exports.

Most researchers classified factors affecting or determining export performance into two broad categories. These are domestic and external factors. External factors are factors that are related with international/regional and individual country's trade and related policies. For instance, the rules established by different international organizations such as world trade organization may probably promote external trade in the long run. Even though the rules established by international organizations such as the World Trade Organization (WTO) may in the long run promote external trade, in the short run, the degree to which globalization pressurizes developing economies to open-up without allowing enough time to prepare for the challenges, could have a serious impact on their export performance. In addition to the above constraints, the tendency of some regional organizations to protect their markets from external competition may minimize the developing countries access to the external market. Protective policies of countries (through tariff and non-tariff barriers), such as, for instance, the agriculture policies of some European

countries, under pressure from internal industries, constrain exports of developing countries. The second one is domestic factors Such as, factors internal and external to the firm ((Mekbib (2008)). Researchers have put their effort towards identifying and addressing the determent (constraints). For instance, according to Abay and Zewdu (1999), the major constraints of the Ethiopian export sector could be seen from demand and supply sides. The demand side constraints include low level of demand for agricultural products due to very slow population growth rate in industrial countries, low income elasticity of demand for primary exports, production of synthetic products, and restrictive trade policies followed by importing countries. On the other hand; type and composition of products, concentration of export markets in few countries, natural factors like drought and diseases, and poor domestic policies are among the supply side challenges of the Ethiopian agricultural export according to the above named researchers.

1.2 Statement of the Problem

Why Ethiopian exports not performing well? In most literature argued by the following concepts those is Ethiopia export revenue highly depended on few agricultural commodities. Such as coffee, chat; oilseeds hide skin, *gold*, and flower accounted 78 percents in average (MOFED 2009/10 report). Even though, agricultural export have a massive contribution in the country's export, agricultural export performance of a country still did not achieve to the preferred step caused by a number of constraints.

High dependence of exports on primary exports has many drawbacks for the country. Those drawbacks are exports of primary product (agricultural product) has been dominated by declining terms of trade, which made export earnings not to increase well enough even with increased export volumes, the second drawback, exports of primary product do not have much significant effect in the economy because mostly they are sent without value added (raw). For example 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, infrastructure is capture by the sum of rural total covered roads in kilometers and urban total covered roads in kilometers

and to looks the current conditions of the major determinate of agricultural export performance of a country.

1.3 Objective of the Study

The objective of the study broken down into general objective and specific objective

1.3.1 General Objective

The overall objective of this study is to assess the major determinants of agricultural export performance of Ethiopia.

1.3.2 Specific Objectives

- To analyzing the main determinants of agricultural exports performance in the country.
- To examine the roles of the determinant of agricultural exports performance in the sector.

1.4 Basic Research Questions

What look like the trend of Agricultural Exports performance and its major selected determinant in Ethiopia?

Does Agricultural Exports performance have a long run relationship with its major selected determinant in Ethiopia?

1.5 Hypothesis

The research hypothesis for this study is that:

Ho: the major determinants or factors have no significant effect on agricultural exports performance

H_1: the major determinant or factors affecting of have significantly effect agricultural exports performance

1.6 Scope and Limitation of the Study

This study is limits to assess the main determinants of agricultural export performances and their economic contributions during the period of 1984 – 2013 (the military regime (Derg regime) and (EPDRF). This time bond was taken because of that has no organized data before 1984 and after 2013 until now and long years of data are not available for most of the variables to be considered in this study . The available data also lack accuracy and accessibility. The available data in different institutions obtained showed different figures for the same year. Furthermore, the lack of long time series of data has limited to take long time series of data to be used as an asset for the study. Therefore, the time series data was fixed between 1984 and 2013.

1.7 Significance of the Study

The study is important in identifying the major determinant of agricultural export of the country by bringing empirical evidence using time serious data analysis. In addition, the study is also essential since it incorporates to observe the variables in different direction that determining the agricultural export performance of the country, that have not been incorporated in other previous or recent studies. Furthermore, the study 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 regarding the growth of the agricultural sector and the economy as a whole and will help broaden the understanding of determinants of agricultural export which will aid policy formulation.

1.8 Organization of the Study

The study has five chapters. The first chapter is an introduction that includes background of the study, statement of the problem, objective of the study, scope/limitation of the study, significant of the study, hypothesis, basic research question, and. Chapter two, provides the literature review (both theoretical and empirical). The third chapter discusses research design and methodology. The analysis of data and major findings is included in the fourth Chapter. It analyzes the major determinants of agricultural export performance in Ethiopia. Finally the fifth chapter presents is conclusions and recommendation.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Reviews

2.1.1 Review of Ethiopian Trade Policy (the three regimes)

Ethiopian's external trade policy under the Imperial Regime was free trade, various actions were taken to improving the quality and quantity of imports, and exports as well as facilitating trade by both the public and private sector were made. In the case of imports of capital goods and raw materials they were free of duty while others were taxed. During The period of Derge regime (1974-1991) Ethiopian external trade policy was socialist oriented and characterized a centralized economic system, where the state is dominant in the external sector. Ethiopian external trade policy in derge regime was focused on: an attempt to control the participation of private capital in trade and strengthening the state's role both in export and import trade; an attempt to closely monitor the price, quantity, and distribution of goods. The Federal democratic republic of Ethiopia government's foreign trade policy has mainly paying attention on ensuring private sector participation, organization the sector by issuing foreign exchange and import-export regulation; designing and providing encouragement to the export sector and replacing quantitative restriction with tariff. In view of high demand for foreign exchange, one sustainable source of financing is growth of export sector (Alemayehu, 2011).

2.1.2 Agriculture in Ethiopia

General speaking we can say that among the three sectors the most dominant sector in Ethiopia is the agriculture sector, like sub SSA countries Ethiopian economy mainly depend on agriculture and more than 80% of the country population work on in the agriculture. These are the reason that most scholars say agriculture is the backbone of Ethiopian economy. Agriculture can be an input for the economic progress of a people and welfare of nation. Its input to the national economy can be observe in to different aspects, like its input as a source of food and raw materials, its input GDP, its input export earnings. Ethiopia has huge prospective on agriculture sector for the reason that, the land of a country is fertile, the climate is favorable for different

species of plants, the rainfall trend is sufficient for plant development and abundant chap labor force. However, agriculture sector face a lot of problem like drought (frequently affect a country), technology gap (led low productivity), lack of accessing infrastructure, high population growth, these the above listed problems make the agriculture sector not performed well as expected. (Samuel Tekeste, 2012).

For the time of the imperial period (before 1974), the agriculture was not developing well for different reason. such as rental and land reform case, the imperial government's do not take into account of the agricultural sector (agriculture gain less than two percent of budget allocation. even if the bulk of the population depended on agriculture), low output, and absence of technological development. Imperial government policy permitting investors to import fertilizers, pesticides, tractors and combines, and (until 1973) fuel free of import duties encouraged the rapid expansion of large-scale commercial farming. As a result, agriculture continued to grow, albeit below the population growth rate. According to the World Bank, agricultural production increased at an average annual rate of 2.1 percent between 1965 and 1973, while population increased at an average annual rate of 2.6 percent during the same period.

Derg regime it goes to similar trend to imperial period. According to the World Bank Report, 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 (2.4 percent for 1980-87) (World Bank, 1987).

The Federal Democratic Republic of Ethiopian Government gives primary priority for agriculture since 1991. The Government adopts Agricultural Development Led-Industrialization (ADLI) and implemented. ADLI as a policy came in action in the year 1993. Initially and primarily, ADLI targeted smallholder farms, especially crop producers, to achieve rapid growth in agricultural production, raise income for rural households, attain national food self-sufficiency, and produce surpluses that could be marketed to the urban or industrial sectors. More specifically, the government was to provide smallholder farmers with technologies and better farming practices, improved seeds, fertilizers, irrigation, rural roads, and marketing

services. A rise in agricultural output was expected to stimulate industrial production, including the production of consumer goods, thus establishing a supply link between the rural and urban sector. The industrial sector, in turn, could produce inputs to agriculture such as fertilizers and farming tools and equipment as well as consumption goods for rural households. Such dynamic linkage was supposed to ignite the first stage of industrialization before the economy moved into a higher level of development.

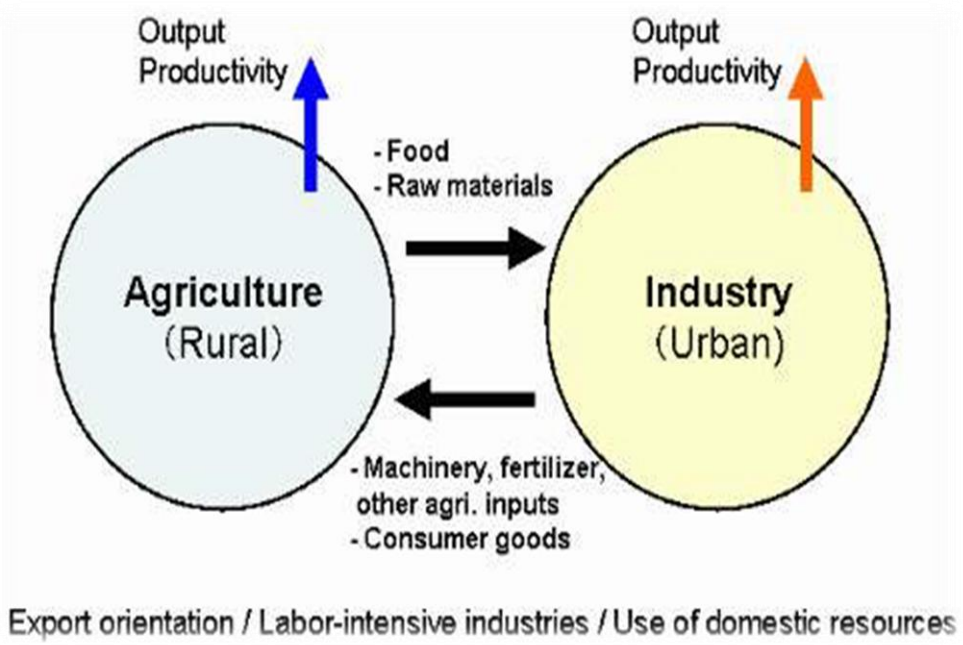


Figure 1 Linkages in ADLI

2.1.3 Major agricultural export Item in Ethiopia

Agriculture in Ethiopia is the foundation of the country's economy, accounting for half of gross Domestic product (GDP), 83.9% of exports, and 80% of total employment (IMf, 2015).)Ethiopia's agriculture is plagued by periodic drought, soil degradation caused by overgrazing, deforestation, high levels of taxation and poor infrastructure (making it difficult and expensive to get goods to market). Yet agriculture is the country's most shows potential resource. A potential exists for self-sufficiency in grains and for export development in livestock, grains, vegetables, and fruits. As many as 4.6 million people need food assistance annually. Agriculture accounts for 46.3 percent of the nation's Gross domestic Product (GDP), 83.9 percent of exports, and 80% of

the labour force Many other economic activities depend on agriculture, including marketing, processing, and export of agricultural products. Production is overwhelmingly of a subsistence nature, and a large part of commodity exports are provided by the small agricultural cash-crop sector. Principal crops include coffee**,** pulses (*e.g.*, beans), oilseeds, cereals, potatoes, sugarcane, and vegetables. Exports are almost entirely agricultural commodities, and coffee is the largest foreign exchange earner. Ethiopia is also Africa's second biggest maize producer. Ethiopia's livestock population is believed to be the largest in Africa, and in 2006/2007 livestock accounted for 10.6% of Ethiopia's export income, with leather and leather products making up 7.5% and live animals 3.1%. Ethiopian exports mainly depend on agricultural product (cash crop). Agriculture and export are closely related to each other. According to IMf (2015) report the major agricultural exports are coffee 27%, oilseed 17%, edible vegetable 17%, flower tree 7%, this report shows that agriculture is the base of export.

Coffee

The most important cash crop in Ethiopia was coffee. During the 1970s, coffee exports accounted for 50-60% of the total value of all exports, although coffee's share dropped to 25% as a result of the economic dislocation following the 1974 revolution. By 1976 coffee exports had recovered, and in the five years ending in 1988/89, 44% of the coffee grown was exported, accounting for about 63% of the value of exports. Domestically, coffee contributed about 20% of the government's revenue. Approximately 25% of Ethiopia's population depended directly or indirectly on coffee for its livelihood. (Wubne, Mulatu,1991).

Pulses and oilseed

Pulses and oilseeds are the second important items for export next to coffee in Ethiopia. According to national statics website In 1974/75, pulses and oilseeds accounted for 34% of export earnings (about 163 million Birr), but this share declined to about 3% (about 30 million Birr) in 1988/89. Three factors contributed to the decline in the relative importance of pulses and oilseeds. First, the recurring droughts had devastated the country's main areas where pulses and oilseeds were grown. Second, because peasants faced food shortages, they gave priority to cereal staples to sustain themselves. Finally, although the production cost of pulses and oilseeds

continued to rise, the government's price control policy left virtually unchanged the official procurement price of these crops, thus substantially reducing net income from them. In 2007/2008, the CSA reported that 17,827,387.94 quintals of pulses were produced on 1,517,661.93 hectares, an increase from the 15,786,215.3 quintals produced on 1,379,045.77 hectares. In the same fiscal year, 707,059.29 hectares under cultivation produced 6,169,279.99 quintals of oilseeds, an increase from the previous year of 4,970,839.57 quintals grown on 741,790.98 hectares In 2006/2007 exports of oilseeds accounted for 15.78% of export earnings (or million 187.4 Birr) and pulses 5.92% (or 70.3 million Birr)(IMF 2009)

Flowers

Flower industry is a new source of export to Ethiopia. It becomes a new source for export revenue. The industry began in 2004, when the government made an aggressive push for foreign investments by establishing a presence at major international floricultural events. According IMF report export earnings from this sector have grown to about US$65 million in 2006/07 and are projected to double over the next few years. Ethiopia is well located because highland temperatures make it ideal for horticulture, the average wage rate is US$20 per month. The price of leased land is about US$13 per hectare, and the government has extremely aided the entry of new businesses into this sector in recent years. As a result, a number of Indian entrepreneurs are relocating to Ethiopia to develop its successful flower industry, which has led to gains in market share at the expense of neighboring countries.

Khat /chat

Khat is a source for export revenue. It is a stimulant which is consumed both inside Ethiopia and in adjacent countries, and which is considered a drug of abuse that can lead to mild to moderate psychological dependence. According to the federal democratic republic of Ethiopia statistics in 2006/2007 export of khat accounted for 25% of export earnings (or 8oo million Birr).

2.1.4 Determinate of agriculture in Ethiopia

The main feature of Ethiopian agriculture is low productivity and quality. Low productivity of agricultural output is due to many reasons. The very important reason is technology gaps the

gaps arising because of low education levels of the peasants. While Low quality may arise due to harvesting and post, harvesting handling of crop produced. In addition, they are other determinant of agriculture in Ethiopia such as land-labor ratio, use of fertilizer, use of pesticide, manure, and household size.

2.2 EMPIRICAL LITERATURES REVIEW

In empirical literature, different researchers have put their effort towards identifying and addressing the determinants of agricultural export performance. Berhanu (2005) using co integration and Error Correction Model analyzed in his/her finding both short- and long-run relationships between the real exports of the country and various explanatory variables. In His/her long-run model shows that when real exchange rate and real private sector credit affect real exports of the country positively, real private consumption affected negatively. Similarly, the short-run factors significantly affecting exports are real GDP, real private sector credit, and real private consumption. Muhamed Tariq Majeed and Eatzaz Ahmad using fixed model pooled data (time-series and cross-section) for 75 developing countries over the period 1970 to 2004. Their result shows that the effect of GDP and GDP growth on exports is highly significant with positive sign. The level of production can be utilized at domestic and international level at the same time. They can maximize benefits of lower cost production by export growth policies. Moreover, large size of GDP creates environments for investment decisions. According to their regression results, real exchange rate positively affects export. It turned out to be the most significant variable affecting export.

Idsardi, E(2010) using gravity model estimated by using panel data for the period 2002 to 2009. In his/her finding reveled that The GDP of South Africa was also significant in the determination of exports of five of the agricultural commodities. The exchange rate was only positively significant in contrary to expectation. Eyayu (2011) determinants of agricultural export in sub-Saharan Africa evidence from panel study his/her empirical result show that from supply side factors, real GDP, real GDP (lagged),and lagged agricultural inputs were statistically significant with their respective expected sign. Mouze (2005) also tried to show the agricultural exports of Ethiopia as a function of real effective exchange rate, terms of trade, infrastructure variable

measured by the percentage of paved road to total road, net value of world trade, agricultural input (fertilizer consumption) and a dummy to capture the impact of government change. His/her Error correction model result shows that only real effective exchange rate, terms of trade and fertilizer consumption are significant in the short-run and long run determinants of agricultural export supply of the country. On the other hand, Kiros Hailu (2012) tried to identify the major determinants of export growth rate in Ethiopian context using time series data for the period 1980-2010 by applying co-integration and error correction model. In his study the impact of gross domestic product, terms of trade, real exchange rate, foreign price level, and foreign direct investment on export growth rate has been analyzed. His/her result shows that foreign price level and terms of trade have a significant positive relationship with export growth rate, and similarly the gross domestic product have a positive significant relationship with export growth rate but it is not statistically strong may be this due to the economy is small and the production is absorbed by the domestic demand. While results of the other variables shows that statistically insignificant in explaining the export growth rate of the country. However, his/her finding is not similar with expectation of the theoretical review for the variables of Foreign Direct Investment and Real Exchange Rate.

Ngeno(1990) studied the determinants of export performance in Kenya in 1990 and he found out that Gross Domestic Product has a positive significant effect in increasing export growth rate. Kasekende and Atingi-Ego while studying the impact of trade liberalization on key markets in Sub Saharan Africa discovered that there is a significant correlation between export performance and Terms of Trade. Amelia and Santos(2000) studied the effect of trade liberalization on export performance in selected developing countries and the estimation result shows that FDI significantly affect export volumes. Sharma (2000), the determinants of exports in India discovered that a fall in domestic prices due to exchange rate depreciation makes exports cheaper in the international markets resulting in their increased demand.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

In this study, the researcher used the quantitative research design for the reason that of the quantifiable and the numerical data that is produced in the process. This study deals with the handling of the empirical variables from time series data during the period of 1984/85 to 2013/2014, (the military regime (derg regime) and (EPDRF. This period ranges from end of socialist Derg regime and coming of EPRDF in Ethiopia with various government policies and reforms. These include trade reforms, exchange rate policies and other global reforms like the liberalization of the economy and the Structural Adjustment programs (SAPs).

3.2 Data Sources

The annual time series data covers the period begins in 1984/1985 and ends in 2013/2014. The study fully relies on secondary data collected from annual reports and publications of Central Statistical Agency in Ethiopia, Ethiopian Ministry of Finance, and Development in Ethiopia, National Bank of Ethiopia, Ethiopian road Authority (ERA), global economy website, trade maps website and the World Bank.

3.3 Methods of Data Analysis

Econometric methods are employed to discuss and analyze different issues in this study. In the Econometric method part, Many of macroeconomics time series data's are expose to the problem of non-stationary in the process of econometric analysis. Regression on such data (non-stationary variables) led to spurious regression as mean and variance are time variant and hence the basic assumption of OLS will be violate. Therefore, it is important to test the variables using the co-integrated and error correction model to solve the problems encountered with OLS regression

and to see the long run and short-run relationship impacts of the variables to be estimated. A macro economics time series data's are stationary, if its mean and variance are constant over time and the value of covariance between the two-time periods depends on distance or lag. when the mean, variance, and auto covariance of individual time series are not time invariant, these time series data are not stationary (Gujerati 1991) (Harris, 1995)). In general, the advantages of using the ECM determining the export growth lie in its ability to capture the short run dynamic characteristics of export demand given the long run co-integration (equilibrium) relationship. In other words, the ECM reflects a dynamic self-correcting process of export demand behavior towards its long-run steady sate (Song, Witt, and Li 2003). In addition, ECM can avoid the occurrence of spurious (false) regression and multi-co linearity problems, which may otherwise affect the reliability and accuracy of the econometric analyses. Therefore, the above reasons answered why this model is select for this study and finally using this model will give reliable and accurate results.

3.4 MODEL SPECIFICATION

This study focuses on the main determinants of Ethiopia's agricultural export performance. The study address Ethiopia agricultural export performance is a function of terms of trade (tot), nominal effective exchange rate (neer),road(infrastructure), gross domestic product (gdp), world price(wp), fertilizer input, and domestic price(dp)

AGRX=f(TOT, NEER, INFR., GDP, WP, FER, DP) ----------3.1

Next, we convert into equation forms

AGRXt= $\beta_0 + \beta_1 TOTt + \beta_2 GDPt + \beta_3 DPt + \beta_4 WPt + \beta_5 NEERt + \beta_6 ROAD + \beta_7 FERTT + \varepsilon t$……3.2

Where:

β_0: The intercept

$\beta_1, \beta_2, \beta_3, \beta_4\ \beta_{5,\beta 6\ and\ \beta 7}$: Coefficients of the explanatory variables: εt Error term that represents omitted variables in the specification of the model, AGRX: agricultural export, GDP: gross domestic product, NEER: nominal effective exchange rates, DP: domestic price, WP:

world price road: (infrastracer), FERT: fertilizer input. This can econometrically stated as: Therefore, to obtain elasticity coefficients and remove the effect of outliers, the variables have to be transformed to natural logarithms. we use log-linear form exports determination model to resolve Ethiopian export performance. The model is adopted from Samuel (2012) determinants of agricultural export in Ethiopian and Nega (2013) what determines the export performance of Ethiopia. By using the above equation we can convert in to log-linear by adding both sides a natural logarithm (ln).

Therefore, the model, which will be estimate to capture the determinant of agricultural export in Ethiopia, is give by:

$$LnAGRXt = \beta 0 + \beta 1 lnTOTt + \beta 2 lnGDPt + \beta 3 lnDPt + \beta 4 lnWPt + \beta 5 lnNEERt$$

$$+ \beta 6 lnROADt + \beta 7 lnFERTt + \varepsilon t \text{----------3.3}$$

$$Where;$$

$$AGRXt = \log of\ Agricultural\ exportperformance\ in\ million\ US\ dollars.$$

$$TOT = \log of\ Terms\ of\ trade$$

$$GDP = \log of\ Value\ of\ gross\ domestic\ product\ in\ million\ US\ dollars.$$

$$DP = \log of\ Domesticprice$$

$$WP = Worldprice$$

$$NEER = \log of\ Nominal\ effective\ exchange\ rate$$

$$ROAD = \log of\ THE\ sum\ of\ total\ rural\ road\ in\ Kilometers\ and\ total\ urban\ coverd\ roads\ in\ kilometers$$

$$FERT = \log of\ Fertilizer\ import\ over\ a\ period\ in\ million\ US\ dollars$$

$$\beta'sare\ unknown\ parameters\ to\ be\ estimated$$

$$t = time\ in\ years\ (1984/85 - 2013/2014)$$

$$\varepsilon = randomterms$$

To estimate the above equation, the time − series approach was applied .

3.4.1 Definition of Variables

All of the variables included in the above model are converted into terms of natural logarithm. The reason behind taking the natural logarithm of the variables is that, it enables to correct skewed data into normal distribution that is a critical assumption in econometric estimation (Verbeek, 2004).

Natural log of terms of trade is terms or rates at which the products of one country is exchange for the products of the other. It is known to us that every country has got its own money. The currency of one country is not legal tender in the other country. Therefore, every country has to export commodities in order to import goods. In addition, the rate of exchange or the term of exchange depends upon the elastic ties of the demand of each country for the products of the other. Terms of trade are measure by the ratio of export prices to import prices. The terms of trade will be favorable to a country when the export prices are high relatively to import prices. This is because the products of one unit of domestic resources will exchange against the product of more than one unit of foreign exchange. If on the other hand, the prices of its imports rise relatively to the prices of its exports, the terms of trade will be unfavorable to the country.

The terms of trade are of economic significance to a country. If they are favorable to a country, it will be gaining more from international trade and if they are unfavorable, the loss will be occurring to it. When the country's goods are in high demand from abroad, that is when its terms of trade are favorable, the level of money income increases. Conversely, when the terms of trade are unfavorable, the level of money income falls. We therefore expect the coefficient of terms of trade to be positive.

Natural log of Nominal effective exchange rate (NEER) is the price of one currency in terms of another is call 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). The NEER is a weighted average of major bilateral nominal exchange rates, with weights based on the trade shares reflecting the relative importance of each currency in the effective exchange rate basket.

According to Love and Turner, an increase in the index would represent an appreciation, by its nature of construction, since is calculate in terms of US dollars per unit of local currency. An appreciation would be associated with a loss in competitiveness and most likely, a deterioration of trade balance, the extent of which is dependent upon the price elastic ties of demand for exports and for imports.

An increase in the NEER means appreciation and appreciation makes Ethiopia's agricultural export less competitiveness in the world market and thus decreases total agricultural exports of the country. On the other hand, depreciation or the decrease in NEER increases agricultural exports of the country by making Ethiopia's agricultural exports more competitive in the world market in general. Therefore, we expect the sign of the coefficient of NEER to be negative.

Natural log Infrastructure is one of the major non-price factors that affects or constrains exports especially in least developing countries. Of the factors that boost production as well as export supply of commodities, infrastructural facilities come at the front. 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 infrastructure is capture by (the sums of rural total covered roads in kilometers and urban total covered roads in kilometers). Since the availability of roads creates

marketing opportunities in the international market and 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.

Natural log of Gross Domestic Product (GDP**)** Higher GDP values in the exporting country imply increased capacities for export. It is expects to have a positive impact on exports. For instance, Kumar (1998) in his study on the determinants of export growth in developing countries confirmed that GDP has a significant positive impact export volumes. He also underlined that higher level of production is the main cause of export expansion. Therefore, a higher GDP implies a higher production and hence larger volume of exports. Therefore, we expect a positive relationship between the dependent variable and GDP.

Natural log of World Price The price of exports on the international market is one of the major determinants of agricultural export growth and especially for countries that depend on exportation of agricultural products (food) which can be expresses as food price index. Which prices fluctuate from time to time (N.Agasha, 2006). When foreign price level increases, the domestic exporters will get incentive to maximize or increase their export. Therefore, we expect positive relationship between the agricultural export and foreign price level.

Natural log of Fertilizer input 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 export supply of the country. Hence, we expect the sign of the coefficient of fertilizer input import to be positive.

Natural log of Domestic price is the price of domestic market is one of the determinants of export of agricultural export growth.

3.4.2 Prior Expectation

The parameter β_1 captures term of trade is expected to be positive sign. β_2 is the coefficient of gross domestic product the expected to be positive. β_3 is the coefficient of domestic price the excepted sign to be positive. β_4 is the coefficient of world price the expected sign to be

positive. β_5 is nominal effective exchange rate the expected sign to be negative. β_6 is the coefficient of road(infrastructure) the expected sign to be positive. β_7 is the coefficient of fertilizer input the expected sign is positive. For the purpose of this study, the sign of this parameter is critical. As long as the parameter is statistically significant, a positive sign will indicate an expansionary, while a negative sign will indicate an indirect relationship.

Table 1: The Expected sign of parameters (ps)

Terms of Trade	+
Nominal effective exchange rate (NEER)	-
World Price	+
Fertilizer input	+
Gross Domestic Product (GDP)	+
Domestic price	+

3.5 METHODOLOGY

3.5.1. Methods of Estimation and Procedure: test used

3.5.1.1 Stationary and non-stationary test

Econometric model constructing throws economic variables, the nature of those variables are time series data. Recent development in econometrics has shown that there are problems associated with time series macroeconomic data analysis due to non-stationary. 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, which it is, computed (Harris, 1995). Moreover, the classical regression technique, the Ordinary Least Squares (OLS), assumes that the variables under considerations

are “stationary”, which means, they have time independent values. Which means, if *(yt)* is stationary series, it would have a finite mean, variance and the covariance between any two consecutive periods which are time invariant or constant. Stationary time series is temporary innovation from the mean and a tendency to return to its mean value. On the other hand, it is found that almost all macroeconomic variables are non-stationary. Unfortunately, a regression carried out with such non-stationary series gives spurious results and referred “spurious” or “non-sense” regression (Alemayehu G., Njuguna N. and Daniel Z., 2012). To avoid the drawback of wrong inferences from the non-stationary regressions, the time series data should be stationary. Hence, prior to estimation of the long run model, the time series properties of the variables, unit root test should be conducted.

3.5.1.2 Unit root test

Before conducting the simultaneous tests, the variables must be found to be individually stationary. Several tests are usually employed to test whether time series variables are stationary or non-stationary; the Dickey-Fuller (DF), the Augmented Dickey-Fuller (ADF) test, Phillips-Peron test, and Auto-Correlation Function (ACF) test. In this study, the Augmented Dickey-Fuller (ADF) test is applied to determine the existence of a unit root. By incorporating the autoregressive process of order p, this model becomes superior to Dickey-Fuller (DF) test. This test has been chosen for its consistency, accuracy, and resourcefulness. The null hypothesis of ADF is *Ho: $\theta = 0$* (or the first autocorrelation $\rho = 1$) against alternative hypothesis that that $\theta \neq 0$. Where $\theta = \rho - 1$. A rejection of this hypothesis (*Ho: $\theta = 0$*) means that the time series is stationary or it does not contain a unit root. While, not rejecting means that the time series is non- stationary or the first autocorrelation $\rho = 1$ is true, then a unit root is obtained. A time series is said to be integrated of order zero, I (0) if it is stationary in levels. Some series needs to be differenced several times before becoming stationary. If the series are stationary, running a regression avoids spurious/non-sense regression.

3.5.1. 3 Engle-Granger/ two-step approach

The Engle-Granger method requires that for co-integration to exist, all the variables must be integrated of the same order. Hence, once the variables are found to have the same order of integration, the next step is testing for co-integration. There are some problems with this Engle-Granger approach. First, the results of the tests are sensitive to the left-hand side variable of the regression that is the normalization applied to the co-integrating vector. Second, if the co-integrating vector happens not to involve y1t but only y2t…ykt, the test is not appropriate and the co-integrating vector will not be consistently estimated by a regression of y1t up on y2t…ykt. Third, the residual-based test tends to lack power because it does not exploit all the variables information about the dynamic interactions of the variables. Moreover, the method only allows for a single co-integration equation. However, in case more than two variables involved, there is a possibility that more than one equation may depict the long-run relationships among the various variables. Therefore, Johansen (1988) maximum likelihood test is considered superior to the Engle-granger / two step approach since it corrects some of the shortcomings of the first test suffers from, mainly being a two-step test in which errors in the first are carried over the second step. Hence, Co-integration test in this paper is conducting by Johansen Maximum Likelihood estimation procedure since this particular method is claimed to be superior to the Engle-Granger two-step method.

3.5.1.4 Johansen test

Johansen (1988) developed a maximum likelihood estimation procedure, which also allows one to test for the number of co-integrating relations. The procedure suggested by Johansen (1988) depends on direct investigation of co-integration in the vector autoregressive (VAR) representation. This analysis yields maximum likelihood estimators of the unconstrained co-integration vectors, but it allows one to explicitly test for number of co-integration vectors so that the weakness of Engle-Granger (1987) two step procedure are overcome. Moreover, Johansen test enables estimating and testing for the presence of multiple co-integration relationships in a single-step procedure. The Johansen method does not require a priori endogenous-exogenous distinction among variables and it can also identify multiple co-integration vectors. The Johansen

procedure sets out a maximum likelihood procedure for the estimation and determining the presence of co-integrating in VAR system.

VAR is one form of multivariate modeling where no variable in the system is assumed to be exogenous a priori. Based up on this procedure, the variables of the model are represented by defining a vector of potentially endogenous variables. In identifying the number of co-integrating vectors, the Johansen procedure provides n Eigen values denoted by λ (also called characteristic roots) whose magnitude measures the extent of correlation of the co-integration relations with the stationary elements in the model. Hence, to identify the number of co-integrating vectors in the system, the Johansen procedure uses two test statistics: the maximal Eigen values (λmax statistics) and the trace statistics (λtrace). These statistics are used to test the null hypothesis that there are at most, "r" co-integrating vectors against the alternative that there are "r + 1" co-integrating vectors (Enders, 1995).

3.5.1.5 Co- integration test

The model of Co-integration is functional to a wide variety of economic models. Any equilibrium relationship among a set of non-stationary variables implies that the variables cannot move independently of each other. These linkages among the stochastic trends necessitates that the variables are co-integrated. The classical regression model assumes that the dependent and independent variables are stationary over time. However, most economic variables exhibit long-run trend movement and only become stationary after they are differenced. Applying the classical regression techniques to the levels of variables leads to a spurious/non-sense correlation, particularly when the variables involved exhibit consistent trend, either upward or downwards, over time.

The empirical literature for unit root shows that almost all macro variables are non-stationary in level while their difference is stationary. To take care of the non-stationary of the variables confirm whether there exists a long-run equilibrium relationship, the co-integration model is used. This model basically refers to the condition that even if individual series are non-stationary (i.e. are I (1) series), if there exists a linear combination of these I (1) series in the regression equation and is stationary, then the regression is not a spurious/non- sense regression. From

economic theory, a group of variables may tie together by the same theory. In empirical work, this relationship can be revealed by co-integration analysis. A principal feature of co-integrating variables is that their time paths are influenced by extent of any deviation from the long-run equilibrium. After all, if the system is to return to the long run equilibrium the movements of at least some of the variables must respond to the magnitude of the equilibrium (Alemayehu 2012).

Moreover, in the case where variables are difference stationary, it is possible to estimate the model by first difference. However, this gives only the short run dynamics in which case valuable information concerning the long run equilibrium properties of the data could be lost. In order to obtain both the short run and long run relationship one can appeal to what is known as co-integration. Co-integration among the variables reflects the presence of long run relationship in the system. In general, we need to test for co-integration because differencing the variables to attain stationary generates a model that does not show the long run behavior of the variables. Hence, testing for Co-integration is the same as testing for long run relationship (Gujarati, 1995). There are two basic ways of testing the existence of Co-integration between variables of interest and estimating the co-integrating vector: one by Engle-Granger (1987) approach and the other by Johansen (1998) approach.

3.5.1.6 Co-integration and the Error Correction Model

Once the orders of integration of the non-stationary variables have been determined and of variables are find 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-integrate, if they have a liner 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 liner combinations of these variables.

The theory of co integration addresses the issue of integrating short-run dynamics with long run equilibrium. Two series are says to be co integrated if there exists a linear combination of the series, which is stationary. Suppose that Yt is I(1) and Xt is also I(1), then Yt and X t are said to be co integrated if there exists a β such that is I(0). In that case, the regression equation makes sense because Yt and Xt don't drift too far apart from each other over time (Madala, 1992). In

general, if Xt and Yt 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 study, the co-integration test carried out is Johannes test of co integrateion. Johansen (1988), who developed a maximum likelihood estimation procedure, which also allows one to test for the number of co integrating relationships. The procedure suggested by Johansen (1988) depends on direct investigation of co integration in the vector autoregressive (VAR) representation. This analysis yields maximum likelihood estimators of the unconstrained co integration vectors, but it allows one to explicitly test for number of co integration vectors. Johansen test enables estimating and testing for the presence of multiple co integration relationships in a single-step procedure. The Johansen method does not require a priori endogenous-exogenous distinction among variables and it can identify multiple co integration vectors. The Johansen procedure sets out a maximum likelihood procedure for the estimation and determining the presence of co integrating in VAR system. VAR is one form of multivariate modeling where no variable in the system is assumed to be exogenous a priori. Based up on this procedure, the variables of the model are represented by defining a vector of potentially endogenous variables. In identifying the number of co-integrating vectors, the Johansen procedure provides n eigen values denoted by λ (also called characteristic roots) whose magnitude measures the extent of correlation of the co-integration relations with the stationary elements in the model. Hence, to identify the number of co-integrating vectors in the system, the Johansen procedure uses two test statistics: the maximal eigenvalues (λmax statistics) and the trace statistics (λtrace). These statistics are used to test the null hypothesis that there are at most "r" co-integrating vectors against the alternative that there are "r + 1" co-integrating vectors (Enders, 1995).

There is a per-condition in Johannes test of co integration. Those are variables are non-stationary at level, (meaning that initial data should be stationary). However, when I convert all

variables in to first difference they will become stationary (meaning that integrated the same order).Null; variable is stationary, Alt; variable is non-stationary.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Result of Unit root test

Before going to regression, we have to check there is a unit root or not among the variables, this is a mandatory step for time series analysis and to forms their order of integration. The reason is the variables should be stationary and co integrated to get a significant relationship from the regression (Samuel,2013). All the variables used in the estimation process are tested using Augmented-Dickey Fuller test statistic and the results are presented in table 4.3 below

Table 2 ADF test at level

Variables	ADF	p-value	Result
LnAGEXt	0.671913	0.9893	Non –stationary
LnTOTt	-2.613215	0.1019	Non –stationary
LnGDPt	1.523648	0.9990	Non –stationary
LnDPt	-4.051449	0.0049	Stationary
LnWPt	-0.179244	0.9306	Non –stationary
LnNEERt	-0.923505	0.7661	Non –stationary
LnROADt	0.505374	0.9840	Non –stationary
LnFERtlt	-3.070013	0.0402	Stationary

Table 3 ADF test at first difference

Variables	ADF	p-value	Result
Dlnagext	-5.195099	0.0002	Stationary
DLnTOTt	-5.850653	0.0000	Stationary
DLnGDPt	-3.819596	0.0073	Stationary
DLnDPt	-2.982889	0.0522	Stationary
DLnWPt	-4.707987	0.0008	Stationary
DLnNEERt	-3.661442	0.0107	Stationary
DLnROADt	-3.827155	0.0072	Stationary
DLnFERtlt	-7.871573	0.0000	Stationary

When we see the above table, all the variables except domestic price and fertilizer are non-stationary at level (at zero difference). To obtain all the variables to be stationary, we will take the first difference of the variables and test for stationary. Therefore, the variables that show in the above table all variables are stationary at first difference. so, they are integrated of order one or I(1).since, 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 (Samuel, 2013)

4.2 Result of Johnson test co integration test

Table 4 Result of co-integration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.979777	288.0884	159.5297	0.0000
At most 1 *	0.838069	178.8625	125.6154	0.0000
At most 2*	0.770968	127.8862	95.75366	0.0001
At most 3 *	0.702287	86.61717	69.81889	0.0013
At most 4 *	0.577242	52.69170	47.85613	0.0164
At most 5	0.517031	28.58494	29.79707	0.0685
At most 6	0.252319	8.206451	15.49471	0.4436
At most 7	0.002306	0.064653	3.841466	0.7993

Source: Own computation Johansson co-integration

- According to the output of EViews result, we have four co integration equations. Maximum eignvalue test indicates that we can get four co-integrating equation at 0.005 level or at 5%.

4.3 Result of the Estimated Long Run Model

Table 5 Result of long run model

Prob(F-statistic) 0.000000

Variables	Coefficient	Std error	t-Statistic	p-value
Constant	-8.104704	3.866879	-2.095929	0.0478*
LnTOTt	0.978071	0.415602	-0.612845	0.0280*
LnGDPt	0.573604	0.668405	-2.369633***	0.0401*
LnDPt	-0.211252	0.344708	0.858169	0.5463
LnWPt	1.084109	0.457363	-2.114944***	0.0270*
LnNEERt	-0.296961	0.140411	1.076154	0.0460*
LnROADt	0.757611	0.703999	2.353384***	0.2935*
LnFERtlt	-0.392282	0.140411	2.370344***	0.0460*

*** denotes significance at 1%. *denotes significant at p-value

Source: Own computation long un model

Number of observation=30 R-squared=0.969089

F-statistic=98.53147 Prob (F-statistic) =0.0000

Adjusted R-squared= 0.959254 Durbin-Watson (DW) =2.11

LNAGXt-0.392LNFERTLt+0.978LNTOTt+0.573LNGDPt+1.084LNWPt-0.757LNROADt-0.211LNDPt-0.296LNNEERt----------3.4

LNAGXt=0.392LNFERTLt-0.978LNTOTt-0.573LNGDPt-1.084LNWPt+0.757LNROADt+0.211LNDPt+0.296LNNEERt----------3.5

The above Equation (take from the above table) shows that FERT (LN FERT), DP (LNDP) and NEER (LNNEER) ROAD (LNROAD) have a positive long run relationship with AGX (LNAGX). On the other hand, TOT (LNTOT), WP (LNWP), and GDP (LNGDP) show a negative long run relationship with AGX (LN AGX). the variables such as gdp, wp,road and fert are statistically significant in explaining/determining agriculture export. since they have absolute t-values greater than two. on the other hand variable such as neer,tot and dp are statistically in significant.

Fertilizer in put (LNFERT) has positive sign and is statistically significant in determining the agriculture export in the long run. This result confirms that the null hypothesis (Fertilizer input have a long run relationship agriculture export of Ethiopia) is accepted. A 0.392 % increases in fertilizer input agriculture export performance increase by 1%. (Eyeyu,2011) also get similar result for in his/her finding agricultural inputs were statistically significant with their respective expected sign. Mouze (2005) finding shows that fertilizer consumption is the significant short-run and long run determinants of agricultural export supply of the country. Based on the finding fertilizer input increase the agricultural export volume will be increase because when we increase the fertilizer input the agricultural output will be increase then agricultural export also increase.

Gross domestic product (LNGDP) has a negative sign and is statistically significant in determining the agriculture export in the long run. A 1% increase agricultural export led to decrease 0.573% of gross domestic product this may be as a result of the economy is small and the production is absorbed by the domestic demand . Idsardi, E(2010) get the same result his/her finding shows that The GDP of South Africa was also significant in the determination of exports of five of the agricultural commodities. Muhamed Tariq Majeed and Eatzaz in there finding get The effect of GDP and GDP growth on exports is highly significant with positive sign. (Eyayu,2011) in his /her finding shows that real GDP, real GDP (lagged),and lagged agricultural

inputs were statistically significant with their respective expected sign. (KirosHailu,2012) his /her finding shows that gross domestic product positive and statistically. significant.(Negeno,1990) his/her finding shows that Gross Domestic Product has a positive significant effect in increasing export growth rate .

Road (infrastructure) has a positive sign and is statistically significant in determining the agriculture export in the long run. A 0.757% increases in infrastructure the agricultural export increase by 1%. According to the long run estimated model, there is an opportunity for improvement by considering the economic condition prevailing in the country. For example if we take the case of rural total covered roads in kilometers and urban total covered roads in kilometers (infrastructure), road network , it would facilitate producers to put up for sale their product and buy raw material(input) the nearby markets. This will bend make them to shift from subsistence production to commercial production. This will show the way to again a higher quantity of gross domestic product constituting export volumes.

World price has a negative sign and is statistically significant in determining the agriculture export in the long- run. A 1% increase agricultural export led to decrease 0.573% world price.

4.4 Result of vector Error correction model:

Table 6 Result of short run Error correction model

Variables	Coefficient	Std error	t-statistics
DLn(AGXt)	-0.199989	0.2396	-0.83461
DLnTOTt	-0.824623	0.40879	2.04365
DLnGDPt	0.075662	0.07735	0.97821
DLnDPt	0.850399	0.18139	04.68814
DLnWPt	0.274526	0.274526	1.56649
DLnNEERt	0.48817	0.20934	2.33194
DLnROADt	0.0850399	0.04698	1.80575
DLnFERtlt	-0.0615	0.1424	-0.4452

Source Own computation vector error correction model

Number of observation=28 R-squared=0.666337

F-statistic=98.53147 Prob (F-statistic) =0.0000

Adjusted R-squared= 0.814632

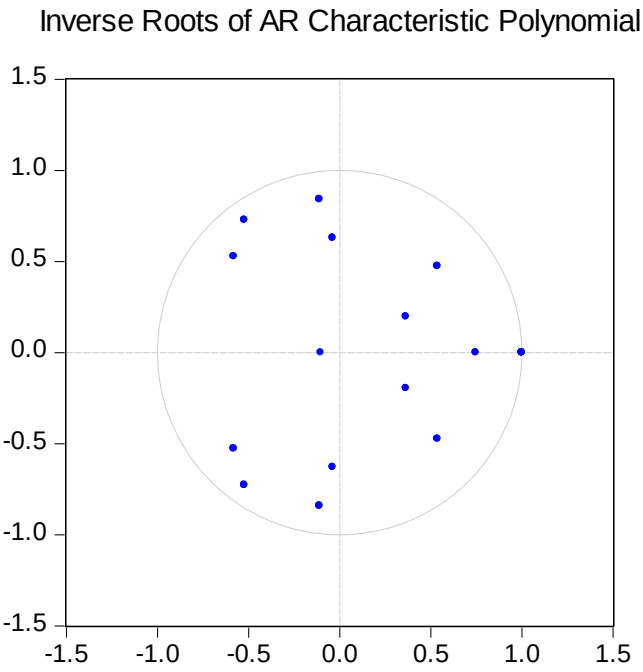
The result of R-squared is also 0.81(81%). Which shows that of Ethiopian agricultural export performance is explains by the explanatory variables included in the model, while 19% is by other variables that were not included in the model. Furthermore, F-statistic is significant with a probability of 0.000 that implies that the model fit.

4.7 Diagnostic Tests on the Residual of VECM

Tests of serial correlation, normality, and hetroskedasticity on the residuals of the vector error correction models are conducted with the help of Lagrange-multiplier test, Jarque-Beta test, White-heteroskedasticity test respectively. From the tests, it was found that the nulls of no serial correlation, normality, and constant variance could not be rejected. These results are confirmed in the.

4.7.1 Stability Test

The very important test in econometric research analysis is checking stability of the model. Stability test for residuals is employed to test the validity of VECM. In this study VECM stability test is conducted by using method of inverse roots of characteristic polynomial. As we seen from the following graph the values are inside the circle except one line its is tolerable in VECM, the values are less than a unity.



4.7.2 Normality Test

The second important test is normality test in this study the VEC residual normality test employed Orthogonalization method of Cholesky of covariance. The table below shows that, the test has high joint t-statistic (29.300049) and low p-value (0.0900). Therefore, the null hypothesis of residuals are multivariate normal is rejected and accept the alternative. But, non-normality of multivariate error terms does not affect and distort estimators BLUE and consistency property because the main purpose of normality tests is to make hypothesis about population parameter using confidence interval. If we increase the size of the sample, the problem of normality can be solved and the distribution comes to normal (Zerayehu, 2006). To sum up, absence of multivariate normality in a given model does not affect t-values and estimated co-efficient.

Table 7 Result of normality test

Component	Jarque-Bera	Df	Prob.
1	0.296055	2	0.08624
2	1.172168	2	0.5565
3	20.372663	2	0.5034
4	0.506005	2	0.7765
5	0.856771	2	0.6516
6	0.192600	2	0.9082
7	3.951524	2	0.1387
8	0.952262	2	0.6212
Joint	29.300049	16	0.09005

Source: Own computation

4.7.3 Heteroskedasticity test

The third important test in econometric research analysis the vector error correction model is Heteroskedasticity. VEC residual Heteroskedasticity test has p-value of (0.3921) and statistically insignificant at 10 percent. residual test results shows that absence of Heteroskedasticity

Therefore, the test is failed to reject no Heteroskedasticity problem showing the variance of error terms are constant.(anxs g)

4.7.4 Autocorrelation test

Serial correlation test for residuals of vector error correction models used a method of langrage multiplies (LM) test. Since most of p-values are greater than 10 percent critical values, we failed to reject the null-hypothesis. Generally, the model is free from the problem of autocorrelation

Table 8 Result of autocorrelation test

Lags	LM-Stat	Prob
1	272.420	0.1100

Source: Own computation

4.7.5. Variance Decomposition Analysis

+Variance decomposition depicts the proportion of movements in one variable that are due to errors in own shocks and to each other variables in the system. These give information on how important is each variable in explaining variations in the variable inquestion in the system.

Table 9: Result of Variance decomposition of analysis

period	S.E	LNAGXt	LNDPt	LNFERTLt	LNGDPt	LNNEERt	LNROADt	LNTOTt	LNWPt
1	0.145591	100.000	0.0000	0.00000	0.0000	0.00000	0.000000	0.00000	0.0000
2	0.221874	53.9621	0.015747	18.27034	0.603241	16.16942	0.384306	2.462655	2.548096
3	0.324055	33.23422	5.683201	10.85236	6.045962	18.72138	7.628360	2.261145	14.72099
4	0.422831	21.50780	15.74728	6.760050	16.93145	21.50716	14.67781	3.477187	16.5128
5	0.536207	14.5834621	18.26096	5.917514	14.3104	19.63660	18.21947	3.477187	13.4261
6	0.626123	11.63311	20.91180	7.326031	14.36562	18.37445	19.89467	10.2697	10.2697
7	0.695525	9.587852	24.03656	8.639158	14.4714	17.33907	20.62727	3.477187	8.50077
8	0.752626	8.500778	25.07054	10.26977	13.4261	16.51284	20.95261	2.281012	14.51507
9	0.788069	8.259515	25.70012	10.88471	13.42613	2.797437	21.12564	2.274302	13.80461
10	0.813161	8.106233	25.88830	10.56873	13.6861	16.35573	21.23719	2.365481	13.43181

Source Own computation

The variance decomposition of agricultural export, which is shows in the above table, that in the very early periods the forecast error of this variable in question is attributed to the variable itself. The deviation explained by the agricultural export decreases to 8.10 percent in the tenth period from 100 percent in the first period. The deviation in agricultural export explained by the variations in domestic prices, are insignificant explaining zero in the first period and significant explaining 25.8 percent in the 10th period. The deviation in agricultural export explained by the

the variations of fertilizer input are insignificant explaining zero in the first period and significant explaining 10.56 percent in the 10th period. The deviations in agricultural export explained by the variations of gross domestic price are insignificant explaining zero in the first period and significant explaining 13.6 percent in the 10th period. The deviation in agricultural export explained by the variations of nominal exchange rate are insignificant explaining zero in the first period and significant explaining 16.3 percent in the 10th period.The contribution of road and terms of trade to the variations in the forecast error of agricultural export are very less.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Ethiopia is largely dependent on primary commodities to get foreign exchange earnings (to get foreign currency for importing). However, foreign exchange earnings obtained has agricultural commodities could not match with the highly increasing demand. This is the main idea of the study has made an effort to identify the main determinate of agricultural export performance of Ethiopia. Therefore, the core idea to reflect in this study is whether or not agricultural export performance is significantly affected by the major selected explanatory variables. such as terms of trade, gross domestic product, domestic price, world price, nominal effective exchange rate, roads (sum of rural total covered roads in kilometers and urban total covered roads in kilometers) (infrastructure) and fertilizer input. To address this core idea, time serious data ranging from the year 1984-2013 was used.

The study used secondary data collected from different sources like Central Statistical Agency in Ethiopia, Ethiopian Ministry of Finance and Development in Ethiopia, National Bank of Ethiopia, Ethiopian road Authority (ERA), global economy website, trade maps website and the World Bank. In this study, agricultural export was used as dependent variable and terms of trade, gross domestic product, domestic price, world price, and nominal effective exchange rate, road (sum of rural total covered roads in kilometers and urban total covered roads in kilometers) (infrastructure) and fertilizer input are used as explanatory variables**.** To estimate the variable of agricultural exports performance and its explanatory variables. I follow Pre-estimation tests of the variables using Johansen test and Augmented Dickey fuller test for the presence of unit root or non-stationary at level. The results show Except GDP all the variables are non-stationary at level. Then we have to checks also the first difference. The result of first difference shows that all the variables stationary at first difference too. Then the next steps is testing co-integration test the result of co-integration test shows that they are integrated of order one. The reason for testing

co-integration test that helps us to know the occurrence of long run relationship between the dependent variable and the explanatory variables.

After co-integration test was conducted using Johansen co-integration method and its existence of co-intgration was confirmed. the long run equation was estimated and the result of long run estimation shows that fertilizer input, gross domestic product, world price and road(infrastructure) determine significantly the agricultural export performance of the country. But , in the long run domestic price (negative in sign), terms of trade ,nominal effective exchange are insignificant. The sign of variables like domestic price and fertilizer input was found to be different from what already expected. The sign of nominal effective exchange rate negative as already expected.

Then, the Error Correction Model (ECM) was estimated to show the short run relationship between the agricultural export (dependent) and domestic price, terms of trade, gross domestic product, fertilizer input, road(infrastructure),nominal effective exchange rate, domestic price, world price (explanatory) variables. Therefore, the regression result shows that domestic price was insignificant in the short run. Moreover, gross domestic product, domestic price, and world price, became insignificant. Meaning that in the short run, these variables have no impact on the agricultural export performance of Ethiopia. The variables like, road (sum of rural total covered roads in kilometers and urban total covered roads in kilometers) (infrastructure), and fertilizer input terms of trade affect the agricultural export performance (dependent variable) significantly. Nevertheless, terms of trade and road (infrastructure) affect negatively and fertilizer input affects positively as already expected.

5.2. Recommendation

The Ethiopian economy is growing from time to time. To be continued the growth our country should or strongly work growth contributed variables .Among growth contributed variable export is the major one. Therefore, Ethiopian exports highly dependent on agricultural commodity. The study is indentifying the major determinant of agricultural export performance of a country that contributed and foreign related market access conditions. Therefore, based on the finding can be recommended to the countries policy makers the following points;

- ✓ Policy makers should have to give attention for all determinants that affect directly or indirectly the agricultural export performance of country.
- ✓ The policy makers should give especially attention for road (infrastructure) rural total covered roads in kilometers and urban total covered roads in kilometers. For instance, if we look the output of the long run estimated model, the coefficient of kilometers of rural total covered roads in kilometers and urban total covered roads kilometers (infrastructure) is very largest of other variables. This shows that road network is a major determinate for the agricultural sector and its development for the encouragement of agricultural export in Ethiopia.
- ✓ Policy makers should addressing the farmer to getting facilities like adequate supply of fertilizer input (by importing or producing in the country) and price interrelated factors such as positive terms of trade and higher foreign price level will lead to upgrading in the agricultural export as the findings of the study show.

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Annexes

A. Unit root test

ADF test at level

Null Hypothesis: LNAGRXT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.671913	0.9893
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: LNTOTT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.613215	0.1019
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: LNGDPT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.523648	0.9990
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Null Hypothesis: LNDPT has a unit root
Exogenous: Constant

Lag Length: 5 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.051449	0.0049
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

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

Null Hypothesis: LNWPT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.179244	0.9306
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: LNNEERT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.923505	0.7661
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: LNROADT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.505374	0.9840
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: LNFERTLT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.070013	0.0402
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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

Null Hypothesis: LNNEERT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic
Augmented Dickey-Fuller test statistic		-0.923505
Test critical values:	1% level	-3.679322
	5% level	-2.967767
	10% level	-2.622989

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

Null Hypothesis: LNROADT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic
Augmented Dickey-Fuller test statistic		0.505374
Test critical values:	1% level	-3.679322
	5% level	-2.967767
	10% level	-2.622989--

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Null Hypothesis: LNFERTLT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic
Augmented Dickey-Fuller test statistic		-3.070013
Test critical values:	1% level	-3.679322
	5% level	-2.967767
	10% level	-2.622989

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

B. ADF test at first difference

Null Hypothesis: D(LNAGRXT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.195099	0.0002
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

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

Null Hypothesis: D(LNTOTT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.850653	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

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

Null Hypothesis: D(LNGDPT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.819596	0.0073
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

Null Hypothesis: D(LNDPT) has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.982889	0.0522
Test critical values:	1% level	-3.769597	
	5% level	-3.004861	
	10% level	-2.642242	

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

Null Hypothesis: D(LNWPT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.707987	0.0008
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

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

Null Hypothesis: D(LNNEERT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.661442	0.0107
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

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

Null Hypothesis: D(LNROADT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.827155	0.0072
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

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

Null Hypothesis: D(LNFERTLT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-7.871573	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

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

C. Co-integration test

Date: 12/26/16 Time: 01:25
Sample (adjusted): 3 30
Included observations: 28 after adjustments
Trend assumption: Linear deterministic trend
Series: LNAGRXT LNDPT LNWPT LNFERTLT LNGDPT LNNEERT LNTOTT LNROADT
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 *	0.979777	288.0884	159.5297	0.0000
At most 1 *	0.838069	178.8625	125.6154	0.0000
At most 2 *	0.770968	127.8862	95.75366	0.0001
At most 3 *	0.702287	86.61717	69.81889	0.0013
At most 4 *	0.577242	52.69170	47.85613	0.0164
At most 5	0.517031	28.58494	29.79707	0.0685
At most 6	0.252319	8.206451	15.49471	0.4436
At most 7	0.002306	0.064653	3.841466	0.7993

Trace test indicates 5 cointegrating eqn(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 *	0.979777	109.2258	52.36261	0.0000
At most 1 *	0.838069	50.97634	46.23142	0.0145
At most 2 *	0.770968	41.26902	40.07757	0.0365
At most 3 *	0.702287	33.92547	33.87687	0.0494
At most 4	0.577242	24.10676	27.58434	0.1310
At most 5	0.517031	20.37849	21.13162	0.0635
At most 6	0.252319	8.141798	14.26460	0.3645
At most 7	0.002306	0.064653	3.841466	0.7993

Max-eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

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

c. Long run

Dependent Variable: LNAGRXT
Method: Least Squares
Date: 12/31/16 Time: 13:40
Sample: 1 30
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNDPT	-0.211252	0.344708	-0.612845	0.5463
LNFERTLT	-0.392282	0.165546	-2.369633	0.0270
LNGDPT	0.573604	0.668405	0.858169	0.0401
LNNEERT	-0.296961	0.140411	-2.114944	0.0460
LNROADT	0.757611	0.703999	1.076154	0.2935
LNTOTT	0.978071	0.415602	2.353384	0.0280
LNWPT	1.084109	0.457363	2.370344	0.0270
C	-8.104704	3.866879	-2.095929	0.0478

R-squared	0.969089	Mean dependent var	12.94011
Adjusted R-squared	0.959254	S.D. dependent var	0.990482
S.E. of regression	0.199936	Akaike info criterion	-0.158461
Sum squared resid	0.879436	Schwarz criterion	0.215191
Log likelihood	10.37692	Hannan-Quinn criter.	-0.038927
F-statistic	98.53147	Durbin-Watson stat	2.113098
Prob(F-statistic)	0.000000		

D. Vector error correctin model

Vector Error Correction Estimates
Date: 01/05/17 Time: 04:27
Sample (adjusted): 3 30
Included observations: 28 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	CointEq2	CointEq3	CointEq4
LNAGRXT(-1)	1.000000	0.000000	0.000000	0.000000
LNDPT(-1)	0.000000	1.000000	0.000000	0.000000
LNFERTLT(-1)	0.000000	0.000000	1.000000	0.000000
LNGDPT(-1)	0.000000	0.000000	0.000000	1.000000
LNNEERT(-1)	0.462846	-0.062619	0.168696	-0.221969
	(0.21382)	(0.08160)	(0.14960)	(0.05732)
	[2.16465]	[-0.76739]	[1.12765]	[-3.87249]
LNROADT(-1)	-0.287596	0.565000	-0.223672	-1.473924

	(0.45742)	(0.17457)	(0.32004)	(0.12262)
	[-0.62873]	[3.23659]	[-0.69890]	[-12.0200]
LNTOTT(-1)	4.388419	2.625940	-3.457910	-1.239684
	(0.82992)	(0.31672)	(0.58065)	(0.22248)
	[5.28778]	[8.29095]	[-5.95519]	[-5.57213]
LNWPT(-1)	-3.187907	-2.035474	0.574798	-0.105438
	(0.45412)	(0.17331)	(0.31773)	(0.12174)
	[-7.01989]	[-11.7448]	[1.80908]	[-0.86610]
C	-17.76659	-13.75637	12.52987	10.19879

Error Correction:	D(LNAGRXT)	D(LNDPT)	D(LNFERTLT)	D(LNGDPT)	D(LNNEERT)	D(LNROADT)	D(LNTOTT)	D(LNWPT)
CointEq1	-0.199989	0.850399	-0.427984	0.075662	0.488174	0.084840	-0.063824	0.274526
	(0.23962)	(0.18139)	(0.31615)	(0.07735)	(0.20934)	(0.04698)	(0.14284)	(0.17525)
	[-0.83461]	[4.68814]	[-1.35374]	[0.97821]	[2.33194]	[1.80575]	[-0.44682]	[1.56649]
CointEq2	-0.936572	-1.438930	0.508040	-0.246199	-0.458135	-0.003640	-0.249273	-0.120535
	(0.38533)	(0.29170)	(0.50840)	(0.12438)	(0.33664)	(0.07555)	(0.22970)	(0.28182)
	[-2.43056]	[-4.93291]	[0.99929]	[-1.97936]	[-1.36089]	[-0.04818]	[-1.08520]	[-0.42770]
CointEq3	-0.681973	0.156003	-0.700366	0.001918	0.052284	0.015681	-0.128993	0.204422
	(0.22886)	(0.17325)	(0.30195)	(0.07388)	(0.19994)	(0.04487)	(0.13643)	(0.16738)
	[-2.97986]	[0.90045]	[-2.31945]	[0.02597]	[0.26150]	[0.34945]	[-0.94550]	[1.22129]
CointEq4	1.049087	0.316842	0.276808	-0.055892	0.872815	0.336224	0.137986	0.639467
	(0.37890)	(0.28683)	(0.49992)	(0.12231)	(0.33103)	(0.07429)	(0.22587)	(0.27712)
	[2.76875]	[1.10462]	[0.55371]	[-0.45698]	[2.63669]	[4.52561]	[0.61091]	[2.30757]
D(LNAGRXT(-1))	-0.437721	-0.445207	-0.352790	0.046712	-0.208553	-0.035419	0.143985	-0.128893
	(0.20304)	(0.15370)	(0.26788)	(0.06554)	(0.17738)	(0.03981)	(0.12103)	(0.14849)
	[-2.15587]	[-2.89658]	[-1.31696]	[0.71274]	[-1.17573]	[-0.88968]	[1.18963]	[-0.86799]
D(LNDPT(-1))	0.821086	0.469092	-0.353982	0.226195	0.276776	0.026201	0.012589	0.209228
	(0.33709)	(0.25518)	(0.44475)	(0.10881)	(0.29450)	(0.06610)	(0.20095)	(0.24654)
	[2.43579]	[1.83827]	[-0.79591]	[2.07878]	[0.93982]	[0.39641]	[0.06265]	[0.84867]
D(LNFERTLT(-1))	0.413185	-0.093088	-0.238599	-0.020315	0.124947	0.011217	0.045558	-0.095161
	(0.14086)	(0.10663)	(0.18585)	(0.04547)	(0.12306)	(0.02762)	(0.08397)	(0.10302)
	[2.93334]	[-0.87300]	[-1.28386]	[-0.44680]	[1.01534]	[0.40613]	[0.54256]	[-0.92372]
D(LNGDPT(-1))	-3.041002	-1.292579	2.008807	0.030953	-0.832915	-0.235269	-0.361963	-0.054159
	(0.88275)	(0.66825)	(1.16469)	(0.28495)	(0.77122)	(0.17309)	(0.52622)	(0.64562)
	[-3.44490]	[-1.93427]	[1.72476]	[0.10863]	[-1.08000]	[-1.35925]	[-0.68785]	[-0.08389]
D(LNNEERT(-1))	-0.645173	-0.920914	0.789095	-0.192724	0.008347	0.080057	0.228036	-0.208281
	(0.35694)	(0.27021)	(0.47094)	(0.11522)	(0.31184)	(0.06999)	(0.21278)	(0.26106)
	[-1.80749]	[-3.40815]	[1.67556]	[-1.67267]	[0.02677]	[1.14386]	[1.07170]	[-0.79784]
D(LNROADT(-1))	1.839056	-0.725051	-1.378714	0.356664	1.732249	0.292683	-0.712636	-0.015129

	(1.10328)	(0.83519)	(1.45564)	(0.35613)	(0.96388)	(0.21633)	(0.65768)	(0.80690)
	[1.66690]	[-0.86813]	[-0.94715]	[1.00149]	[1.79717]	[1.35297]	[-1.08356]	[-0.01875]
D(LNTOTT(-1))	0.835431	0.459949	-0.148100	0.088428	-0.323396	0.093940	0.100902	0.442890
	(0.40879)	(0.30946)	(0.53935)	(0.13196)	(0.35714)	(0.08015)	(0.24369)	(0.29898)
	[2.04365]	[1.48629]	[-0.27459]	[0.67013]	[-0.90551]	[1.17199]	[0.41406]	[1.48134]
D(LNWPT(-1))	-1.557509	0.869473	0.467716	-0.194376	0.415912	0.088111	-0.411967	0.182062
	(0.44657)	(0.33806)	(0.58919)	(0.14415)	(0.39014)	(0.08756)	(0.26621)	(0.32661)
	[-3.48772]	[2.57197]	[0.79382]	[-1.34843]	[1.06605]	[1.00627]	[-1.54754]	[0.55743]
C	0.217595	0.048384	0.059713	0.020747	-0.101944	0.050760	0.066533	0.016130
	(0.07182)	(0.05437)	(0.09476)	(0.02318)	(0.06275)	(0.01408)	(0.04282)	(0.05253)
	[3.02955]	[0.88988]	[0.63012]	[0.89485]	[-1.62463]	[3.60433]	[1.55395]	[0.30706]
R-squared	0.814632	0.798115	0.758636	0.554838	0.606074	0.686490	0.672891	0.479581
Adj. R-squared	0.666337	0.636607	0.565545	0.198708	0.290933	0.435681	0.411204	0.063246
Sum sq. resids	0.317951	0.182206	0.553476	0.033129	0.242679	0.012224	0.112985	0.170072
S.E. equation	0.145591	0.110214	0.192090	0.046996	0.127195	0.028547	0.086789	0.106481
F-statistic	5.493326	4.941644	3.928908	1.557965	1.923182	2.737108	2.571354	1.151912
Log likelihood	22.96259	30.75722	15.20211	54.62330	26.74481	68.58172	37.44758	31.72207
Akaike AIC	-0.711613	-1.268373	-0.157294	-2.973093	-0.981772	-3.970123	-1.746256	-1.337291
Schwarz SC	-0.093090	-0.649849	0.461230	-2.354569	-0.363248	-3.351600	-1.127732	-0.718767
Mean dependent	0.112399	0.003084	0.019893	0.058358	-0.082074	0.041812	0.001031	0.024721
S.D. dependent	0.252046	0.182830	0.291428	0.052501	0.151052	0.038001	0.113105	0.110017

Determinant resid covariance (dof adj.)	6.56E-20
Determinant resid covariance	4.45E-22
Log likelihood	370.4512
Akaike information criterion	-16.74651
Schwarz criterion	-10.27581

E heteroskedasticity

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 01/05/17 Time: 10:42
Sample: 1 30
Included observations: 28

Joint test:

Chi-sq	Df	Prob.
349.6976	336	0.2922

Individual components:

Dependent	R-squared	F(16,11)	Prob.	Chi-sq(16)	Prob.
res1*res1	0.501301	0.691086	0.7564	14.03642	0.5960

res2*res2	0.467544	0.603687	0.8259	13.09124	0.6661
res3*res3	0.834806	3.474271	0.0208	23.37457	0.1041
res4*res4	0.294266	0.286663	0.9882	8.239440	0.9414
res5*res5	0.760824	2.186957	0.0960	21.30308	0.1672
res6*res6	0.837414	3.541041	0.0194	23.44760	0.1023
res2*res1	0.522824	0.753267	0.7054	14.63906	0.5512
res3*res1	0.658124	1.323466	0.3238	18.42749	0.2995
res3*res2	0.514506	0.728584	0.7257	14.40618	0.5685
res4*res1	0.685342	1.497414	0.2515	19.18958	0.2590
res4*res2	0.639212	1.218049	0.3773	17.89792	0.3299
res4*res3	0.638526	1.214437	0.3793	17.87874	0.3310
res5*res1	0.899386	6.145512	0.0021	25.18279	0.0667
res5*res2	0.712409	1.703046	0.1871	19.94744	0.2226
res5*res3	0.608773	1.069791	0.4662	17.04564	0.3826
res5*res4	0.493558	0.670011	0.7735	13.81964	0.6121
res6*res1	0.824887	3.238544	0.0269	23.09684	0.1112
res6*res2	0.640214	1.223356	0.3744	17.92598	0.3282
res6*res3	0.466128	0.600262	0.8285	13.05159	0.6690
res6*res4	0.646185	1.255604	0.3574	18.09317	0.3185
res6*res5	0.686264	1.503836	0.2491	19.21540	0.2577