



ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
DEPARTMENT OF ECONOMICS

**THE CAUSAL RELATIONSHIP BETWEEN TRADE OPENNESS AND
ECONOMIC GROWTH IN ETHIOPIA**

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ADDIS ABABA, ETHIOPIA

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**A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES,
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DEPARTMENT OF ECONOMICS IN PARTIAL FULFILLMENT OF THE
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Abstract

The main purpose of this study was to investigate the causal relationship between trade openness and economic growth in Ethiopia. The model which is economic growth was estimated using both short run and long run models using econometric and descriptive techniques. The model was also tested different diagnostics tests and other forecasting methods using secondary annual time series data covers the period range from 1980/81-2020/21 Ethiopian fiscal year, a total of 41 data points. The empirical analysis part which was results of ADF and PP unit root tests were stationary at first difference. The Johansen co-integration results of both the trace test and the max-Eigen value test had four co-integrating equations relationship for both models. The results of pair wise granger causality test supports trade lead growth hypothesis. Trade openness, labor force and capital expenditure had a positive impact on economic growth and its coefficient was statistically significant at the one percent level, in the long run but remittance and education expenditure negatively related to economic growth. In the short run, remittance was statistically significant at five percent level to economic growth. Based on finding of the study the author recommended: the formally flowed remittances should spend on the productive sector and providing incentives and accesses to allow Ethiopian Diasporas to engage highly in the domestic investment than before activity.

Key Words: Co-integration, EconomicGrowth, Ethiopia, Granger Causality, Trade Openness and VECM

Declaration

I, **HaftomMebrahtu**, declare that, this study, “*The Causal Relationship between Trade Openness and Economic Growth in Ethiopia*” is my own work. I have undertaken the research work independently with the guidance and support of the research supervisor. This study has not been submitted for any degree or diploma in this or any other institution. It is in partial fulfilment of the requirements for the Degree of Master of Science in Economics (Economic Policy Analysis). All sources of material used for the research have been duly acknowledged.

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Endorsement

This thesis has been submitted to Addis Ababa University, Collage of Business and Economics for examination with my approval as a university supervisor.

Supervisor: JEMBERULULIE (PhD)

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Lists of Acronyms

ADF = Augmented Dickey Fuller

ARDL = Auto regressive Distributed Lag

CPI= Consumer price index

CUSUM SQ = cumulative sum of square

CUSUM= cumulative sum

CA= Capital Expenditure

IRF = impulse response function

ITA = International Trade Administration

K= Physical capital

L= Labour force

LM = Lagrange multiplier

NBE= National Bank of Ethiopia

OECDG = Global Organization for Economic Co-operation and Development

OLS= Ordinary Least Square

PP = Philips Peron

EEX= education expenditure

PWT = Penn World Table

REER= Real effective exchange rate

REM= Remittances

RGDP = Real gross domestic product = proxy for economic growth

TOP = Trade openness

USD= United States Dollar

VAR = vector auto regressive model

VD = variance decomposition

VECM = vector error correction model

EG = Economic growth

Chapter One

1.1 Introduction

In this chapter the author would present back ground of the study, statement of the problem, hypothesis of the study, objective of the study, scope of the study, limitation of the study, significance of the study and organization of the study, respectively.

1.2 Back Ground of the Study

For several centuries, trade was the source of growth for all developed and developing nations. Trade is not only contributing for more efficient allocation of resources but also transforming growth from developed economy to less developed economy (Okonkwo, E. & Adigwe, 2015).

The entire export performances of Africa have been totally depends on a few traditional exports or primarily agricultural products. As World Bank reported in 2000, African countries have lost in the global export market share at the same time there have been none any significant effect for promotion or diversifying their traditional export products for the post 30 years(Lakew, 2003).To eliminate the obstacles and to improve economic growth in Africa, the governments in these countries have adopted trade policies (import substitution strategies, tariffs exchange rates and quantitative controls) to improve in the global trade. These trade policies have performed to reduction of trade fluctuations, technological transformations, better economic management, increasing productivity and efficient allocations of resources (Abendin & Duan, 2020).

Until the 1990s the Ethiopian major exports has been dominated by three commodities sector which are coffee, hides and skins, oilseeds and pulses. Between 1966 and 1967 the total export earnings share was 59% of the total export and in 1997/98 the total earning share from coffee was 70% of the total export. But the total exports of coffee in 2009/2010 were decreased by 20%. The share of exports for non-coffee and major manufacturing commodities (leather and leather products (textile and agro processing products) were 30% in 1997/98, but in 2009/10 these commodities were significantly increased to 80%(Hailu, 2012).

During the previous 10 years, the total import of Ethiopia on average increase by 12.5% per year, which caused the country to grow more its trade deficit. The increasing in trade deficit is rising due to increasing imports by \$3.6 billion in 2010 to \$12.5 billion in 2017; this is recorded for the country as the highest trade deficit. Understanding this problem, the

government of Ethiopia, works to narrow the trade deficit by \$12.3 billion in 2018 and by \$11.6 billion in 2019(ITA, 2021a).

Ethiopia's dominant merchandise exports and their share from the total exports in 2019 were coffee 28.7 percent, cut flowers 14.1percent, oil seeds11.5 percent, chat10.9percent, pulses7.9 percent,gold6.6percentand leather and leather products2.4 percent and the most Ethiopia's exports destinations in 2019 were china holds about 13 percent, the united states of America (primarily exports coffee, leather, and leather products) holds 9.6 percent, Saudi Arabia 8 percent, Germany5.9 percent and United Arab Emirates 5.5 percent, respectively. The top destinations for Ethiopia's exports by region in 2019 were Asia covers about 52 percent, Europe covers 24 percent, Africa covers 13, and Americas covers 11 percent from the total exports and the top imports by region were from Asia 67percentof which China accounted 26 percent, from Europe 17 percent, from the united states of Americas 9.8 percent (mainly aircraft and aviation parts) and followed from other countries in Africa holds 8.1 percent. In summary Ethiopia's most dominant imports were construction equipment, aircraft sales, agricultural machinery, farming, and engineering services (International Trade Administration, 2021b).

To diversified the exports goods and services for getting foreign currency and better economic growth in Ethiopia the government of Ethiopia takes two incentive schemes measure (via the proclamation No.249/2001 and later amended through the proclamation No. 543/2007). the first incentive is fiscal incentive which hold the following incentives, the customs duty refund for exporters who paid on imported goods (The Duty Drawback Scheme), voucher scheme and importing raw materials duty and tax-free conditioned for exporting of these in terms of finished goods or raw materials (Bounded export factory and industrial zone schemes). The second incentives are financial trade incentive that includes, supplying credit access for exporters (export credit guarantee scheme), exporters allowed to hold foreign currency from their portion of foreign exchange earnings (foreign exchange retention) and external loan and supplier credit (Gemed, 2020).

Based on the empirical paper sourced from (Getie, A. and Haiyun, L., 2019)after 1992, Ethiopian government have planned new policy and implemented different reforms to reduce poverty to stabilize macroeconomic variables and to fast the economic growth. Ethiopia's economy is dominated by agriculture which covers about 47% of GDP, service covers around 39% of GDP and the remaining 13 % of GDP covers by industry. As result of rapid economic growth and trade openness to the rest of the world the share of trade from GDP rise from 11.4

% in 1990 to 42.1 % in 2006 from which the share of export covers 16% of GDP and import covers about 42 % of GDP.

The causality between economic growth and trade openness has studied by academicians and policymakers and their correlation is not inclusive. There are two hypothesis regarding the relationship between trade openness and economic growth which are trade-lead growth hypothesis and growth-lead trade hypothesis(Khalid, 2016). What about in Ethiopia i.e. which hypothesis would be appropriate for our country, trade-lead growth or growth-lead trade or both?

1.3 Statement of the Problem

Traditional trade theory suggests that, economic growth have sourced from the international trade through specialization, investment in research and development and increasing productiveness or improving resources allocation. There are debates in theoretical literature regarding the role of trade policies in economic growth. The first theoretical literature is the Ricardo's theory; proposed that, taking part in the international trade converts the nation's resources from scarce to more efficient sectors. The second theoretical literature review is the neoclassical growth model drawn from Solow's (1957) models; suggests technological changes is an exogenous and trade policy doesn't have any efficient on economic growth and the third theoretical literature review is, new economic growth suggests that technological change is an endogenous variable and trade policy plays significant impact on economic growth that is opposite to the neoclassical economic growth. To sum up, there are still debates regarding the relationship between trade and economic growth chiefly in developing countries as the researcher sourced from paper of (Pam, 2019).

The classical economists are in favour of free trade policy and they assumed that all nations are benefited from trade. They believe that, trade can increases output and employment levels. Developed economic countries are benefited more as they open their trade to the rest of the world, because, they exported industrial products with high quality products. But less developed countries can grow faster than the developed if the cost of imitated technology is less than the cost of domestically developed technology. This caused these less developed economy to grow more rapidly as much as they open their trade to attract new ideas. These countries are growing faster than the developed nations until the equilibrium level reached but afterward the growth rate becomes to slow down which is sourced from the empirical paper of (Patra & Murthyr, 2014).

There are two empirical literature reviews with reference to trade-growth relationship: the first sides are the trade-growth hypothesis link; different empirical reviews such as (Okonkwo, E. & Adigwe, 2015), (Emagne, 2017) and (Shayane wako, 2018) support this hypothesis that is trade stimulates long run economic growth. Due to the fact that, many countries open their trade as a result resources allocated to more efficient sector or transformed from non-efficient to efficient resources, increases the access of use goods and services to use and that increases total factor of productivity through technological transformation and knowledge spill over. According to Stieglitz and World Bank, countries from the East Asian economies benefited more as they open their domestic trade than the less opened countries. The second sides are these who are opposed the existing of trade-growth hypothesis; these empirical literatures such as ((Bourdon, Mouël and Vijil, 2005) and (Silajdzic and Mehic, 2019)) argue that taking part in the international trade caused to raise the price of goods and services and which cause to devalue the country's currency. This is highly pronounced in less developed nations which are characterized by exporting agricultural primarily products and their terms of trade is affected by shocks. However, even there are debates about the trade support growth hypothesis, many scholars and researchers believe that, trade used as engine of economic growth for all most all countries in the long run(Shayane wako, 2018).

The link between trade performance and economic growth is one of a major topic that has received a great attention in empirical studies. A number of studies have been conducted to validate the trade-growth or the export-led growth proposition in many less developed an economy in an attempt to provide policy recommendations geared towards enhancing export growth and subsequently economic growth. However, the studies yielded mixed results across countries and within a country with no definite conclusive evidence on the causality relationship between trade openness and economic growth. A survey of empirical studies with in Ethiopia also noted the contradictory results on the relationship between trade openness and economic growth. In a summary, the evidence from theoretical and empirical studies regarding the relationship and causality between trade openness and economic growth is mixed and this issue is true for Ethiopia. The rationale for this study is, therefore, to contribute the following unique points in Ethiopia:

I, The researcher try to examine what would be the impact of economic growth on trade openness or the growth lead trade hypothesis if there is granger causality from economic growth to trade openness from the Cobb-Douglass production function in case of Ethiopia. II,

Ethiopian Exports are dominated by primary agricultural products which are seasonal products and our imports are dominated by industrial products. We are a net importer country and faced with scarce of hard currency i.e. even our imports volume increased from year to year our imports are not stable. Inferring from this, the researcher going to investigate what would be the impact of trade openness on economic growth using current data. III, Further, a few papers have conducted in Ethiopia such as (Chemed, 2001), (Emagne, 2017) and (Getahun, 2014) regarding the problem but there are mixed results no still inclusive results. So that, the author assumed to conduct an empirical study to check the causal link either from trade openness to economic growth or from economic growth to trade openness or both in Ethiopia at the same time if there is unidirectional to proof which hypothesis i.e. the trade lead growth hypothesis or the growth lead hypothesis is appropriate for Ethiopian. IV, A lot of researchers vary in terms of methodological used, the measurement of real values of the variables and the sample size or the period covered and data frequency used in the empirical investigations to analyse the relationship and causality between trade openness and economic growth (mainly in Ethiopia) such as (Emagne, 2017) used error correction model (ECM) in a time series data and (Fanta and Teshale, 2013) used trend analysis and co relational in a time series data in Ethiopia and (Khandaker Jahangir Alam, 2019), used vector error correction model (VECM) in a panel data, (Hicham Ayad, 2017), used vector auto regressive model (VAR) model in a panel data, (Khandaker Jahangir Alam, 2019), used vector error correction model (VECM) in a time series data outside of Ethiopia. Based on these clues the author supposed to use the Solow Model of economic growth which derived from the Cobb-Douglas production function by utilizing the econometric vector error correction model (VECM) and current annual time series data to analyze the causal relationship between trade openness and economic growth in Ethiopia. V, Finally, the author would conducting the study to understand to which previous empirical finding (conducted using similar models and data types) is converging or differencing based on the short run and long run results of the study mainly in Ethiopia.

1.4 Research Questions

Based on our research problem and based on different literatures the researcher would rise and expected to answer the following questions:

- i. Is there causal relationship between trade openness and economic growth?
- ii. Is there significant relationship between trade openness and economic growth both in the long run and in the short run?

- iii. To what extent does trade openness affects economic growth or economic growth to trade openness?

1.5 Hypotheses of the Study

Based on the order of the research questions the researchers would form the following testable and measurable hypothesis (H_0 = null hypothesis and H_1 = alternative hypothesis) as follow:

H_0 : there is unidirectional causality from trade openness to economic growth or the inverse

H_1 : there is bidirectional causality between trade openness and economic growth

H_0 : there is no significant relationship between trade openness and economic growth both in the long run and in the short run

H_1 : there is significant relationship between trade openness and economic growth both in the long run and in the short run

H_0 : the growth lead trade (export) hypothesis is appropriate in Ethiopia

H_1 : the trade lead growth hypothesis is appropriate in Ethiopia

1.6 Objectives of the Study

1.6.1 General Objective of the Study

The main objective of this study is to determine the causal relationship between trade openness and economic growth in Ethiopia.

1.6.2 Specific Objectives of the Study

- To investigate the existence of short run/long run relationship between trade openness and economic growth
- To demonstrate the trends of the trade openness and economic growth in a given time period
- To forecast the relationship between trade openness and economic growth for the next ten years in Ethiopia
- To forward policy recommendations

1.7 Scope and Limitation of the study

The main purpose of the study is to determine the causal relationship between trade openness and economic growth in Ethiopia. The study would include two models which are economic growth and trade openness and which would be estimated both short run and long run models using econometric and descriptive techniques. These models would apply vector error

correction model (VECM) to estimate these secondary annual time series data covers the period range from 1980/81-2020/21 Ethiopian fiscal year, a total of 41 data points. The data for the variables which would be included in this study would be real gross domestic product (RGDP), trade openness (TOP), capital expenditure (CA), remittance (REM) and education expenditure (EEX) that would be collected from National Bank of Ethiopia, while for the variable of labour force would be collected from version 10.0 of the Penn World Table (PWT).

The main limitations of the study noted, there are a lack of previous published researches from the Cobb-Douglas production function in case of Ethiopia, which limits to obtain enough information.

1.8 Significance of the Study

The methodology which would be used to analyze the data in the paper expected to follow step by step econometric and descriptive techniques of tests as well as updated and long sets of data. Through the econometric techniques, the researcher expected to find accurate and proper results. Based on the findings, the output would be used as a reference for policy makers, for trade sectors and for other concerned sectors or bodies. In addition, the paper would also be used as a reference for further study and would highlight the Ethiopian economy.

1.9 Organization of the Study

The rest of the paper would be structured as follows: Section two would cover an overview of Ethiopian economic growth, Ethiopia's balance of trade, an overview of trade openness, an overview of economic growth, an overview of theoretical literature review and empirical literature reviews respectively. Section three would devote the methodology of the study (data and model estimation), while section four and five would discuss empirical results and conclusions and recommendation of the paper, respectively.

Chapter Two: Literatures Review

2.1 Introduction

In this chapter, the researcher going to illustrate or discuss the following sub topics briefly which are an overview of Ethiopian economic growth, Ethiopian trade balance, theoretical literature review, empirical evidences which are similar with the research topic, theoretically framework and finally, conceptual framework, respectively.

2.2 Theoretical literature Review

2.2.1 Overview of Ethiopian Economic Growth

After the revolution of the 1974 that had a resulted of nationalization and structural economic reforms. The revolution was divided in to four phases and each phase was clarified as follow: The first phase revolution (1974-1978): In this period there had been rapid institutional reforms but it was deriving a little economic growth due to unstable political phenomena and higher military budget which come about dislocated agricultural and manufacturer sectors. In that time even, agriculture and manufacturing was the back bone of the Ethiopia's economy, the economy was grow annually only on average by 0.4 percent.

The second phase revolution (978-1980): The government began to highly reform the governmental institutions and tried to implement these institutions through cooperation. The reform leads the economy to grow faster on average by 5.7 percent annually. Agriculture sector and manufacture sector were increased on average growth rate of 3.6 percent and 18.9 percent, respectively. The manufacture sector had been growing by greater rate than the agriculture sector, as a result of manufactures reopened in Eritrea that had been shut down.

The third phase revolution (1980-1985): In this revolution period except for the Ethiopian fiscal period 1982/83, the country's economy was faced different problems due to the following four factors. i, drought (1984-85), ii, shortage of input resources for manufacturing products, iii, shortage of foreign exchange and, iv, high level of military establishment with higher budget expenditure and that budget was share from 40 to 50 percent out of the government annual budget.

The fourth phase (1985-1990): Even there was good weather for agricultural products which recovered from declining in the Ethiopian fiscal year 1985/86 and 1986/87, the economy was continue to stagnant. In this phase, manufacture sector was growing, but due to the previous drought, the economy on average only increases by 5 percent annually.

1991 to present, Since this year the government performed different economic reforms like privatise state owned enterprises and rationalized government regulations. These economic reforms are still ongoing and attract a lot of foreign investors (Affairs, 1996).

Agricultural sector; there is good weather condition for agricultural products and which is the most dominant sector i.e. contributes about half of the country's gross domestic product. In agricultural sector there are three activities. the first activity is small holder which is the most dominant activity and that produces staple grains ("Teff", wheat, barley, barley...) and pulses (peas, beans, farm plots..), the second activity is cash cropping (coffee which is the dominant cash crop in the country and holds very great share of export revenue, oilseeds, bees wax...) and the third activity is raising live stocks (herbs, goats, goats..)

Manufacturing sector; this sector share one tenth of the country's gross domestic product. This sector produced primary for domestically consumed goods such as textile, beverages, and processed foods, chemical.

Service sector; this sector is share about two fifth of the country's gross domestic product and this is dominated by tourism (Britannica, 2021).

2.2.2 The Mercantilist Theory of Trade

As the author retrievethe source from (Abendin, S. & Duan, P., 2021), the mercantilist trade theories believe that, the country have to export goods and services than the country import goods and services to become powerful and wealthy nation. Doing that action, the country would have positive trade balance and would improve economic development and faster prosperity. This one way trade transaction or preferring more export than import leading the country self-seeks trade.

2.2.3 Absolute Advantage Trade Theory

Adam smith, who was the first economist, studied the relationship between international trade and economic growth. According to Adam smith's studied in 1976, he found that, specializations and labour divisions are the main determinants of the country's wellbeing and economic growth. His followings also conducted research paper on the impact of free trade policy on economic growth for all nations or developed and developing countries (Smith, 1993 [1776]).

2.2.4 The Theory of Comparative Advantage

In 1817, David Ricardo developed the classical theory of comparative advantage by explain the questions as why countries are engaged in the free trade even the country is producing a single goods with efficient worker than the other. According the David Ricardo, countries that are engaged in trade are mutually benefited because the country is specialized in which the county has lower opportunity cost and which he called “the win-win approach. David Ricardo suggested that trade improves both production and compilation efficiently and which leads the nation’s citizens for better welfare. The economists said that, comparative advantage is more responsible for international trade than the absolute advantage. Assuming the country is producing two goods, even the nation is less efficient than the other nation there is still a base for win-win approach. They believed that less efficient nations should specialize (with low comparative disadvantage) for the commodities that the country exports and import for the commodities with the greater comparative disadvantage (Ricardo, 1817).

2.2.5 Heckscher-Ohlin Trade Theory

The (Heckscher, 1919)&(Ohlin, 1933)trade theory assuming that, difference in resources factor production and factor intensity of products are the major reasons to engage in the foreign trade(Morrow, 2010)the theory assuming that, two countries, two goods and two production factors (2x2x2), the country should export the commodity required abundant production factors and should import the country that couldn’t produce domestically easily. (Heckscher, 1919)&(Ohlin, 1933) concluded that, if the country produce goods and services with a large scale that required sufficient factor endowment, focusing on the trade can increase country’s countries growth(Heckscher, 1919)&(Ohlin, 1933).

2.2.6 New Trade Theory

The comparative advantage trade theory emphasized that, poor countries are traded with rich countries or poor countries are exchanged primary agricultural products with rich countries in turn to high quality industrial products. But in the 20 century countries which have similar characteristics (rather than rich with poor countries) have become to engage each other with a large share (George et al, 2017). Based on the (Krugman, 2009)’s economist research paper explanation, countries with similar characteristics, there should few assumptions to taking part in the foreign trade. The first assumption is consumer should prefer different kind of brands i.e. country should specialize in few brands instead of different products. The second assumption is producing at maximum economic of scale which means country should

produce goods and services with a large amount at a lower cost and the surpluses after domestic consumption should be exported to the global market instead of narrowing the ranges of products.

2.2.7 Neo-Classical Growth

The neo-classical growth model suggested that a sustainable increase in capital investment do not bring permanent economic growth because the capital labour ratio goes up then economy returns back to the long term growth. According to the Solow growth model, to increase the growth permanently the exogenous growth model alone doesn't bring that but there should be endogenous growth theory which would be discussed in the next section (Solow, 1956).

2.2.8 Endogenous Growth Theory

The model believed that, conducting research and development and investment in human capital by government sector and private institutions in business and individual enterprise can faster economic growth. Accumulations of knowledge have a central role in determining growth. In developed countries, the endogenous growth model suggested that, giving incentives to promote innovation of new technology for governmental and private sectors in the business sector would be compile in the market and which leads to permanent increase economic growth. In summary, investment in new capital and investment in private enterprise are a key source of technical process in addition to this investment in human capital is also an important ingredient to the long term growth. The source has taken from the journal article of (Kehinde, A. et al, 2021).

2.2.9 Harrod – Domar Growth Model

The (Harrod, 1939)-(Domar, 1946) growth model is based on the linear production function and the theory believed that, economic growth is active if and only if more investment is invested from saving. By augmenting capital stock, investment in the country can generate income and productive capacity of the economy. To achieve full employment, real income and output should be expand at the same rate with the productive capacity of capital stock. The basic idea of this theory is that the country should save from portion of their real income so as to boost the country's economic growth.

2.2.10 Trade Openness and Economic Growth in Ethiopia

Endogenous growth model is the best model to relate trade openness and long run economic growth based on the endogenous technological change (Winters, 2004). Due to the dynamic

characteristics of trade, specialization can boost productivity growth via learning by doing. Trade is the source of productivity or technological progress by expanding market for output and input (Lucas, 1988). According to (Romer P. , 1990) trade openness initiates all the access or advantages to export domestically produced goods and services to the rest of the world and import different products from abroad specially capital goods, wider the access of knowledge spill over and creates a wider market; all of which increases rapidly economic growth.

Economists based on several theories suggested that, trade openness can increase economic growth by; I, in the present of scarce foreign currency in the economy, for the purpose of importing capital goods or consumption goods exporting domestically producing products is the main solving mechanism. II, can faster the rate of capital formation and technical change by widening economic of scale and efficient market size. III, foreign trade policy can stimulate economic growth by; increases efficiency and overall productivity as a result of importing and attracting foreign direct investment(Çevik, E., Atukeren, E. & Korkmaz, T., 2019)

As the author retrieved the source from (Salahuddin, M. & Gow, J., 2015),if a country have an ambition to engage in the foreign trade with other partner country, the latter country should specialized in the sector that has abandon factor endowment and produce goods and services with a large scale. Then, the country could augment its total productivity and which leads the country to export more results to increases the overall economic growththis is based on the comparative trade theory. The economists of Krueger (1978) and Bhagwat (1978) was propagated the comparative advantage trade theory and they suggested that trade liberalization forced the country to specialization in the sector which have large economies of scale and that improves the efficiency and productivity in the country. New endogenous growth model proposed that, in the long run, there would be positive relationship between trade openness and economic growth due to, transformation of advanced technology between countries especially from developed to developing countries

According to the (Hye, K.M., Shahida Wizarat, S. and Lau, W.Y., 2016), technological transformation from developed to developing countries, efficient allocation of resources and learning by doing leads to increase economic growth via outward-oriented trade policy. To examine the relationship between trade openness and economic growth there are two economic hypotheses. The first hypothesis is trade lead growth or export lead growth hypothesis and the second hypothesis is growth lead trade or domestically generated exports.

The trade growth hypothesis suggests that advanced technologies and knowhow from advanced countries can stimulate total factor productivity and then economic growth. The growth lead hypothesis is based on the neoclassical trade theory and it suggested that economic growth are the source of productivity growth and that leads to increase competitiveness of the country's export in the international market.

(Hicks, 1953) Was the famous inaugurate lecture and he was the famous person who flourished literature on growth and trade and in the 1950s and in the 1960s. He was the first person who developed a frame work for the effects of capital stock and exogenous technical change on balance of payment and terms of trade. And, his work was expanded in the second half of the 1960s by the dynamic analysis of neoclassical growth mode to the open economy.

2.3 Empirical Literatures

2.3.1 Empirical Literatures in African Countries

(Getie, A. and Haiyun, L., 2019) Empirically examined the impacts of trade openness for the economic growth of Ethiopia using annual time series data over the time period from 1981-2017. The study employed the method of two-stage least squares (2SLS) to analyse the data. The empirical result of the paper indicates that trade openness has negative and significant effect for economic growth of Ethiopia.

(Abebe, 2020) Investigated the long-run relationship between trade openness and economic growth in Ethiopia empirically, using annual time series data over the period of 1982 to 2019. The study was applied the vector error correction model (VECM) techniques and the Block-Exogenous Wald Tests. The empirical result showed of a one-way causality running from trade openness to economic growth.

(Emagne et al, 2017) Examined the impact of trade liberalization on Ethiopian economic growth during the period from 1980 to 2016 of the annual time series data, employing, the Error Correction Model (ECM). The empirical results indicated that, trade liberalization and economic growth has a significant relationship between them in both the short-term and long-term.

(Malefane, 2020) Examined the impact of trade openness on the economic growth of Botswana and the study used the annual time series data covering from 1975 to 2014 and applied techniques of autoregressive distributed lag (*ARDL*) bounds testing approach. Evidence from the results showed that, there is significant impact of trade openness on economic growth in both the short run and the long run periods.

(Bouoiyou, 2003) Investigated empirically the relationship between trade and economic growth in Morocco over the period from 1960 to 2000 and the study employed the Co-integration and Granger-causality tests using the vector error correction model (VEM). The results revealed that, there was no long run causality from trade to economic growth or inversely from economic growth to trade. The study showed that there was granger cause from trade to economic growth.

(Olufemi, 2004) Empirically studied the causal relationship between the openness and economic growth in Nigerian using the annual time series data covered from 1970 to 2000. The study utilized the Granger-causality techniques based on the vector error correction model (VECM) to estimate the short run and long ran relationship between openness and economic growth in Nigeria. The result of the study showed that, the unidirectional causality running from economic growth to openness.

(Yusuf, S. and Omar, M.R., 2019) Investigated trade openness and economic growth of Tanzania, covering over the period of 1981 to 2017, in addition, The study applied the Johansen co-integration approach and analysing the short run and long run impact of trade openness on economic growth utilizing the vector error correction model (VECM) for the annual time series data. From the vector error correction model (VECM) result showed that, there was positive and significant relationship between trade openness and economic growth. The result also showed that, there was no causality between Trade openness and economic growth.

(Attah, 1998) Studied the export-led growth hypothesis in Ghana and the annual time series data was ranging from 1960-1992. The study was utilized granger (1969) causality test technique. The result of the paper indicated that, unidirectional causality link from the real exports to the growth rate of real GDP i.e. the growth of export leads to improve economic growth. This implies exports were the source of economic growth in Ghana during the period.

(Chigusiwa, L., Bindu, S., Mudavanhu, V., Muchabaiwa, L. and Mazambani, D., 2011) examined the validity of the export-led growth hypothesis in Zimbabwe using annual time series data for the period 1977-2006 within export augmented aggregate production function frame work. Applying the bound testing (ARDL approach to co-integration, the study investigated whether a long run relationship exist between export and non-export GDP. The empirical result confirming the existence of the long run relationship between export and

non-export GDP with evidence supporting the export lead growth hypothesis in that causality runs from export to non-export GDP in both the short run and the long run.

(Serge, 2010)Examined the export led growth hypothesis for Cote d'Ivoire in the period 1980-2007 using the bound test analysis or unrestricted error correction model, considering exports, labour force, economic liberalization policies, imports and exchange rate as determinants of economic growth in Cote d'Ivoire. The result indicated that there exists a long run relationship between economic growth and its determinants included in the model. In addition, the VAR granger/block-erogeneity Wald test reveals an evidence of bi-directional causality between exports and economic growth.

(Jordaan, A.C. and Eita, J.H., 2008)Looked in to the causal relationship export and economic growth for Botswana using quarterly data for the period 1996-2007 and Granger causality was applied to test the causal relationship between export and economic growth. Since the variables used in the estimation are I (0), the study applied a VAR model technique. The result suggested bi-directional causality relationship between export and economic growth i.e. the two variable complement each other, implying the existence of export led growth hypothesis and reverse causality between export and economic growth.

2.3.2 Empirical Literatures in Non-African Countries

The empirical studies regarding the relationship between trade openness and economic growth that are listed in the below table 2.1, indicated that, varieties of findings in different countries even in the same countries for the same or similar research problem. This is may be due to difference in methodology use, variables included in the study, time coverage and others in the analysis.

Table 2.1: Empirical findings of non-African countries

No	Authors	Country	Sample period	Methodology	Findings
1.	(Singh, 2015)	Canada	1948–1996	Granger-causality test and VAR model	long-run relationship and unidirectional causality from trade to economic growth
2.	(Sharmina, K., 2019)	Bangladesh	1972-73 - 2015-16	VECM model and Engle-Granger co-integration test	long-run relationship between trade openness and economic growth
3.	(Faiza, 2014)	Pakistan	1960-2011	autoregressive distributed lag (ARDL)	long-run relationship between trade openness and economic growth
4.	(Lau, W. & Hye, Q., 2012)	INDIA	1991-Q1 to 2007-Q4	ARDL model and granger causality test	long-run relationship and unidirectional causality from trade to economic growth
5.	(Muhammad, 2012)	Pakistan	1970 - 2012	VECM model and Johnson co-integration technique	long-run relationship between trade openness and economic growth
6.	(Çevik, 2019)	Turkey	1950 - 2014	granger causality test	bidirectional causality between trade openness and economic growth
7.	(Bashar, 2008)	Malaysia	1970-2003	VECM model and granger causality test	long-run relationship between trade openness and economic growth but not granger causality between them
8.	(Hye, Q., Wizarat, S. & Lau, W., 2016)	China	1975-2009	ARDL model	long-run relationship between trade openness and economic growth
9.	(Ozturk, January 2010)	Turkey	1989-2006	Toda and Yamamoto (1995) test for granger non-causality in the augmented VAR	causality flows from export to economic growth
10.	(Paul, 2014)	Bangladesh	1979-2010	ARDL bound test	Long-run relationship and causality link from export to economic growth

Source: own compilation

2.4 Theoretical Framework

The main objective of the study is to determine the causal relationship between trade openness and economic growth in Ethiopia. In this part, the main objective is to discuss theoretically, the causal relationship (one-way or two way causality) between trade openness and economic growth in Ethiopia.

As the author taken source from(Çevik, E. Atukeren, E.& Korkmaz, T., 2019), there are two hypothesis regarding the relationship between trade openness and economic growth, that are, trade-led growth and growth-led trade.

The first hypothesis is, the trade-led growth hypothesis; the hypothesis believed on the transformation of advanced technology and how to use practically the technology or know how from developed economy to less developed countries that stimulates total factor of productivity. Then, the hypothesis supports trade openness stimulates economic growth.

The second hypothesis is the growth-led trade hypothesis; the hypothesis proposed that, an increase exportable products and improving competitiveness in the international market is due to the improvement of productivity growth. The productivity growth is also derived from economic growth, therefore, the hypothesis suggests, the causal relationship runs from economic growth to trade growth.

The trade-led growth hypothesis is also supported by the theory of comparative advantage. The theory suggests, two countries are expected to benefit each other by engaging in the trade because the exporter country is focused in the product which has comparative advantage,also, the importers country is benefited from the trade by producing goods (the produced goods may not the same to which imported) in which has comparative advantage. The benefit from trade is derived from specialization in the sector for that has economic of scale or producing in a large scale with lower cost and in which has better factor endowments. Due to these factors, exportable products increase and which boosts economic growth (Ricardo, 1817).

The neoclassical trade theory which supports the growth-led trade hypothesis suggests that, economic growth can stimulate trade through demand and supply side or as the economy growth more the productivity of varieties of goods supplied to the global market and also demanded more in the domestic market (evik, 20198).

Based on the above hypothesis or theory, the researcher expected that, there would be bidirectional causality running between tare openness and economic growth in Ethiopia.

2.5 Conceptual Framework

The main objective of this study is to determine the causal relationship between trade openness and economic growth in Ethiopia. In this part, the main objective is to show conceptually and graphically, the causal relationship (one-way or two way causality) between the variables based on objective of the study. The authors framed for each of the variables in conceptually and graphically explanation in detail as follows:-

Ethiopia's good exports are dominated by agricultural products and import of goods both capital goods and consumption goods which, causes trade deficit i.e. the characteristics of developing countries like Ethiopia. Although, there is trade deficit in Ethiopia, the researcher expected trade openness stimulates economic growth due to the following reasons, increasing service exports (transportation, financial service, tourism service etc.), the capital goods which are imported as capital goods begin to produce exportable products (the source for the capital goods may not only from export but also from remittance and external loans).

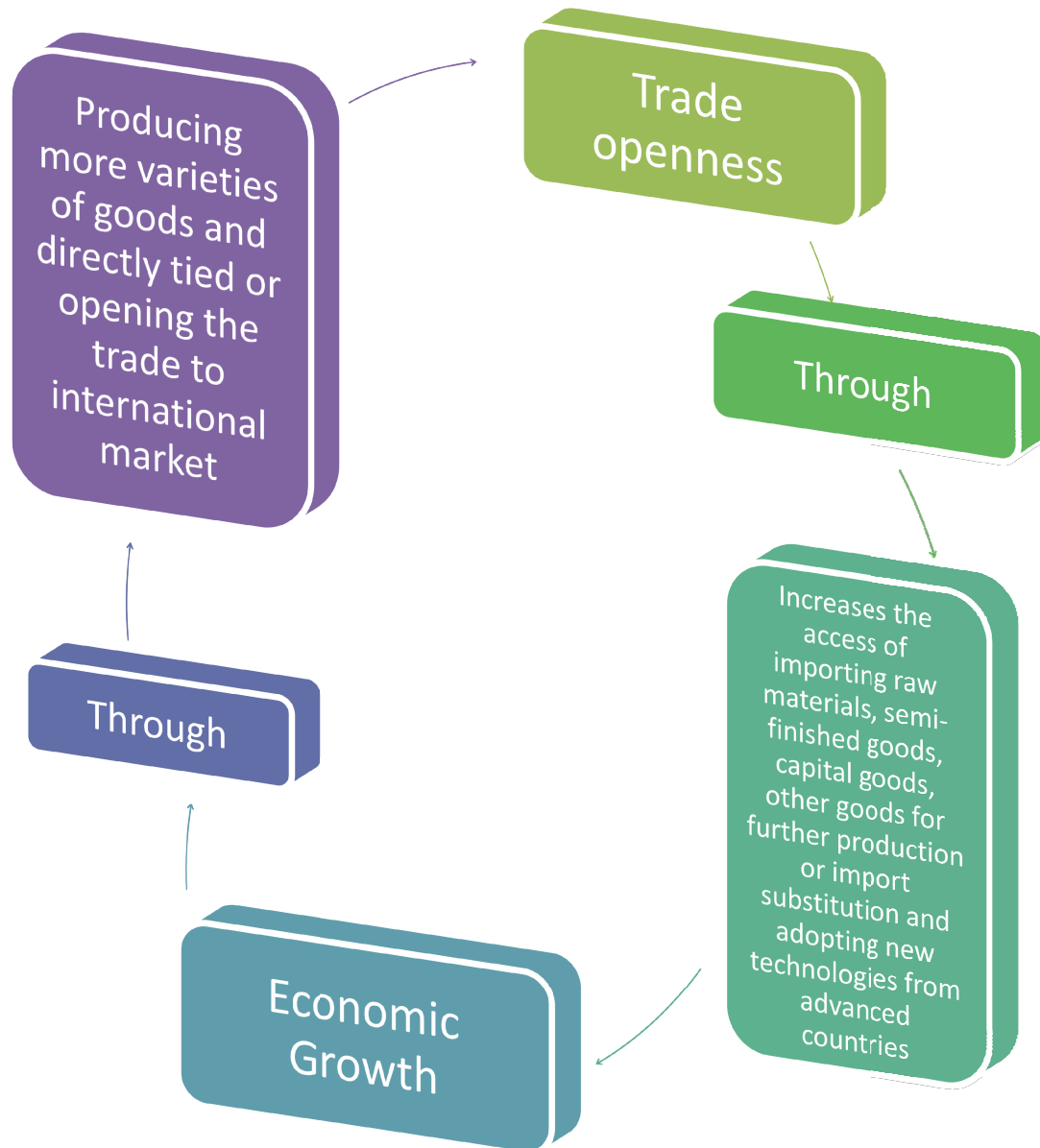
Different empirical studied has been examined the relationship between trade openness and economic growth in different countries such as (Kojo, M., Nazlioglu, S. & Wolde-Rufaelc, Y., 2014),(Ahmad, 2011), (Deme M. , 2002) and (Asfaw H. , 2014). The empirical studied have supported the trade lead growth hypothesis (the traditional view)or trade openness boost economic growth in the long run.

Empirical studies also supports the growth lead trade hypothesis which suggests, as the economy improved, the productivity of the country increased and then the amount of export and import transaction increased. Different empirical studies support the bidirectional relationship between trade openness and economic growth in Ethiopia such as (Jordaan, A.C. and Eita, J.H., 2008), (Çevik, 2019), (Shayane, 2018) and (Sakyi, 2015).

Therefore, based on the above empirical studies evidences, the researcher expected that, there would be bidirectional causality running between tare openness and economic growth in the long run in Ethiopia.

In order to easily understand, the above conceptual expression and theoretical frame work could be illustrated in the following figure 2.2, as follow:

Figure 2.1: The Conceptual Frame Work of the Study



Source: Own Compilation

Chapter Three: Research Design and Methodology

3.1 Introduction

This chapter broadly would discuss, source of the data, model specification and econometric framework. In the econometric framework would include and discuss, stationary test co-integration test in which, if the variables would integration of order one I(1) ECM would be applied and there would be three steps involved when formulating an ECM. Firstly, there is a need to test for unit root and order of integration. Secondly, if all variables are integrated of order I (1), one needs to proceed to testing for co-integration. Thirdly, if co-integration is present, an ECM can be built to capture the long run relationships and short run dynamics. The next step would discuss for granger causality test, variance decomposition (VD) and impulse response function (IRF) analysis and stability test.

3.2 Source of the Data and Method of data analysis

The source of data for the analytical analysis of this study, for the variables of real gross domestic product (RGDP), trade openness (TOP), capital expenditure (CA), remittance (REM) and education expenditure (EEX) would be collected from National Bank of Ethiopia, while for the variable of labour force would be collected from version 10.0 of the Penn World Table (PWT). These secondary annual time series data covers the period range from 1980/81-2020/21, a total of 41 data points. To estimate for the annual time series data the researcher would use the econometrics and descriptive analysis to the quantitative annual time series data using Eview 9. In this paper capital expenditure (CA), remittance (REM), education expenditure (EEX) and labour force (LAB) assumed to be as control variables to show the causality and endogeneity between economic growth and trade openness.

3.3 Model Specification

In the methodological approach, the research would use the Solow Model of economic growth which derived from the Cobb-Douglas production function that had been used by (Chaudhry, I., Malik, A. & Faridi, M., 2010) and (Emagne, 2017).

The Cobb-Douglas production function with constant returns to scale with reference to the variable of physical capital, labour force and total factor productivity would formulate as follow:

$$EG_t = F(K_t, L_t, A_t) \dots\dots\dots (3.1)$$

Where:

EG_t = Total output

K_t = Physical capita

L_t = Labour force

A_t = Total factor product at time t

Total factor productivity (A) is factors or variables that are affected economic growth or output other than or not explained by labour and capital inputs.

The above formula of the Cobb-Douglas production function could be rewritten as:

$$EG_t = K_t^\alpha L_t^\beta A_t \dots \dots \dots (3.2)$$

Note that: $0 < \alpha < 1$ and $0 < \beta < 1$

In this study, the researcher would extend the total factor productivity that is taken from the Cobb-Douglas production function. The variables which would be included in place of the total factor productivity is based on different researchers such as public education expenditure (EEX) which had used proxy for human capital referring to an empirical literatures such as (Al-Yousif, 2018), (Lloyd, 2018), (Barro, 1993), (Emagne, 2017) and (Haiyun, 2019), government capital expenditure (CA) which had used proxy for physical capital such as (Dereje, 2012) and (Iskandar, M. & Revmianson, N., 2018), trade openness which had used by (Dereje, 2012) and (Emagne et al, 2017) remittance had used by (Emagne1, 2017).

The author proposed that, total factor productivity (A) would determine by the variables of remittances (REM), trade openness (TOP) (CA) and public education expenditure (EEX).

$$A_t = f(\text{REM}, \text{TOP}, \text{EEX}) \dots \dots \dots (3.3)$$

The above total factor productivity function in equation 3.3 can be rewritten as follows:

$$A_t = \phi \text{REM}_t^\delta \text{TOP}_t^\eta \text{EEX}_t^\pi \dots \dots \dots (3.4)$$

Where:

ϕ is time invariant constant

$0 < \delta < 1$, $0 < \eta < 1$, $0 < \pi < 1$ and $0 < \alpha < 1$

The total factor productivity model from the above equation 3.4 can be substitute to equation 3.1 i.e. to the Cobb-Douglas production function as follows:

$$EG_t = \phi \text{REM}_t^\delta \text{TOP}_t^\eta \text{EEX}_t^\pi \text{CA}_t^\alpha L_t^\beta \dots \dots \dots (3.5)$$

After taking the natural logs on both sides of the equation (3.5) which give us the linear function as follow:

$$LEG_t = \phi + \eta_0 LTOP_t + \delta_0 LREM_t + \pi_0 LEEEX_t + \alpha_0 LCA_t + \beta_0 LL_t + \varepsilon_t \dots \dots \dots (3.6)$$

Where:

LEG_t = proxy for economic growth

$\phi, \delta, \eta, \pi, \alpha \& \beta$ are coefficients of the variables to be estimated in the economic growth model.

ε_t = random error term

t = the time trend

Regarding the causality relationship between economic growth and trade openness the researcher assumes there would be bidirectional relationship between trade openness and economic growth can be modelled in log-linear form as follow:

$$LTOP_t = \beta_0 + \theta_1 LEG_t + \delta_1 LREM_t + \pi_1 LEEEX_t + \alpha_1 LCA_t + \beta_1 LL_t + \mu_t \dots \dots \dots (3.7)$$

Where:

$\theta, \delta, \eta, \pi, \alpha \& \beta$ are coefficients of the variables to be estimated in the trade openness model.

μ_t = random error term

t = the time trend

3.4 Measurements and Description of Variables

In this sub-section we would discuss some of the main measurement and description of variables of real gross domestic product (RGDP), trade openness (TOP), capital expenditure (CA), remittance (REM), labor force (LAB) and education expenditure (EEX).

Economic growth: is an increase in the produced goods and services items of values or volumes during in the given time period especially in the given year and country. Mathematically economic growth calculated as percentage increase of the real gross domestic product (Yifru, 2015). Economic growth expected to have positive impact on trade openness because when the economy growing, the productivity of the country accelerated and which increases demand for import due to higher income of house hold or increase exports of goods and services.

Trade Openness (TO): many researchers have used different measures for trade openness (you can see from the statement of the problem), but in this study the researcher would use the most commonly used measures of trade openness which is the ratio of total trade to real gross domestic product. Trade Openness is the ratio of total trade (total exports of goods and services and total imports of goods and services) to gross domestic product. The effects of total trade on economic growth could be positive or negative which depends on different

factors like trade balance, political and economic levels, macroeconomic stabilities and other factors (Getie, H. and Liu, 2019). But in this study, trade openness supposed to have positive impact to economic growth because as mentioned in the theoretical and conceptual framework, trade openness can boost economic growth typical for Ethiopia through importing of capital goods, semi-finished goods, raw materials and others for further production, encouraging to foreign direct investors with their capital i.e. financial capital and physical capitals, technological transfer from technology advance countries and other mechanisms. Therefore, the researcher highly believed trade lead growth hypothesis is also appropriate for Ethiopia.

Public expenditure on education is direct expenditure on education and education institutions or it is subsidy given to house-hold and educational institutions. It is the share of government expenditure from the given real gross domestic product or economic growth. Public expenditure on education is the total spending on education by the federal government, regional states as well as other public agencies such as schools, universities and others (OECD). Public expenditure on education is proxy for human capital in this case, and then it is expected to have positive impact on both models of economic growth and trade openness. Human capital increases the capability of productivity and which enhances production of goods and services in the country, at the same time it improves economic growth and trade transaction in the global market.

Capital expenditure is the amount of public expenditure whose benefits lasts more than one budget year and that provide benefit to the public and enhances wealth of the country. Capital expenditure can be either directly provide benefit to the public such as ambulance service, roads and bridges and others or the benefited the public indirectly for instance construction on governmental buildings, official vehicles and others (Iskandar, M. & Revmianson, N., 2018). There is no doubt that, developing country like Ethiopia there is a limitation of physical capital, therefore, obtain such goods is expected to increase economic growth and trade openness.

Labour force: according to the international labour organization, labour force is defined as the people who are economically active i.e. people who supply to the labour force for the productive purpose or producing goods and services in the given economy with in the country. Labour force is the summation of employed and unemployed and it includes unemployed armed forces and first time job seekers. Opposite to this labour force excludes unpaid caregivers, home servants and workers in the informal section (Bahmani-Oskooee,

M., Economidou, C. and Goswami, G., 2015). Ethiopia is one of the most populated countries in Africa and which have a large amount of people who engaged and want to engage in different tasks in the country. Agriculture is the dominant sector economy in the country and more than half population engaged in that sector. Therefore, labour is expected to have positive impact on economic growth. But labour in Ethiopia is expected to have negative impact on trade openness because labours are not educated and familiar with these advanced technologies and the labours are dominated in the informal sectors.

Remittance: is the transfer of money/good and services to the private individuals or households through migrants who are outside of the country. The number of internal and international migrants from less developed country to the developed economy is increasing rapidly. Remittance plays great role in economic growth and economic development of the recipient countries (Giorgis, M., K. and Molla, M., 2013). Remittance is a direct foreign currency source and which may directly use for consumption via importing consumption goods or used for further investment in the country. Therefore, the researcher remittance expected to have negative impact for economic growth because since Ethiopia is a net importer and which is scarce with hard currency, remittance may use to finance for importing goods and services. An increase importing of goods and services greater than exporting of goods and services (negative trade balance), leads to deteriorating of current account and then economic growth in the long run. But the researcher expected, remittance to have positive impact to trade openness because as we mentioned, remittance may financing importing of goods and services, so that, the share of trade to economic growth increases.

3.5 Descriptive analysis

Descriptive statistics is very crucial in demonstrating clue about measurements of central tendency (mean, mode and median), measurement of dispersion (range, variance, standard deviation and others), checking the presence of outliers and testing normality. Normality of the variables that are measured through Skewness which measures the degree of symmetry or the flatness of the distribution of the series around its mean and kurtosis measures the sharpness (the tallness and flatness) of the distribution of the variable around its mean. If the variable has positive value in its skewness, it has right tail but if negative value, it would have left tail. If the variable has zero value, the variable is normally distributed or the distribution is symmetric around its mean which is the desire one. If the value of the kurtosis has three which shows the series is normally distributed and which is called mesokurtic. If the value of the kurtosis is greater than three, the series has positive kurtosis and the series is peaked

curve relative to normally distribute which is called leptokurtic. If the variable has negative kurtosis i.e. less than three or less than the mean value of the sample which is called platykurtic.

3.6 Econometric Framework

Selecting appropriate methodology is leading to appropriate inference for further results from the regression results of the time series data. But if the researcher applying wrong methodology during analyzing of the times series data, the result would be biased and unrealistic estimates.

So as to determine the stationary of the variable, the method selection for the time series data should be based on the unit root test result. The methodology which is appropriate for analyzing the stationary time series data must not be analyze for non-stationary time series data i.e. if the desire data is requires to be stationary, no need to use non-stationary data. If all the variables of time series data are stationary at level the appropriate methodology to apply is the vector autoregressive (VAR) model. But if all the variable s of the time series data are stationary at first difference applying vector error correction model (VECM) is the best selecting method. If some of the variables are stationary at level but some of the other variables are stationary at first difference then, applying autoregressive distributed lags (ARDL) is appropriated(Shrestha, M. & Bhatta, G. , 2017).

If the variables are integrated of the same order or integrated of order one I (1), that represents the existing of long run equilibrium relationship between the series. Then to estimate the short run and long run relationships of the variables applying vector error correction model (VECM) is preferable. The general regression equation for VECM is formed as follows:

$$\Delta LY_t = \alpha_1 + \sum_{i=1}^{p-1} \beta_{1i} \Delta LY_{t-i} + \sum_{i=1}^{p-1} \beta_{2i} \Delta LX_{2t-i} + \sum_{i=1}^p \gamma_{1i} \Delta LZ_{1t-i} + \mu_{1t} \dots \dots \dots (3.8)$$

$$\Delta LX_t = \alpha_2 + \sum_{i=1}^{p-1} \psi_{1i} \Delta LY_{t-i} + \sum_{i=1}^{p-1} \psi_{2i} \Delta LX_{t-i} + \sum_{i=1}^p \gamma_{2i} \Delta LZ_{2t-i} + \mu_{2t} \dots \dots \dots (3.9)$$

Where:

β_1, β_2, ψ_1 and ψ_2 = the short-run coefficients

γ_1 and γ_2 = the error correction instrument

Δ = the difference operator

t = the time trend

L = log

The co-integration rank represents the number of co-integrating vectors, for instance if the co-integration rank represents two then that represents the combinations of the two non-stationary linear independent variables would be stationary. The vector error correction terms (VECT) which are indicated in the above equation 3.8 and equation 3.9, γ_{1i} and γ_{2i} coefficients expected to be negative and significant at five percent level of significance and these show the speed of adjustment from the short-run fluctuation to the long run equilibrium (Ada, O., Oyeronke, A., Odunayo, A., Okoruwa, V. & Obi-Egbedi, O., 2014).

3.6.1 Unit Root Tests

The way of determining stationary of the variables is called ‘unit root test’. The most widely applied methods of testing stationary are Augmented Dickey Fuller (ADF) and Philips Peron (PP). Let’s discuss in detail each of the tests as follow:

3.6.1.1 Augmented Dickey Fuller (ADF) test

In time series data to estimate appropriately variable must be stationary. As the researcher taken from the journal of (Shrestha, M. & Bhatta, G. , 2017), the most common known method to estimate the unit root is the Augmented Dickey Fuller (ADF) test. The following equation 3.10 i.e. the Augmented Dickey Fuller (ADF) test would test the unit root as follow:

$$\Delta Y_t = \delta + \rho Y_{t-1} + \sum_{i=1}^k \beta_i \Delta Y_{t-1} + \epsilon_t \dots \dots \dots (3.10)$$

Where,

$$\rho = \alpha - 1$$

α = coefficient of Y_{t-1}

ΔY_{t-1} = first difference of Y_t

The null hypothesis for Augmented Dickey Fuller (ADF) test is $\rho = 0$ against to the alternative hypothesis of $\rho < 0$. If we accept the null, the variable is non-stationary but if we reject the series the variable is stationary.

3.6.1.2 Philips Perron (PP) test

The (Phillips, P. C., & Perron, P., 1988) (PP) test model used to test for the presence of a unit root and which is an alternative testing method for ADF test. The following equation 3.12 i.e. the (Phillips, P. C., & Perron, P., 1988) (PP) test would test the unit root as follow:

$$\Delta Y_t = \lambda Y_{t-1} + \tau_i D_{t-1} + \epsilon_t \dots \dots \dots (3.11)$$

Where,

ε_t is order I (0) with zero mean and D_{t-1} is a deterministic trend component.

The hypothesis is tested for $\lambda = 0$. The PP test is a non-parametric i.e. no need to specify the form of the serial correlation of ΔY_t under the null hypothesis which makes difference between Philips Perron (PP) test and Augmented Dickey Fuller (ADF) test. Therefore, the calculation procedure of the t-ratio to get the value of λ becomes different. Although, Augmented Dickey Fuller (ADF) test is more reliable than PP test, the PP test is proposed for the large volume of financial data and that corrects the statistics to consider the autocorrelation and heteroscedasticity issues.

3.6.2 Co-integration Test

The next step i.e. after testing the stationary of the time series data or after having the same order of integration the author would test the presence of co-integration. The need to test Co-integration is to study the existence of long-run relations between the variables (one or more variables). The existence of long-run relations between the variables represents the gap or difference between the variables is constant or the series in the long run move closely each other or the series are existing long run equilibrium relationship between the series (Hall, S. & Henry, S., 1989).

Based on the (Johansen, S. & Juselius, K., 1990) study, if all the variables are integrated of the same order i.e. I (1) or if all the variables are stationary at first difference, the variables are said to be existing co-integration. The (Johansen, S. & Juselius, K., 1990)co-integration test applied both the Trace and maximum Eigen value tests based on the null hypothesis i.e.no co-integrating and the alternative hypothesis which is presenting of co-integration. The null hypothesis is rejected for the Trace and maximum Eigen value tests, if the test statistic value is greater than the critical value or if the p-value is less than five percent level of significance. The Johansen co-integration test can be modeled as:

$$X_t = A_1 X_{t-1} + X_{t-1} + \varepsilon_t \dots \dots \dots (3.12)$$

$$X_t = (A_{t-1}) X_{t-1} + \varepsilon_t \dots \dots \dots (3.13)$$

$$X_t = \Pi X_{t-1} + \varepsilon_t \dots \dots \dots (3.14)$$

Where,

X_t And ε_t are ($\eta.1$) vectors

A_1 =an ($n \times n$) matrix of parameters

I = an ($n \times n$) identity matrix

$t - 1$ = time trend

$\Pi = A_{1-1}$

ε_t = a vector of random errors

If the rank of A_{1-1} matrix, which is the rank of $\Pi=0$, it is said to be, the model or the series is faced with the problem of non-stationary but if the rank of $\Pi=k$, the series is stationary and that is said to be, co-integration is exist. If the model is existing co-integration, thus VECM is appropriate and which is used to address the short run and long run model. The following VECM model (equation) 3.15 and 3.16 can be derived from the general model (equation) of VECM 3.8 and 3.9, as follow:

$$\Delta LEG_t = \beta_0 + \sum_{i=1}^{n-1} \eta_i \Delta LTOP_{t-i} + \sum_{i=1}^{n-1} \delta_i \Delta LREM_{t-i} + \sum_{i=1}^{n-1} \pi_i \Delta LEEX_{t-i} + \sum_{i=1}^{n-1} \alpha_i \Delta LCA_{t-i} + \sum_{i=1}^{n-1} \beta_i \Delta LLAB_{t-i} + \Omega ECT_{1t-i} + \mu_t \dots \dots \dots (3.15)$$

$$\Delta LTOP_t = \nu + \sum_{i=1}^{n-1} \eta_i \Delta LEG_{t-i} + \sum_{i=1}^{n-1} \delta_i \Delta LREM_{t-i} + \sum_{i=1}^{n-1} \pi_i \Delta LEEX_{t-i} + \sum_{i=1}^{n-1} \alpha_i \Delta LCA_{t-i} + \sum_{i=1}^{n-1} \beta_i \Delta LLAB_{t-i} + \Psi ECT_{2t-i} + \varepsilon_t \dots \dots \dots (3.16)$$

Where:

ECT_{1t-1} and ECT_{2t-1} = lagged values of the error terms

Ω, Ψ = coefficients of the error correction terms

μ_t, ε_t = random error terms

The coefficients of error correction terms must be negative in sign and statistical significant to exist the long-run Granger causality between the variables (if the coefficients of the error terms i.e. Ω and Ψ are significant or rejected the null hypothesis then there would be long run equilibrium relationships (Ahmed, 2013).

3.6.3 Granger Causality Test

The Granger causality test is used to predict and reflect the correlations between time series variables based on the linear regression model. The Granger causality test used to provides past information of one variable (X) to explain the current value and enhance the prediction of another variable (Y). Or when a variable X is caused by Y if X is better predicted from the past value of Y and X together rather than from the past values of X alone. So that, the granger causal relationship could be unidirectional causality from X to Y or from Y to X. the relationship between X and Y can also be bidirectional causality running from X to Y and Y to X or no granger causal relationship between X and Y. this paper also adopted the granger

causality technique to examine the causal relationship between trade openness and economic growth in Ethiopia based on the equation specified as follow:

$$LEG_t = \Phi + \sum_{i=1}^n \eta_i LTOP_{t-i} + \sum_{j=1}^n \delta_j LREM_{t-j} + \sum_{k=1}^n \pi_k LEEX_{t-k} + \sum_{l=1}^n \alpha_l LCA_{t-l} + \sum_{r=1}^n \beta_r LLAB_{t-r} + \mu_{1t} \dots \dots \dots (3.17)$$

$$LTOP_t = v + \sum_{i=1}^n \eta_i LEG_{t-i} + \sum_{j=1}^n \delta_j LREM_{t-j} + \sum_{k=1}^n \pi_k LEEX_{t-k} + \sum_{l=1}^n \alpha_l LCA_{t-l} + \sum_{r=1}^n \beta_r LLAB_{t-r} + \mu_{2t} \dots \dots \dots (3.18)$$

Where:

n, the optimal lag length and Φ and v are intercepts

$\eta_i, \delta_j, \pi_k, \alpha_l$ and β_r = short run dynamic coefficients of the model's adjustment long run coefficients

μ_{it} = random error term

t = the time trend

The hypotheses from equation 3.17 and equation 3.18 for trade openness and economic growth would be:

H₀: $\eta_i = 0$ which means LTOP does not granger cause ΔLEG

H₁: $\eta_i \neq 0$ which means LTOP granger cause ΔLEG

The same mechanism is applied to both models for the entire variables each with each independent (trade openness and economic growth).

3.6.4 Diagnostic Tests of the Time Series Model

The estimated model must be robust and unbiased. Hence, to check the model should be checked the goodness of fit via statistics and conducting diagnostics tests.

3.6.4.1 Goodness of Fit

The main reason to apply the goodness of fit on the estimated regression coefficients is to check if the estimated coefficients hold the robustness and unbiased in the given model. The robustness of the estimated regression coefficients can be measured; how good is the estimated regression line explain the variables or the data, is the whole model is statistically significance or not, is there serial correlation in the residuals or not and if the model is free from serial correlation, statistically significant, the coefficient line explained the data and others. In view of this, the model is good for the future analysis. Goodness of fit tests are applied in all most all, software's and the most known tests for goodness of fit tests are R

square which values range from zero to one and the value closer to one is considered to be better, the Durbin Watson statistics that is used to check the presence of autocorrelation in residuals. The Durbin Watson statistics ranges from one to four and if the Durbin Watson statistics is closer to two then the model said to be free from Durban autocorrelation and the F statistics which is used to test the overall significance of the model

3.6.4.2 Diagnostics Tests

The main purpose of testing the goodness of fit through the diagnostic test is to check the robustness of the estimated coefficients. The diagnostic tests required to report separately because the diagnostic tests are not shown automatically in the regressed results by the econometric software. There are different types of diagnostic tests. But based on the modelling techniques the most common used Diagnostic tests in many empirical studies are coefficient diagnostics, residual diagnostics and lag structure. From these different Diagnostic tests, residual diagnostics is the most desirable in econometric modelling because residual diagnostics minimizes the error while estimating in the regression model. Residual diagnostics investigates the errors term whether the errors are achieved the desired characteristics of an innovation or not i.e. an error is expected to be white noise or the independently and identically distributed. The most popular methods of testing the residual diagnostics tests are serial correlation, Lagrange multiplier (LM) test and heteroscedasticity tests (Shrestha, M. & Bhatta, G. , 2017).

3.6.5 Variance decomposition (VD) and Impulse Response Function (IRF)

Different empirical studies have been mentioned that, the interpretation of the adjustment coefficient of short run fluctuations to the long run equilibrium through the error correction model is difficult in the vector auto-regressive model (VECM). Hence, it is assumed that, it is appropriate applying the impulse response function (IRF) and the variance decompositions (VD) for these dynamic models. The impulse response function also called dynamic multipliers shows, the respond of the dependent variable dynamically to one standard shocks comes from another variable. The impulse response function also indicates the impact of sudden temporary change shocks, on other variable that included in the model and upon the variable itself or it shows, the future path of the variables to shocks in the error term. The impulse response function portrays the direction and size effect of one standard shock on one variable and in turn the shock effects on other variables in the system overtime. Or it indicates a one unit structural shock to one variable affects for the whole variables in the given model. The impulse response function presented both in magnitude and sign and it is

more rely on signs of the estimate because the sign shows the impact of the shock in economic content or meaning but the magnitude shows the statistical influence impact of the shock.

The variance decomposition function (VDF) showed that, each variable which are found in the auto regressive model (VECM) provides information to the other variables with in the model. In the forecast error variance decomposition analyze, it measures how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables (Ojewum, S. & Akinlo, A., 2017).

3.6.6 Model Stability

The cumulative sum (CUSUM) and cumulative sum of square (CUSUM SQ) tests are applied to assess the stability of coefficients in the multiple linear regression models of the long-run coefficient together with short run dynamic and which is applied to the residuals of the series included in the model (Pearson and Pearson, 1997). The null hypothesis for the CUSUM and CUSUM SQ tests are desirable for all the series coefficients in the VECM model meaning that, the line of significance which is lie within the two pair of straight lines drawn at 95% level of significance or lies within the critical bound of 95% level of significance. But the null hypothesis is rejected if the line is lies outside/crossed the two pair of straight lines drawn at 95% level of significance. The cumulative sum of square (CUSUM SQ) test is tested based on the square recursive residuals (Altaee, H., Saied, S., Esmael, E. & Mohammad, M., 2014).

Chapter Four: Estimation Technique

4.1 Introduction

The first task for the researchers in this chapter would be describing the descriptive statistics part and the next part would estimate the econometrics technique in which the following activities would be takes place as follow: checking whether the variables are stationary or not. Time series data by their nature are not stationary at level, so the first work is transforming the variables to stationary via differencing. The next step would testing for the presents of co-integrate between the variables to determine the long run equilibrium relationship. The long run relationship among variables included in the model is proved byapplying co-integrations mechanism if the variables are integrating of the same order or I(1) and the researcher would utilised vector error correction model(VECM) to run the short run and the long rum models.

4.2 Descriptive statistics

4.2.1 Ethiopia Balance of Trade

During the fiscal year 2019/20, the Ethiopian trade deficit was narrowed from \$12.4 billion to \$10.9 billion a year earlier; this was due to fall in goods import and increasing in goods export. As a result of this, the ratio of merchandise trade to gross domestic product (GDP) stood at 10.1 percent (NBE, FY 2019/20).

4.2.1.1 Merchandise Export

During the fiscal year 2019/20, total merchandise export was growing up annually by 12 percent. The main driving reason to grown the Ethiopian merchandise export was as a consequences of higher export revenue from coffee , flower, gold, live animal, chat, textile and textile products and electricity by 12.0 percent, 64.6 percent, 604.5 percent, 18.1 percent, 6.9 percent, 10.5 percent and 19.3 percent, respectively.

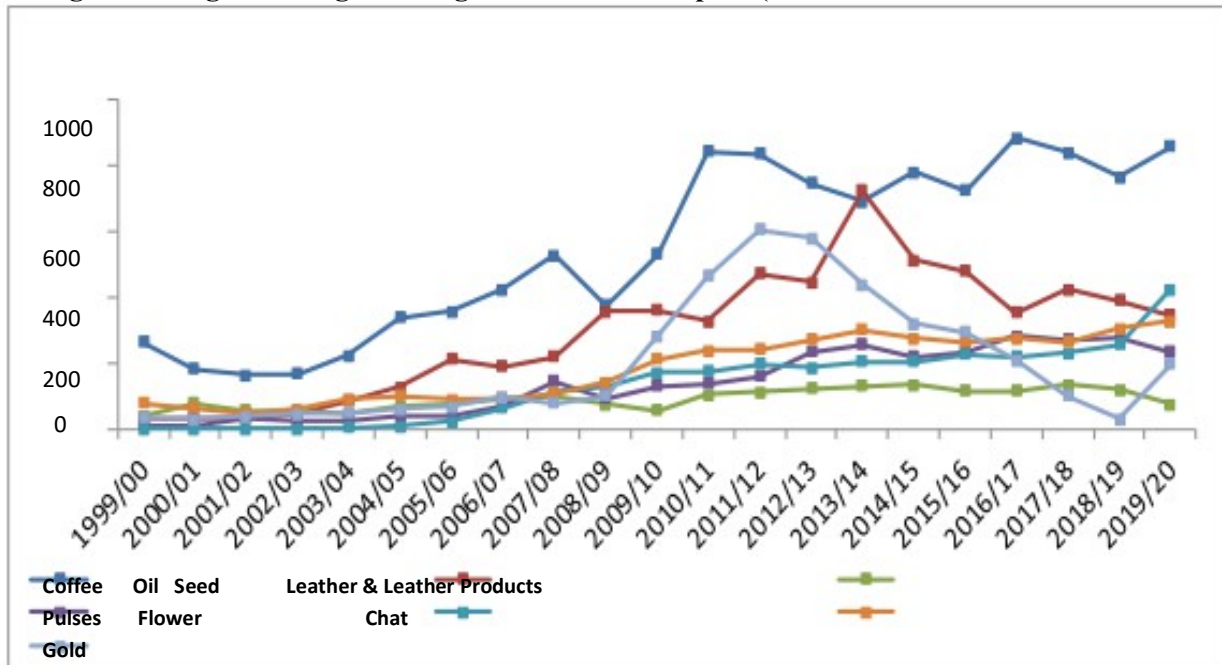
As we can see from the pie chart fig 3.2., the share of coffee is the dominant sector which share from the total merchandise goods export is 28.6 percent and the remaining export products that are Flower(14.1 percent), Oilseeds(11.5 percent), Chat(10.9 percent), Pulses(7.9 percent), gold(6.6 percent), textile & textile products(5.7 percent), leather and leather Products(2.4 percent), meat & meat products(2.3 percent), electricity(2.2 percent), fruits &vegetables(2 percent), live animals(1.8 percent) and others share (4 percent), respectively(NBE, FY 2019/20).

Table 4.1: Values of Major Export Items (In millions of USD)

Particulars	2017/18		2018/19		2019/20		Percentage Change	
	A	%share	B	%share	C	%share	B/A	C/B
Coffee	839.0	29.6	764.1	28.7	855.9	28.6	2.0	12.0
Oilseeds	423.5	14.9	387.8	14.5	345.0	11.5	- 18.5	-11.0
Leather and Leather Products	132.4	4.7	117.4	4.4	72.0	2.4	-45.6	-38.6
Pulses	269.5	9.5	272.3	10.2	234.8	7.9	-12.8	-13.8
Meat & Meat Products	101.7	3.6	88.6	3.3	67.4	2.3	-33.7	- 23.9
Fruits & Vegetables	61.4	2.2	60.9	2.3	58.8	2.0	-4.2	-3.4
Textile & Textile Products	103.8	3.7	152.9	5.7	168.9	5.7	62.6	10.5
Live Animals	61.1	2.2	45.8	1.7	54.1	1.8	-11.5	18.1
Chat	263.2	9.3	303.6	11.4	324.4	10.9	23.3	6.9
Gold	100.2	3.5	27.9	1.0	196.5	6.6	96.2	604.5
Flower	228.6	8.1	256.6	9.6	422.3	14.1	84.7	64.6
Electricity	80.5	2.8	55.7	2.1	66.4	2.2	-17.4	19.3
Others	171.2	6.0	132.9	5.0	121.1	4.1	-29.3	-8.9
Total Export	2,836.1	100.0	2,666.5	100.0	2,987.7	100.0	5.3	12.0

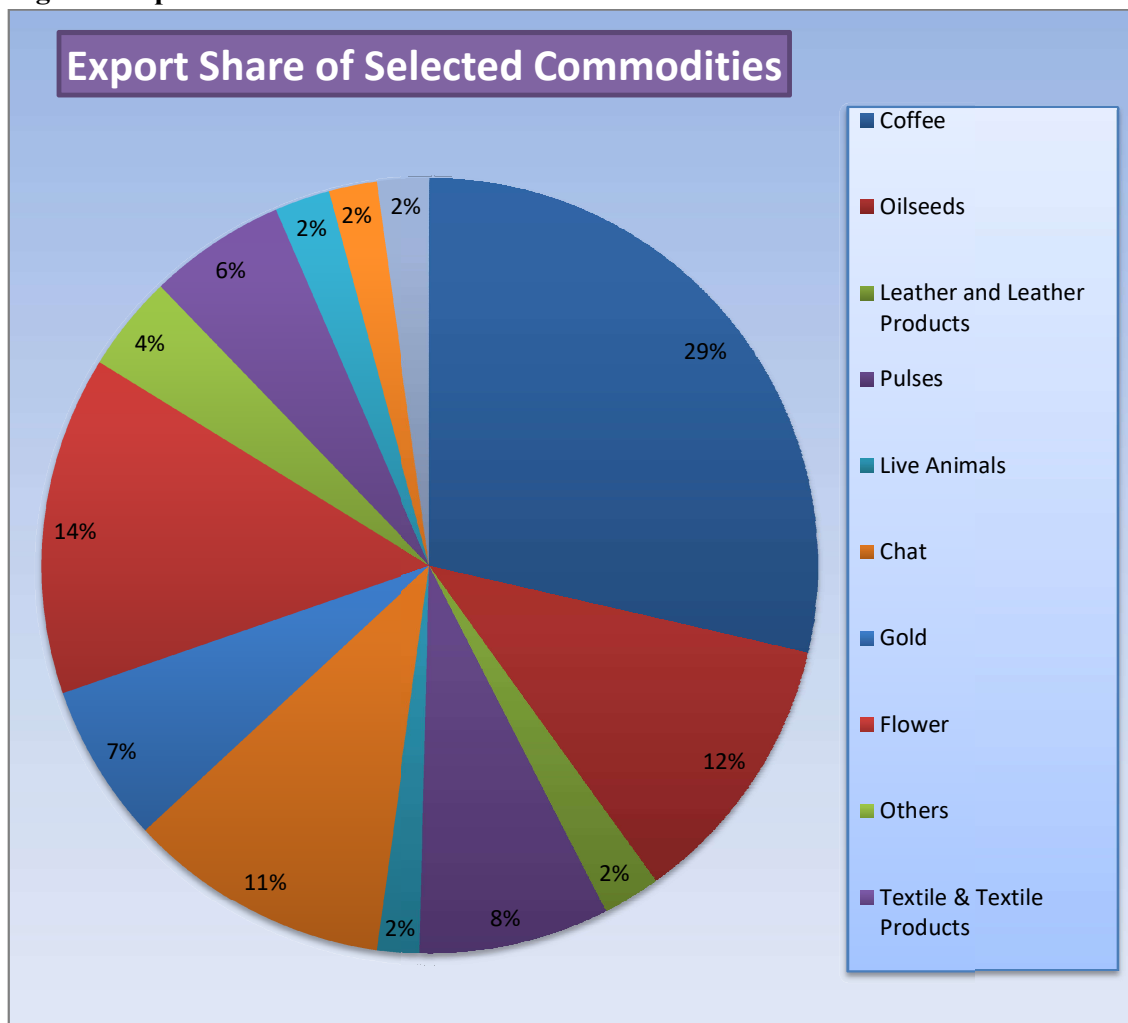
Source: National bank of Ethiopia

Fig. 4.1 Foreign exchange earnings from selected export (In millions of USD)



Source: National Bank of Ethiopia

Fig. 4.2: Export Share of Selected Commodities



Source: National Bank of Ethiopia

4.2.1.2 Import of Goods

During the fiscal year 2019/20, total merchandise import was \$13.9 billion which declined annually by 8.1 percent. The most rationality for declining the merchandise import was due to lowering imports of capital goods, consumer goods and bill of import. However, imports were increased annually for semi-finished goods, raw materials and miscellaneous goods. The ratio to merchandise import was declined by 12.9 percent compared to the last year the same period by 15.8 percent. In detail the import for capital goods, transport capital goods, industrial goods and agricultural capital goods were declined by 18.1 percent, 72.2 percent, 2.6 and 50.7 percent, respectively to the last year the same period.

From the total merchandise import, Consumer goods import was \$ 4.0 billion and its share from the total merchandise import was 28.9 percent which slightly higher than 28.3 percent

of last year the same period. And from the total merchandise import, Semi-finished goods import was \$3.1 billion, and its share from the total merchandise import was 22.4 percent which slightly higher than 18.4 percent of last year the same period (NBE, FY 2019/20).

Table 4.2: Value of Imports by End Use (In Millions of USD)

Categories	2017/18		2018/19		2019/20		Percentage change	
	A	% share	B	% share	C	% share	B/A	C/B
Raw Materials	138.0	0.9	151.5	1.0	162.2	1.2	9.8	7.0
Semi-finished Goods	2,527.8	16.6	2,778.8	18.4	3,110.7	22.4	9.9	11.9
Fertilizers	478.5	3.1	499.7	3.3	597.8	4.3	4.4	19.6
Fuel	2,319.3	15.2	2,600.7	17.2	2,088.1	15.0	12.1	-19.7
Petroleum Products	2,227.2	14.6	2,493.4	16.5	2,003.7	14.4	11.9	-19.6
Others	92.0	0.6	107.3	0.7	84.3	0.6	16.7	-21.4
Capital Goods	5,269.1	34.5	5,030.6	33.3	4,122.0	29.7	-4.5	-18.1
Transport	1,130.9	7.4	1,429.2	9.5	397.6	2.9	26.4	-72.2
Agricultural	51.5	0.3	58.6	0.4	88.2	0.6	13.7	50.7
Industrial	4,086.7	26.8	3,542.9	23.4	3,636.2	26.2	-13.3	2.6
Consumer Goods	4,707.0	30.9	4,273.1	28.3	4,010.6	28.9	-9.2	-6.1
Durables	1,351.7	8.9	1,200.7	7.9	920.5	6.6	-11.2	-23.3
Non-durables	3,355.3	22.0	3,072.3	20.3	3,090.1	22.3	-8.4	0.6
Miscellaneous	294.2	1.9	277.2	1.8	387.8	2.8	-5.8	39.9
Total Imports	15,255.3	100.0	15,112.0	100.0	13,881.3	100.0	-0.9	-8.1

Source: National Bank of Ethiopia

4.2.2 Descriptive Statistics Analysis

The following descriptive statistics give detail information about the raw data and which is measured in millions birr.

The descriptive statistics, the average value of economic growth (EG) for the sample period of 1980/81 to 2020/21 data is, 666,898Birr with minimum and maximum values of 201,252Birr and 2,228,081Birr, respectively, for trade openness (TOP) i.e. the total trade share to economic growth is about 35 percent with minimum and maximum percentage share of 13 percent and 56.8 percent respectively, private remittance (REM) has the average value of 36,456 Birr, with minimum and maximum values of 66.2Birr, and 247,642.2Birr, respectively and for the remain variable can be seen from the following summary statistics table 4.3. From the above explanation private remittance, faced with problem of outlier because the maximum value for it is different from the other order of observations (mean, median and normality) that is why it has higher peaked at 5.54 or have higher kurtosis.

The standard deviation shows the deviation or the spread of the variable's value from its own sample mean. Economic growth deviates from its mean value by 568,585.3 Birr which is very high this may be due to fluctuations in our primarily agricultural production since which is the dominant sector in our economy. Trade openness deviates from its own sample mean by 11.7 percent which is good. Labour force deviates from its sample mean by 64,682.2 that is above its own sample mean which shows in our country, labour force engagement in the work is dominated by seasonal or daily workers. The same interpretation is given to the remaining variables from the statistical result below.

Economic growth (EG), Labour force (LAB), trade openness (TOP), capital expenditure (CA), education expenditure (EEX) and remittance (REM) have positive skewness i.e. 1.31, 0.12, 0.81, 1.58, 0.5 and 1.84, respectively. Positive skewness indicates the series are distributed from the mean to the right and which has right tail. Economic growth (EG), the capital goods expenditure (CA) and , remittance (REM) have greater than four or positive kurtosis value which shows the variables have peaked curve relative to their mean kurtosis or normal distribution and the variables have leptokurtic shape. The remaining variables which are Labour force (LAB), trade openness (TOP) and education expenditure (EEX) have lower than three and variables have platykurtic shape.

The normality for the series is also tested via Jarque-Bera test. As can be seen from the descriptive statistics result, the probability of the p-value for trade openness (TOP), Labour force (LAB) and education expenditure (EEX) is 0.36, 0.83 and 0.15, respectively which are greater than five percent, thus the variables are normally distributed. But the variable economic growth (EG), capital expenditure (CA) and remittance (REM) have p-value of 0.002, 0.00 and 0.00, respectively which are less than five percent the model accepts the null hypothesis i.e. thus are not normally distributed for the raw data.

Jarque-Bera test statistics measures the differences of the skewness and the kurtosis of the variable with those from the normal distribution. As we can see from the below table 4.1, the variable economic growth (EG), capital expenditure (CA) and remittance (REM) have higher kurtosis value than the mean at the same time the variables have lower skewness value or have left tail. Both the skewness and the kurtosis values for these variables are not normally distributed and their standard deviation is dispersed above the mean or almost the same with their mean.

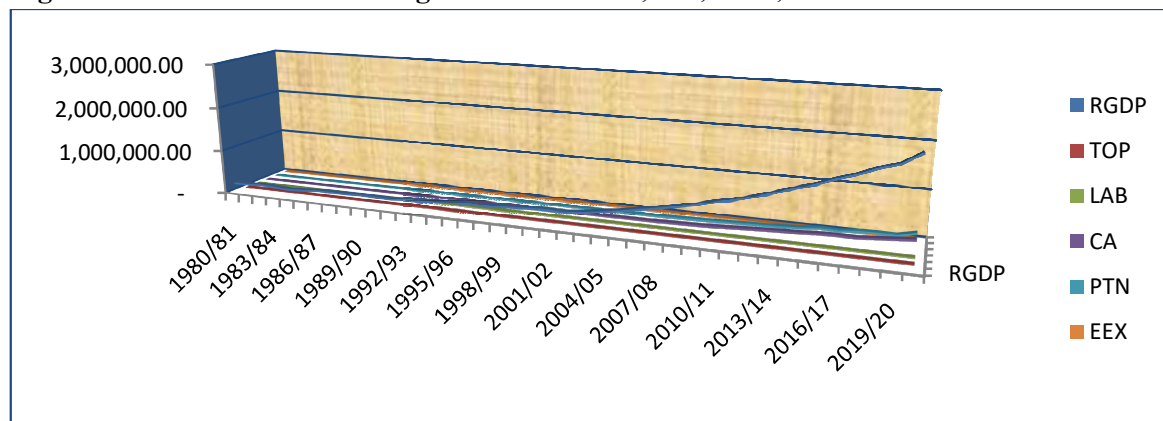
Table 4.3 Summary Statistics

	EG	TOP	LAB	CA	EEX	REM
Mean	666896.0	0.350956	32.52315	41249.79	0.025252	36456.79
Median	390102.9	0.341655	28.58510	4912.466	0.023530	3707.733
Maximum	2228081.	0.567761	62.60202	235409.7	0.035710	247642.6
Minimum	201252.8	0.132918	16.24250	487.0030	0.017383	66.20000
Std. Dev.	568585.3	0.117868	13.45908	64682.21	0.004792	60896.81
Skewness	1.314741	0.119447	0.811376	1.581328	0.494159	1.838773
Kurtosis	3.529595	1.927387	2.474692	4.280364	2.182392	5.537174
Jarque-Bera	12.29085	2.062932	4.970004	19.88795	2.810644	34.10106
Probability	0.002143	0.356484	0.083325	0.000048	0.245288	0.000000
Sum	27342737	14.38919	1333.449	1691241.	1.035323	1494728.
Sum Sq. Dev.	1.29E+13	0.555716	7245.870	1.67E+11	0.000918	1.48E+11
Observations	41	41	41	41	41	41

Source: Author's computation in Eviews 9

Figure 4.3, illustrates the trend in economic growth (EG) with trade openness (TOP), Labour force (LAB), capital expenditure (CA), education expenditure (EEX) and remittance (REM). The study ranges from the period of 1980/81 to 2020/21 and it is better to see the period in two ranges. The period from 1980/81 to 2002/03 shows all most all the variables (economic growth (EG) with trade openness (TOP), Labour force (LAB), capital expenditure (CA), education expenditure (EEP) and remittance (REM) move together parallel smoothly for about twenty two years but afterward, from the period 1983/84 to 2020/21, economic growth dramatically increase at higher speed compare to the others.

Figure 4.3 Trends of Economic growth with LAB, CA, TOP, REM and EEX

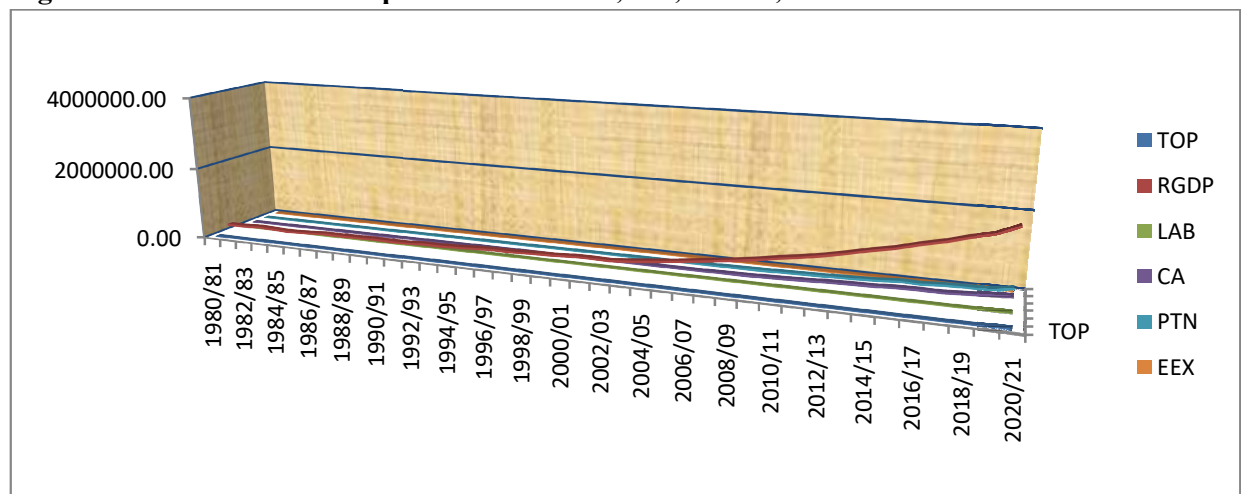


Source: Author's computation in Excel

Similarly, capital expenditure (CA), education expenditure (EEX) and remittance (REM) shows an improvement but not similar as the speed of economic growth rather these variables show a little improvement. But trade openness and labour force have still continued with the same rate or move parallel from the beginning to the end period with similar trend (1980/81 to 2020/21).

Figure 4.4 illustrates, the trend of trade openness (TOP) with economic growth (EG), Labor force (LAB), capital expenditure (CA), education expenditure (EEX) and remittance (REM). This figure shows the same trend and interpretation as the above figure 4.3 which we have discussed above.

Figure 4.4 Trends of Trade openness with LAB, CA, RGDP, REM and EEX



Source: Author's computation in Excel

4.3 Unit root Result

The mean and the variance of the stationary variable do not change over time and hence the mean and variance are time independent. However, stationary problem is unlikely exist for most macro variables despite it is a key requirement for the validity of time series regression. If the variables are not stationary in level, it is required to transform the variable towards stationary process through differencing before proceed to the next step.

The Augmented Dickey-Fuller and PP unit root tests with intercept would have applied to determine the order of integration of the variable. The hypothesis for both the null hypothesis and the alternative hypothesis would be presented as follows:

$H_0 = \rho = 0$; there is a unit root or non-stationary

$H_1 = \rho < 0$; the time series is stationary

Accepting the alternative hypothesis is the desired one which means the series is stationary or the series is integrated of order one I (1). Opposite to this, the null hypothesis, there is a unit root concern, or variables are not stationary. The acceptance of the level of stationary is based on, either comparing t statistic against critical values or significance of p-value of the respective variable. If the test statistic is less than the test critical values or if the p-values are greater than conventional significance levels (1 percent and 5 percent), all included variables are non-stationary in their levels. There is a need for these variables to difference to make them stationary.

The results of ADF and PP unit root tests in table 4.4 indicated that, all variables are non-stationary at level meaning that, there is a unit root problem in order of I (0). But all the time series variables are stationary at first differenced or the variables are co-integrated of same order I (1) at 5% level of significance. Thus, the variables are free from the issue of unit root that is showing, the existing of long run relationship among the variables.

Table 4.4: Unit root test Estimation

Variables	Test Method	In level with intercept		First difference with intercept	
		test statistic	p-value	test statistic	p-value
LEG	ADF	2.612	1.000	-4.546	0.000
	PP	2.620	1.000	-4.474	0.000
LTO	ADF	-1.443	0.551	-6.125	0.000
	PP	-1.443	0.551	-6.125	0.000
LLAB	ADF	1.517	0.999	-3.069	0.037
	PP	2.091	0.999	-3.064	0.037
LCA	ADF	0.120	0.963	-6.463	0.000
	PP	0.145	0.965	-6.463	0.000
LEEX	ADF	2.324	0.169	-7.007	0.000
	PP	2.324	0.169	-6.971	0.000
LREM	ADF	-0.711	0.832	-5.637	0.000
	PP	-0.702	0.834	-5.614	0.000
Critical values					
1%		-3.610453		-3.610453	
5%		-2.938987		-2.938987	
10%		-2.607932		-2.607932	

Source: Author's computation in Eviews 9

As we can see from the above table 4.4, for the test critical value and test statistics value, at first difference the test statistics is greater than the test critical which means the variable are stationary. This is providing additional information to p-value regarding the significance level of the variables.

4.4 Lag Length Selection Criteria

Before estimating the VECM model, determining the number of lags is very important in econometrics studies because the larger the lag interval shows the dynamic nature of the model. But in this case, more parameters will be needed to be estimated to constantly reduce model degree of freedom. There are different methods of lag selection criteria, but the most popular method is Akaike's information criterion (AIC). The table 4.5 below for the economic growth model shown us that, there are three number of lag length, and it is the optimal lag order obtained from the result of lag length criteria at five percent level of significant. Since the researcher have used time series data, many researchers advised to use lower lag that is between one or two optimal lags but the author in this paper use three lags because there are forty-one observations and also the information criterion automatically selects the optimal length i.e. three lags. In the trade openness model in table 4.6 also shown, the author has obtained three optimal lags. Thus, in the next regression analysis the author would use three lags for both models.

Table 4.5: Lag length selection (economic growth)

Endogenous variables: LEC TOP LLAB CE EPG PTN

Lag	LogL	LR	FPE	AIC	SC	HQ
0	258.8225	NA	6.70e-14	-13.30645	-13.04788	-13.21445
1	506.1681	403.5639	1.02e-18	-24.42990	-22.61994*	-23.78593*
2	544.6865	50.68212	1.03e-18	-24.56245	-21.20109	-23.36650
3	598.3553	53.66882*	6.18e-19*	-25.49239*	-20.57963	-23.74446

Source: Author's computation in Eviews 9

Table 4.6: Lag length selection (trade openness)

Endogenous variables: TOP LEC LLAB CE EPG PTN

Lag	LogL	LR	FPE	AIC	SC	HQ
0	258.8225	NA	6.70e-14	-13.30645	-13.04788	-13.21445
1	506.1681	403.5639	1.02e-18	-24.42990	-22.61994*	-23.78593*
2	544.6865	50.68212	1.03e-18	-24.56245	-21.20109	-23.36650
3	598.3553	53.66882*	6.18e-19*	-25.49239*	-20.57963	-23.74446

Source: Author's computation in Eviews 9

4.5 Co-integration Result

Time series variables may stationary even the variables are not stationary or contain the problem of spurious regression. The only way solving these kinds of difficulty is when the variables are co-integrated of the same order. The variables are said to be co-integrated if the variables indicated the presents of long-run equilibrium relationship among the variables. To identify a long-run relationship among the variables, the Johansen (1988) co-integration test is readily used based on the trace tests and the maximum Eigen value tests.

Based on Khan (1999), from the trace tests and the maximum Eigen value tests the trace tests are more robust than the maximum Eigen in testing for co-integration. In this study, both the trace tests and the maximum Eigen tests have the same order of integration i.e. four co-integration equations and the hypothesis is presented as:

H₀: there are no co-integration equations

H₁: there are co-integration equations

if the test statistic is greater than the critical value or if the p-value is less than the critical values at five percent levels of significances, the null hypothesis would be rejected or accepting the alternative hypothesis. The Johansen co-integration results of the trace test in table 4.7 shown that, both the trace test and the max-Eigen value test (see from the appendix part for max-Eigen) have four co-integrating equation relationship because the trace test statistics is greater than the critical values or all the p-values are less than the critical values at 5 percent levels of significance.

The presents of co-integration relationship indicates the existing of a long-run relationship among the variables and then the paper would estimate the long run and short run model using VECM estimation method.

Table 4.7: Johansen test of co-integration
Series: LEC TOP LLAB CE EPG PTN

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.873947	219.0829	95.75366	0.0000
At most 1 *	0.765652	142.4541	69.81889	0.0000
At most 2 *	0.719622	88.76894	47.85613	0.0000
At most 3 *	0.547729	41.71911	29.79707	0.0014
At most 4	0.253862	12.36057	15.49471	0.1404
At most 5	0.040387	1.525323	3.841466	0.2168

Source: Author's computation in Eviews 9

4.6 Granger Causality Test

Economists have been debating about the importance of causality, some economists believed that granger causality is good for time series variable to examine the direction of causation between variables for robust policy formulation, opposite to this; some economists believed, running causality is not necessary. In this study, the researcher believed that, causality is appropriate to get additional information about the directional relationship between the variables in the models. In the above regression result, we have known statistical relationship but not their causality i.e. which variable influence to the other or to know their erogeneity (strong or weak) between the variables.

The Granger causality test is used to predict and reflect the correlations between time series variables based on the linear regression model. To test the causality among variables i.e. dependent variable and independent variable the author used Pairwise Granger Causality tests. The granger causal relationship could be bidirectional causality from X to Y or from Y to X. the relationship between X and Y can also be unidirectional causality running from X to Y or no granger causal relationship between X and Y. The null hypothesis for Granger Causality Test is:

H₀: X does not granger cause Y in the first regression

H₁: Y does not granger cause X in the second regression

The results of pair wise granger causality tests which are in tables 4.8 shows, the null hypothesis i.e. trade openness (LTO) does not Granger Cause economic growth (LEC) is rejected. The alternative hypothesis is accepted which is trade openness one way Granger Cause to economic growth at the 5% level of significance. The study supports trade lead growth hypothesis; trade openness accelerates moderate export and economic growth through efficient allocation of resources, transfer technology form advanced country, know how from developed nations and others mechanisms. All these factors increase the total factor productivity of the country and further accelerate economic growth (Hye Q. , 2012).

Labor force (LAB) and capital expenditure (CA), granger causes one-way to economic growth, at the 5% level of significance. This result keep up with the Solow's neoclassical economic theory i.e. economic growth can be achieved by properly utilizing labor force and physical capital. The abundant labors in Ethiopia are the dominant factor for enlarging productivity and then economic growth of the country. Public capital expenditure is also having positive impact on economic growth. Education expenditure (EEX) is also granger

causes one-way to economic growth, at the 5% level of significance. The long run economic growth regression result indicated, education expenditure negatively associated with economic growth, the granger causality test also shows education expenditure influences economic growth, but it does not indicate us its sign i.e. positively/negatively, it is only indicated us directional causality.

Capital expenditure (CA), granger cause one-way to labour force (LAB), at the 5% level of significance. Developing countries like Ethiopia are faced with scarce of modern technology, so increasing capital investment by the government should give priority to increase the labor productivity in the country.

Finally, remittance (REM) granger cause one-way to capital expenditure at the 5% level of significance. There is no doubt, since remittance is direct source of financial asset, it can use either directly in the home country for investment purpose or importing capital goods for further production purpose regardless of its amount. The remittance is a direct source of finance for capital expenditure in our country.

The following table 4.8 shows, pairwise granger causality tests which are presented the significant variables only but the remaining whole result, you can see from the annex part.

Table 4.8 Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
TOP does not Granger Cause LEC	38	4.77223	0.0076
LEC does not Granger Cause TOP	38	1.52663	0.2271
LLAB does not Granger Cause LEC	38	4.38006	0.0111
LEC does not Granger Cause LLAB	38	1.97380	0.1384
CE does not Granger Cause LEC	38	5.86886	0.0027
LEC does not Granger Cause CE	38	0.28514	0.8357
EPG does not Granger Cause LEC	38	3.02953	0.0441
LEC does not Granger Cause EPG	38	1.51537	0.2300
CE does not Granger Cause LLAB	38	7.67282	0.0006
LLAB does not Granger Cause CE	38	1.25008	0.3085
PTN does not Granger Cause CE	38	6.46682	0.0016
CE does not Granger Cause PTN	38	0.33509	0.8000

Source: Author's computation in Eviews 9

4.7 Vector Error Correction Models Result

If all variables are stationary at first difference or I (1), and the error term is stationary at level or I (0) it is said to be co-integration or long run relationship between the variables is existed. A vector error correction model is a restricted VAR model that has co-integration restrictions built in to the specification and it is allowing a wide range of short-run dynamics (Engle, R.F., and Granger, C. W. 1987).

Before checking the goodness of the model or diagnostic tests first let us see the long run and the short run relationships between the dependent and the independent variables in economic growth model based on the normalized co-integrating coefficients and the vector error correction model (VECM), respectively. But the trade openness model is not included in the thesis since the granger causality result shows, economic growth does not granger cause trade openness.

4.7.1 Result of the Long –run Model

The following equation 4.1 is the normalized co-integrating coefficients which show the long run relationship between the economic growth and the independent variables. As the equation shown, the t-values (if the $|t| \geq 1.96$ accepting alternative hypothesis) are statistically significant at 5 percent level of significance. The significant variables shown the existing of long run relationship between the dependent and independent variables and it would modeled and interpret as follow:

$$LEG = 0.1191LTOP + 2.580LAB + 0.357LCA - 0.393LEEX - 0.390LRM + 9.86 \dots \dots \dots (4.1)$$

Table 4.9: Normalized co-integrating (Long-run) coefficients

LEG	LTOP	LLAB	LCA	LEEX	LREM
COE	-0.119282	-2.580134	-0.357404	0.393785	0.390647
SD	(0.03670)	(0.27346)	(0.03071)	(0.07151)	(0.04564)
t-value	3.250	9.435	11.638	-5.506	8.559

Source: Author’s computation in Eviews 9

Where:

COE = coefficients

S.D = standard deviation

Based on the above equation 4.1, all variables is rejected to null hypothesis i.e. there is no existing of long run relationship among the variables.

In the long run, trade openness has a positive impact on economic growth and its coefficient is statistically significant at the one percent level of significant. Or a percent increase in trade openness is associated with 0.12 percent increase in economic growth on average, other things remains constant in the long run.

Trade openness increases the access of importing variety of goods like raw materials, semi-finished goods, capital goods as well as consumption goods. Trade openness expand or wider the markets either by importing or by exporting goods and services. Participating in the international trade encourages to specializing in which the country relatively most efficient for example in Ethiopia, coffee production, leather, and leather products and live animals which increase the competitiveness via lowering values of the products, increasing quality and other mechanism which boost economic growth in the long run.

Trade openness encourages local investors to adopt new technologies; new ideas and knowledge spill over from technologically advanced countries. Trade openness also enforced the government to collect import tax or tariff and other incomes which in turn used for infrastructures constructing like railway, hospitals, educations and the like.

Foreign investors have been flowing to Ethiopia from different countries with their capital goods or machinery for further production of goods and services. In addition, domestic investors played a great role in the economic growth through allowing these domestic investors to import capital goods, raw materials, semi-finished good and others for the long run production. Then trade openness in Ethiopia has shown us as an engine or source of economic growth.

There is no doubt that, trade openness affects negatively our trade balance since we are a net importer but what we have been saying is that, the share of total trade i.e. the sum of import and export to our economy is high when our trade with rest of the world is opened. Based on our empirical finding, the net effect of total trade to our economy is significant and positive but very small amount that is less than one percent, in the long run. This finding is supported by the empirical finding of (Olaifa, F., Subair, K. & Biala, M., 2013),(Pissarides C. , 2000)and (Babatunde, 2009).

Labor force has a positive impact on economic growth and its coefficient is statistically significant at the one percent level, in the long run. Or one percent increase in labor force

other things remain of constant, on average economic growth increases by 2.6 percent, in the long run.

Agriculture in Ethiopia is the dominant sector which covers, about 80 percent of exports, 40 percent of the GDP and 75 percent of the country's labor forces (USAID, 2021). In Ethiopia there is also increasing different agro processing and other manufacturing products which plays big role in the reduction of unemployment and enhancing productive capacities of workers because these sectors have workshops for their labor training and enhancing skills based on their job classifications (CSA, 2014). Thus, labor in Ethiopia is the engine of economic growth.

In Ethiopia, there is abundance of unemployed labors and they are flowing from the rural agriculture sector to the urban sector dominated by manufacture and service sectors for better wages. Especially, foreign direct investors are encouraged to invest in Ethiopia by these lower cost labors. Even though, these labors are inexperienced, unskilled and unfamiliar with these advanced technologies but over time they expected to be familiar with these technologies and skilled and finally, enhancing economic growth in the long run. The finding is matched with the findings of (Al Hemzawi, B. & Umutohi, N., 2021), (Gunter, B., Taylor, L. & Yeldan, E., 2005), (Nyasulu, 2013)&(Usman, 2011).

The coefficient of capital expenditure is positively and significantly related to economic growth i.e. a one percent increase in capital expenditure brings on average about 0.36 percent in the long run, *ceteris paribus*.

Capital expenditure deals with accruing physical or tangible goods such as building infrastructures, accruing machines and so on (Darma, 2014). Wagner (1883), Keynes (1936) and Smith (1776) believed that, government expenditure in capital goods is the priority action in economic growth and expenditure out of the capital goods is wastage i.e. no return in the long run. Capital expenditure in developing countries like Ethiopia which is limited with capital investment can boost economic growth via conducting research and development on agriculture on varieties of seeds, new technology improvement and other investments or capital expenditure. Capital expenditure is basic and pre-condition for faster and better economic growth thus the finding of the study is nice. Although, capital expenditure in Ethiopia indicated positive impact on economic growth but, it has very lower impact on growth i.e. less than one percent. The finding of the paper is supported by the empirical findings of (Rosoui, 2015), (Aregbeyen, 2007)&(Laudau, 1983).

In the long run, remittance is negatively related to economic growth and its coefficient is statistically significant at the five percent level. A one percent increase in log of remittance is associated with 0.39 decreases in economic growth on average, *ceteris paribus* in the long run.

Ethiopian migrants use both formal and informal channel of remittance services. Formal channel services offered by, officially registered or exempted entities, banks or Ethiopian Postal Service and financial institution that determined by the National Bank of Ethiopia. But informal channel services offered by, any other remittance services than the formal channel. As annual report 2017/18 reported by national bank of Ethiopia, the informal channel is as significant as the formal sector which has share of about 48 percent of the total private remittance. The informal remittance inflow has basically two channels. The first Informal channel is the one that exist in different regional capital cities and in Addis Ababa. The second informal channel is referred as “Hawala” or “Hundi” operators. It is relatively new compared to the first type of informal remittance channel explained above. In this channel, foreign currency is not necessarily transferred from the origin/host country to the recipient/home country or Ethiopia during the transaction. Arrangements are made to provide funds in local currency at the recipient's end. As a result, Hundi creates two distortions the first, in this process as dollars are retained with dealers in the US or host countries. The Ethiopian banking sector loses the opportunity of using foreign currency and, therefore, the country does not gain any benefit from the worker’s remittance. Second, even if the dealer sends dollars at a very later date to replenish the equivalent of Ethiopia Birr, again there is an opportunity cost to the country as foreign currency is not available when needed (National Bank of Ethiopia, 2018).

Around half of Ethiopia’s total remittance is flowed through black market or informal channel and that are decided whether to send to the home country or retain in abroad. These kinds of money flow are expected to use for underground import goods and services based on the interest of the merchants. Merchants, are stand for their profit and they are not expected to import capital goods rather luxury goods that makes them higher profit.

In Ethiopia there is always foreign currency shortage and the formal remittance is the main source to finance imports in the short run. The formal channel which is used to finance imports, highly for consumption purpose and capital goods in the short run and the informal channel which is determined by profit oriented merchants that are not expected to use the

hard currency for productive sector. Due to, these reasons private remittance in Ethiopia might negatively affects economic growth, in the long run.

Remittance can also negatively affect our trade (export) competitiveness through appreciating of the real exchange rate because of high remittance flow or Dutch disease (Dutch disease arise out of large flow of foreign currency and that forced to appreciate the birr). Even our real exchange rate in magnitude shown us depreciation, it is at a very low rate and there is higher remittance flow of foreign exchange rate more than our total exports (see annual national bank of Ethiopia report 2019/20). Due to these factors and consumers preference, we forced us to import at a lower price than we export that negatively influences our balance of payment and become lower productive to the future economic growth. Remittances also encourage people to stop their work, since they financed from abroad families. All these factors caused to deteriorating of our long term economic growth. Different empirical studies found that, remittance have negative impact on economic growth which are supports this finding like (Gebbisa, M.& Feyissa, G., 2019),(Tenaye, 2019),(Tassew, D. & Tolcha, D. N., 2016), (Stahl, C. & Arnold, F., 1986)& theoretically from neoclassical economic theory.

In fact, if remittance used for productive purpose it can play significant role for developing nations like Ethiopia since it would have solved directly the financial constraints mainly foreign financial asset.

The government education expenditure is also negatively and significantly related to economic growth i.e. a one percent increase in education expenditure follows on average 0.39 percent to increase in the long run, *ceteris paribus*.

African countries like Ethiopia are characterized by possessing inadequate education infrastructure, old teaching method, leaving school without required sufficient knowledge (Pulse, 2018). Government education expenditure in developing countries, assumed to be consumption because the knowledge or skill acquired to individual students is based on the interest of an individual (returns to education like higher wages) and which may not have contribution in economic growth. Workers are choosing the best job which would offer them higher wage and the labours are not engaged in their talented that makes the country more productive (Pissarides C. A., 2000). Public education expenditure for developing countries is for the purpose of quantity improvement not for the quality of productivity (Goel, 1974). That why the empirical studies of (Devarajan, S., Swaroop, V., & Zou, H., 1996) in 43 developing countries indicated that, expenditure in educations are negatively related to economic growth.

Theoretically like endogenous growth theories, (Romer P. M., 1990) and Lucas (1988) believed that education expenditure is a crucial action to improve fast economic growth through enhancing human capital. But empirical researches are shown mixed results and believed that expenditure in education on the short term, increase quantitative human capital and increase production. But much qualitative growth in human capital is not seen in the long-term just it is wastage of material resources (Tabar, T., Najafi, Z. & Badooei, Y., 2017). In fact, it is difficult to interpret public expenditure having negative effect on economic growth and this may be true as different studies in Ethiopia referred like (Bekele Y. E., 2017) and (Emagne Y., 2017) said, the negative impact on economic growth is as a result of low education qualities, inappropriate policy expenditure on education, and scarce resources to education.

4.7.2 Result of the Short-run Model

Once we know the prevalence of equilibrium relationship, the next step is determining the speed of adjustment at which the distortions are reversed within a given period of time. In this regard, the following table displays speed of adjustment and short run effects of explanatory variables on economic growth.

As can be seen from the following short run equation 4.2 inference from the Wald test, only the last two years lag of economic growth and the last two years lag of remittance are statistically significant at five percent level. But the remaining variables which are trade openness, labor, capital expenditure and public education expenditures are not statistically significant.

Based on the results of the Wald test which is shown below in 4.10, the last two lag years of economic growth is statistically significant at five percent level of significance i.e. coefficients of $c(5) = c(6) \neq 0$ or the null hypothesis for the joint significant is rejected, thus, lag one and lag two economic growth jointly are not zero or there is significant relationship between the two years lag last year economic growth and the current economic growth, in the short run.

Table 4.10 Wald Test (EG)

Test Statistic	Value	df	Probability
F-statistic	6.242036	(2, 21)	0.0075
Chi-square	12.48407	2	0.0019

Source: Author's computation in Eviews 9

The previous year economic growth has positive impact on its own present economic growth. A percent increase on the previous year or one lag year, the present economic growth increased by 0.3 percent, other things hold constant, in the short run. But couples years ago economic growth has negative impact on the present economic growth by 0.23 percent, citers Paribas in the short run. The previous year economic growth has a multiplier effect in the present economic growth. This positive and negative relationship or fluctuations in the previous two years, in the present economic growth shown us, the provision basis for economic growth like external debt, aid, policy reforms and the like are not sustainably performed or managed for present economy growth in the country. This empirical finding is consistent with the views of (Olaifa, F., Subair, K. & Biala, M., 2013)&(Dogga, 2014).

$$\Delta LEG_t = 0.28LEG_{t-1} - 0.23LEG_{t-2} + 0.001LTOP_{t-1} + 0.087LTOP_{t-2} + 0.509LAB_{t-1} + 0.105LAB_{t-2} - 0.084LCA_{t-1} - 0.034LCA_{t-2} - 0.112LEEX_{t-1} - 0.121LEEX_{t-2} + 0.022LRM_{t-1} + 0.097LRM_{t-2} - 31.45ECT_{t-1} + 0.029 \dots \dots \dots (4.2)$$

Regarding to remittance, the Wald test which is depicted in table 4.11 below, the last two lag years of remittance is statistically significant at five percent level of significant i.e. the null hypothesis or coefficients of (15) = (16) ≠ 0 or the null hypothesis for the joint significant is rejected, thus, the last two year lag one and lag two remittance jointly are not zero or there is significant relationship between the last two lag years remittance and the current economic growth, in the short run.

Table 4.11 Wald Test (REM)

Test Statistic	Value	df	Probability
F-statistic	6.490922	(2, 21)	0.0064
Chi-square	12.98184	2	0.0015
Null Hypothesis: C(5)=C(6)=0			

Source: Author's computation in Eviews 9

The above equation 4.2 the Wald tests demonstrated, remittance is statistically significant at one percent level of significant and the previous year's remittances have positive but very low impact on economic growth. An increase one percent on remittance a previous years, economic growth increases by 0.02 percent on average, other things hold constant, in the short run. Since remittance are funds transferred from migrants to their home country which can be saved or directly spend in the home country. Therefore, the previous year remittances either increase to the present domestic consumption or directly increasing the stock of foreign assets and these boosts to the present economic growth in the short run. But a years ago

remittance to the present economic growth negatively affects or one percent increase on remittance a years ago, the present economic growth declined by 0.1 percent on average, other things hold constant, in the short run. This shows us remittance have used for consumption purpose and which have not return to the present economic growth and this why the long run economic growth model shown us negative relationship between remittance and economic growth. This is similar with the empirical finding of (Golitsis, P., Avdiu, K. & Szamosi, L., 2018)&(Pradhan, 2016).

The error term coefficient which is in the above equation 4.2 is negative and significant at five percent level of significance with the expected negative sign and ranged between zero and one. The error term coefficient shows the speed of adjustment from the short run fluctuations on economic growth to its long run equilibrium. Statistically, the coefficient of the error correction term adjusts the deviation from the equilibrium, to the next year at an adjustment speed of 31.45 percent, periodically.

4.8 Diagnostics Tests

Before we decide the final conclusion from the analysis part it is necessary to test diagnostics tests because with wrong specification leads to misleads the result and interpretation of the model.

The estimated regression results of economic growth, the computed R-squared which is a measure of fit indicated that, about 90 percent of the total variation in the dependent variable is explained by the model. The estimated model also shown us, the F-statistic is statistically significant or all the independent variables are jointly significant at one percent (0.0000) level of significant which is shown in annex part 9a.

Serial correlation is existing when the residuals in one period corresponding to any variable in period one is depends in residuals corresponding to the variable in any another period in the model. Even though, in the present of autocorrelation the estimated coefficients are correct, but it leads to the higher standard errors of coefficients and which leads wrong inference (Gujrati, 2004). Therefore, testing the problem of autocorrelation is very crucial because it shows the problem of omitting relevant variable (since the error term emerged from omitted variable, measurement error & non-linearity) and misspecification of the error term. The hypothesis for the problem of serial correlation is;

H₀: no serial correlation problem

H₁: there is serial correlation problem

Based on the Breusch-Godfrey serial correlation LM test that is shown in the below table 4.15 for economic growth model, the model is free from the problem of serial correlation since its probability level of significant is greater than the five percent(0.6).

Normality test shows the normal distribution of the residual in the model or the residual must hold zero mean and constant variance or lower variance (Mordkoff, 2016). The model is said to be normally distributed if the Jaque- Bera test result is holds the null hypothesis i.e. the p-value must be greater than five percent. The result for the Jaque- Bera in table 4.15 for economic growth model shown, 0.96 which greater than five percent which is highly significant meaning that the residual is normally distributed and the model are appropriate for estimation.

Heteroscedasticity problem exist when the variance of the residual is not constant within the spread of the residual over the ranges of the measured value and the residual is dependent with one of the dependent variable(Draper, N.R. & Smith H., 1998). The null hypothesis for the heteroscedasticity is:

H₀: there is no heteroscedasticity

H₁: there is heteroscedasticity

Breusch-Pagan-Godfrey also used to test for the presenting of heteroscedasticity problem in the model. The value of Breusch-Pagan-Godfrey which is indicated from table 4.15for economic growth model is greater than five percent i.e. 0.79 (79 percent), therefore, the model is free from problem of heteroscedasticity.

Table 4.12 Diagnostic test (economic growth model)

Diagnosis	Tests	Null hypothesis	Prob.
Autocorrelation	Breusch-Pagan-Godfrey	No serial correlation	0.0626
Heteroscedasticity	Breusch-Pagan-Godfrey	No Homoscedasticity	0.7938
Normality	Jaque- Bera	No normality	0.9561

Source: Author's computation in Eviews 9

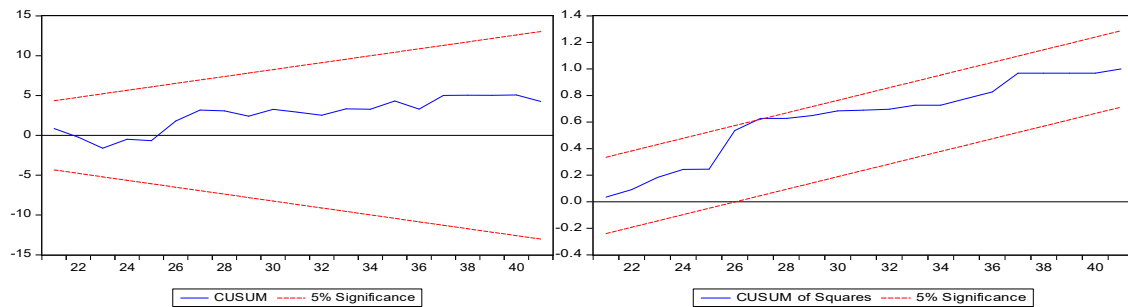
As shown from the above table 4.12, the diagnostic tests for economic growth model are appropriate or the model is free from suffering the problem of serial correlation, heteroscedasticity and non-normality problem. Therefore, the model is appropriate for further statistical inference.

4.9 Stability Test

To investigate the stability of long-run and short-run parameters the study has conducted two stability tests such as CUSUM and CUSUMSQ. The tests are proposed by Brown, Durbin and Evans (1975) to assess the parameters constancy. If the plot of the CUSUM or CUSUM SQ statistics lies within the critical bound of 95% level of significance represented by a pair of straight lines drawn at 95% level of significance, there is no possibility existence of structural breaks.

As can be seen from the below figure 4.5, the CUSUM and CUSUM Squares tests of stability for economic growth model, the model is lie within the two parallel lines or do not cross critical bounds for all the interval years. Thus, in addition to the above Jaque-Bera, CUMSUM and CUMSUM Squares tests also have shown stability.

Figure 4.5 Graphical Representation of CUMSUM and CUMSUM Squares tests (EG)



Source: Author's computation in Eviews 9

4.10 Impulse Response Function

An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. A shock to one variable not only directly affects that variable, but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the VECM. Impulseresponsefunction shed further light on the information showed by granger causality which was revealed only the directional relationship not the sign between the variables. From the figure below 4.5 which is revealed for the impulse response functions, the X-axis shows duration (time) of the shock (above X-axis shows positive impulse and below X-axis shows negative impulse) while the Y-axis shows the percentage variation.

In fact, impulse response function are appropriate for Vector Auto-Regressive (VAR) model because the model is automatically converted the inputs time series data variables to their first difference or the model is stationary when we apply the VAR model. When the dependent variable experienced shock, it would return back to its equilibrium, in a certain

period of time. Even though, VECM is a special case for VAR model, the researcher would apply VECM model in the impulse response function because the study have regressed using VECM model. VECM is not stationary at level rather stationary at first difference, thus the shock effect that experienced to the dependent variable by its independent variable i.e. notstationary, would be permanent. Therefore, impulse response function in VECM model, only shows the sign of relationship between the variables, despite the shock effect is permanent not transitory (after fluctuations return to its equilibrium).

For the analysis, 10 years has been chosen as the lead length, i.e. if the impulse is given in the present period, how the variables would respond to it 10 years in future.

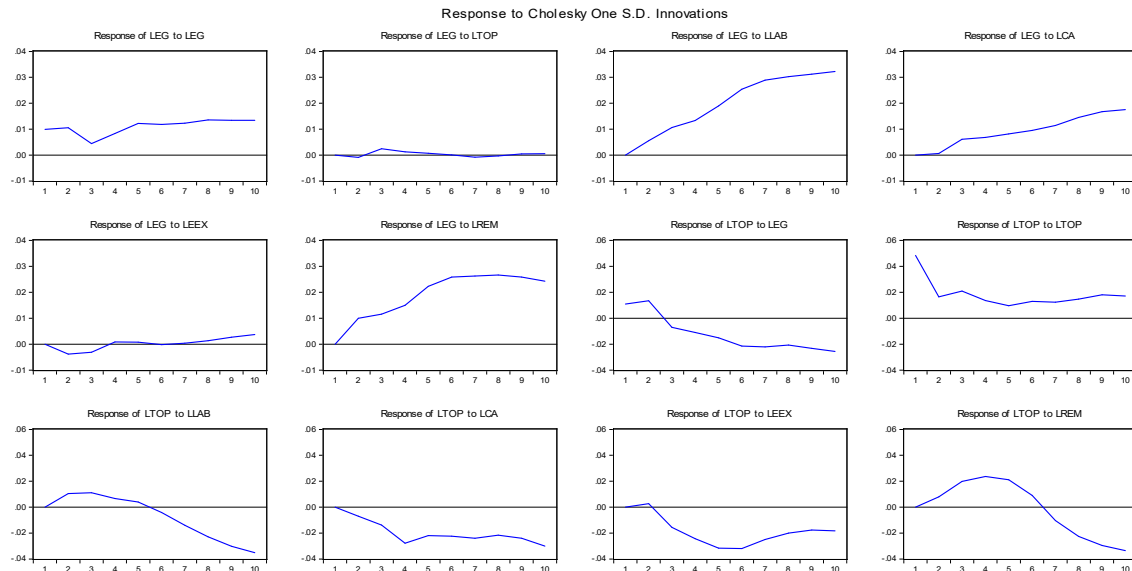
The impulse response function in Figure 4.6 foreconomic growth shows, a one-time positive shock to economic growth first year reacts by going down up to year three, then start to rise until year five, afterward leads to a permanent increase in its own economic growth. Or a one-time shock 1% increase in economic growth leads to a permanent increase in economic growth its own of 0.012 percent. Therefore, there would a positive relationship with its own in the future ten years.

A one-time positive shock to trade openness does not bring significant fluctuations to economic growth rather it fluctuates around the zero horizontal axes. Or a one-time shock 1% increase in trade openness leads to a permanent increase cloth to x-axis on economic growth of 0.001 percent as we have shown from descriptive figure above. It inferred that, there would be a lower positive relationship with economic growth in the future ten years.

The impulse response function on labour force, capital investment or expenditure and remittance shows, a one-time positive shock to labour force, capital expenditure and remittance leads to a permanent increase in economic growth,. Or a one-time shock 1% increase in labour force, capital expenditure and remittance leads to a permanent increase in economic growth by 0.032 percent, 0.017 percent and 0.024 percent, respectively. These inferred that, there would be positive relationship between “labour force, capital expenditure and remittance” and economic growth in the future ten years.Finally, a one-time negative shock to public education expenditure after one year bring negative effect on economic growth until year three, after three year it continue close do x-axis but positively, as time progresses there is fluctuations(ups and down)until year eight and finally continue positively with economic growth. Or a one-time negative shock 1% increase in public education expenditure leads to a permanent increase on economic growth of 0.0036 percent. Therefore,

there would be a mixed or negative/positive relationship with economic growth in the future ten years.

Figure 4.6 Impulse Response Function



Source: Author's computation in Eviews 9

4.11 Variance decomposition analysis

The variance decomposition of the forecast error gives the percentage of unexpected variation in each variable that is produced by shocks from other variables or it shows how much of the variability in the dependent variable is explained by its own shock and the shock in other variables in the system.

In the short run 100% of forecast error variance in real EG is explained by EG by its self (in period one). The contribution from the other independent variables (trade openness, labour force, capital investment, remittance and public education expenditure) is strongly exogenous or very weak influence or no contemporaneous effect on the predicting future EG.

In the long run that is when we move to the future or from second period onward till year five the influence to the EG variables in the model increased i.e. EG only explained itself 19.76 percent but the remaining 41.99 percent, 30.08 percent, 6.64 percent, 1.15 percent and 0.38 percent by the other variables which are labour force, remittance, capital investment, public education expenditure and trade openness, respectively. But five periods on ward the

contribution to economic growth is become strongly endogenous. EGIt-self explained 10 percent to itself but the remaining 42.8 percent, 35.9 percent, 9.8 percent, 0.4 percent and 0.08 percent by labour force, remittance, capital investment, public education expenditure and trade openness, respectively. economic growth is explained 10 percent by other factor other than in the model included, which may credit distribution, institutional service and quality, fiscal or monetary policies and the like.

In summary, the result shows labour force and remittance are the main determinant factors for Ethiopian economic growth in the next ten years which supports labour force and remittance granger cause economic growth. The model also supports for the solo's neoclassical economic growth, labour force and physical capital are the predominant variables for economic growth.

Table 4.13 variance decomposition (EG)

Period	S.E.	LEG	LTOP	LLAB	LCA	LEEX	LREM
1	0.009918	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.018866	58.85612	0.217941	8.727167	0.117547	4.213084	27.86814
3	0.025985	33.89926	0.969960	21.44030	5.513405	3.667958	34.50912
4	0.034553	25.00162	0.680610	26.92210	7.011516	2.129922	38.25424
5	0.047632	19.76190	0.379786	30.07985	6.635656	1.147504	41.99530
6	0.061747	15.40949	0.226033	34.81426	6.331416	0.683598	42.53520
7	0.074970	13.15195	0.165692	38.51183	6.611026	0.466072	41.09343
8	0.087432	12.07711	0.123530	40.30946	7.617976	0.365492	39.50643
9	0.098766	11.31615	0.098769	41.57577	8.852257	0.357132	37.79992
10	0.109003	10.80461	0.083526	42.86970	9.857710	0.408146	35.97630
Cholesky Ordering: LEG LTOP LLAB LCA LEEX LREM							

Source: Author's computation in Eviews 9

In summary, the empirical finding of the previous study in Ethiopia which has similar problem with the present paper such as (Emagne et al, 2017) paper has found, trade openness, capital and labour has positive impact on economic growth and education expenditure has negative impact on economic growth that are the same results with the present paper. Both studies also showed, trade openness and economic growth has significant relationship between them in the short-run and in the long-run. The main difference the present paper with the (Emagne et al, 2017) is, the present paper used additional tests like granger causality,

variance decomposition function test, impulse response function test and others such as proxy for physical capital.

The expected sign of hypothesis of the paper or the impacts of the independent variables on economic growth have matched with the estimated result except for education expenditure which had found to be negative impact on economic growth. The conceptual framework and theoretical framework for the study has rejected which was proposed trade openness and economic growth has bidirectional causality but our result indicates there was only unidirectional causality running from trade openness to economic growth.

Chapter Five: Conclusion and Policy Implications

5.1 Introduction

In this sub-section would be presented conclusion of the study which covers all the above briefly discussed points and the next section would be presented policy implications.

5.2 Conclusion

The author conducted the empirical study aimed to determine the causal link either from trade openness to economic growth or from economic growth to trade openness or both and to proof which hypothesis i.e. the trade lead growth hypothesis or the growth lead hypothesis, is appropriate for Ethiopian if unidirectional exist.

The economic growth which was estimated both short run and long run models using econometric and descriptive techniques. The model was also testes different diagnostics tests and other forecasting methods using secondary annual time series data covers the period range from 1980/81-2020/21 Ethiopian fiscal year, a total of 41 data points.

The results of ADF and PP unit root tests were non-stationary at level. But all the time series variables were stationary at first differenced i.e. co-integrated of same order I (1). The Johansen co-integration results of both the trace test and the max-Eigen value test had four co-integrating equations relationship for the model.

The results of pair wise granger causality tests which showed trade openness one way Granger Cause to economic growth. The study supported trade lead growth hypothesis; trade openness accelerates moderate export and economic growth through efficient allocation of resources, transfer technology form advanced country, know how from developed nations and others mechanisms.

Trade openness had a positive impact on economic growth and its coefficient was statistically significant at the one percent level of significant, in the long run. Trade openness increases the access of importing variety of goods for further production in the long run and which widened the markets either by importing or by exporting goods and services. Participating in the international trade encourages to specialize in which the country relatively most efficient. Labor force had a positive impact on economic growth and its coefficient was statistically significant at the one percent level, in the long run. Agriculture in Ethiopia is the dominant sector which covers, about 80 percent of exports, 40 percent of the GDP and 75 percent of the country's labor thus, labor in Ethiopia is the engine of economic growth.

Capital expenditure was positively and significantly related to economic growth in the long run. Government expenditure in capital goods was the priority action in economic growth and expenditure out of the capital goods was wastage i.e. no return in the long run.

Remittance was negatively related to economic growth and its coefficient is statistically significant at the five percent level, in the long run. This was expected due to, half of Ethiopia's total remittance was flowed through the informal channel and remittance negatively deteriorated our trade balance since we are a net importer.

The government education expenditure was negatively and significantly related to economic growth in the long run. This may be as a result of low education qualities; scarce resources to education, the expenditure on education policy may not appropriate and matched with the long run production return.

In the short run, only the last two years lag of its own economic growth and the last two years lag of remittance were statistically significant at five percent level but the remaining variables which were trade openness, labor, capital expenditure and public education expenditures were not statistically significant to economic growth.

5.3 Policy Implications

The author would provide some basic recommendations for policy makers and other concerned body regarding the causal relationship between trade openness and economic growth based on the empirical finding of the paper as follow:

- Although trade openness shown positive impact on our economic growth in the long run but our trade balance is negative since we are net importer. Therefore, government of the country should import goods that are ready for further production and reduce consumption goods via strengthen import substitution mechanisms more than the previous and should apply better trade policy which creates the way of working domestic investors in alliance(technology transfer, know how, financial provision, market..) with the foreign direct investors.
- The amount of remittance flowed from abroad is greater than the amount of revenue receipts from exporting goods and services but around half from the total remittance flowed by informal sector. National bank of Ethiopia should be forced these informal sectors to be engaged in the formal sector and should be cut the line informal sector of transaction cooperating with the federal government of the country. In addition, the government should spend these remittances in the productive sector or

importing productive goods and providing incentives and accesses to allow Ethiopian Diasporas to engage highly in the domestic investment than before.

- Public expenditure on education had negative effect on economic growth in the long run thus the government should focus on the quality of the education improvement, introducing modern way of teaching and introducing adequate education infrastructures that accelerates our economic productivity and then growth.
- Immigrants send remittances to Ethiopia and which play significant effect in the short run for import financing however, in the long run, the country highly lose human capital or the more productive labor in the economy. Thus, to prevent from losing the most productive or skillful labor in the economy the government should shows this as a serious issue and takes an action to remain in his or her country via providing incentives and paying competitive salaries or wages.
- The result of Variance decomposition analysis showed, labor force and remittance are the main determinant factors for Ethiopian economic growth in the next ten years therefore government should utilize properly these resources better than present to be productive for our economic growth.
- Since the proxy for trade openness, physical capital and technology improvement are different and their empirical finding might also different. Therefore, further study regarding this problem is still open thus the researcher calls for further exploration.

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Appendixes

Appendix 1: Summary of Descriptive Statistics

	EG	TOP	LAB	CA	EEX	REM
Mean	666896.0	0.350956	32.52315	41249.79	0.025252	36456.79
Median	390102.9	0.341655	28.58510	4912.466	0.023530	3707.733
Maximum	2228081.	0.567761	62.60202	235409.7	0.035710	247642.6
Minimum	201252.8	0.132918	16.24250	487.0030	0.017383	66.20000
Std. Dev.	568585.3	0.117868	13.45908	64682.21	0.004792	60896.81
Skewness	1.314741	0.119447	0.811376	1.581328	0.494159	1.838773
Kurtosis	3.529595	1.927387	2.474692	4.280364	2.182392	5.537174
Jarque-Bera	12.29085	2.062932	4.970004	19.88795	2.810644	34.10106
Probability	0.002143	0.356484	0.083325	0.000048	0.245288	0.000000
Sum	27342737	14.38919	1333.449	1691241.	1.035323	1494728.
Sum Sq. Dev.	1.29E+13	0.555716	7245.870	1.67E+11	0.000918	1.48E+11
Observations	41	41	41	41	41	41

Appendix 2: Heteroscedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey				
F-statistic	0.676812	Prob. F(18,19)		0.7938
Obs*R-squared	14.84608	Prob. Chi-Square(18)		0.6725
Scaled explained SS	4.139413	Prob. Chi-Square(18)		0.9997
Test Equation:				
Dependent Variable: RESID^2				
Method: Least Squares				
Date: 03/31/22 Time: 08:59				
Sample: 4 41				
Included observations: 38				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.007919	0.010015	-0.790656	0.4389
LEC(-1)	-0.000308	0.001088	-0.283445	0.7799
EPG(-1)	-0.000351	0.000456	-0.768788	0.4515
PTN(-1)	-0.000267	0.000240	-1.114446	0.2790
TOP(-1)	-6.96E-05	0.000383	-0.181594	0.8578
LLAB(-1)	0.004701	0.005061	0.928832	0.3646
CE(-1)	0.000113	0.000270	0.418581	0.6802
LEC(-2)	0.000589	0.001221	0.482579	0.6349
LEC(-3)	-0.000899	0.001181	-0.761464	0.4557
TOP(-2)	-9.25E-05	0.000396	-0.233608	0.8178
TOP(-3)	0.000157	0.000360	0.437166	0.6669
LLAB(-2)	-0.001704	0.007316	-0.232959	0.8183
LLAB(-3)	-0.001425	0.004835	-0.294709	0.7714
CE(-2)	-0.000160	0.000246	-0.652481	0.5219

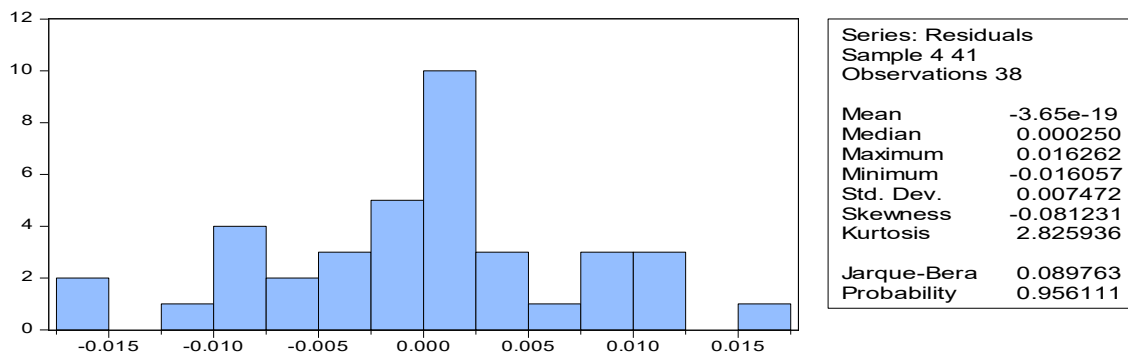
CE(-3)	3.97E-05	0.000266	0.149148	0.8830
EPG(-2)	0.000340	0.000557	0.609912	0.5491
EPG(-3)	-3.86E-05	0.000480	-0.080418	0.9367
PTN(-2)	-2.82E-05	0.000320	-0.088202	0.9306
PTN(-3)	0.000193	0.000275	0.701571	0.4915
R-squared	0.390686	Mean dependent var		5.44E-05
Adjusted R-squared	-0.186558	S.D. dependent var		7.44E-05
S.E. of regression	8.11E-05	Akaike info criterion		-15.69527
Sum squared resid	1.25E-07	Schwarz criterion		-14.87648
Log likelihood	317.2102	Hannan-Quinn criter.		-15.40395
F-statistic	0.676812	Durbin-Watson stat		2.996735
Prob(F-statistic)	0.793811			

Appendix 3: Autocorrelation Test

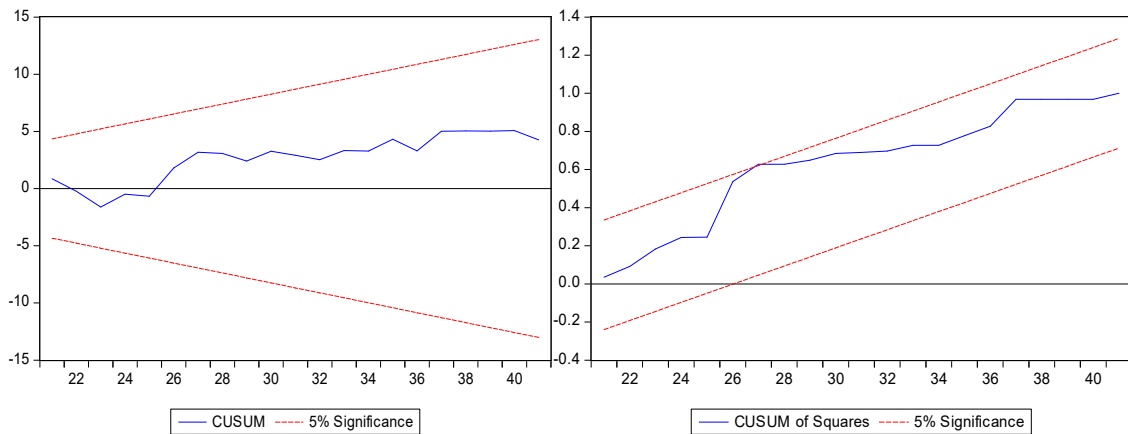
Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	2.913100	Prob. F(3,18)		0.0626
Obs*R-squared	12.41967	Prob. Chi-Square(3)		0.0061
Test Equation:				
Dependent Variable: RESID				
Method: Least Squares				
Date: 03/31/22 Time: 08:58				
Sample: 4 41				
Included observations: 38				
Presample missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.000880	0.106235	-0.008283	0.9935
C(2)	-0.009080	0.014097	-0.644073	0.5277
C(3)	-0.004055	0.184646	-0.021963	0.9827
C(4)	-0.014191	0.046043	-0.308220	0.7615
C(5)	-0.122246	0.114465	-1.067978	0.2996
C(6)	-0.021606	0.114930	-0.187996	0.8530
C(7)	-0.023840	0.038035	-0.626780	0.5387
C(8)	-0.044543	0.043336	-1.027840	0.3176
C(9)	-0.183104	0.528240	-0.346630	0.7329
C(10)	0.446266	0.551686	0.808913	0.4291
C(11)	0.031126	0.038198	0.814854	0.4258
C(12)	0.035846	0.030539	1.173790	0.2558
C(13)	-0.040745	0.057667	-0.706552	0.4889
C(14)	-0.000261	0.059926	-0.004357	0.9966
C(15)	-0.037840	0.039110	-0.967544	0.3461
C(16)	-0.011291	0.033386	-0.338177	0.7391
C(17)	3.06E-05	0.008455	0.003623	0.9971
RESID(-1)	0.131311	0.266696	0.492363	0.6284
RESID(-2)	-0.202275	0.286446	-0.706154	0.4891
RESID(-3)	-0.792677	0.268710	-2.949935	0.0086

R-squared	0.326834	Mean dependent var	-3.65E-19
Adjusted R-squared	-0.383731	S.D. dependent var	0.007472
S.E. of regression	0.008789	Akaike info criterion	-6.325165
Sum squared resid	0.001391	Schwarz criterion	-5.463277
Log likelihood	140.1781	Hannan-Quinn criter.	-6.018512
F-statistic	0.459963	Durbin-Watson stat	2.313796
Prob(F-statistic)	0.949198		

Appendix 4: Normality Test



Appendix 5: CUMSUM and CUSUM SQ Result



Appendix 6: Lag Order Selection Result

VAR Lag Order Selection Criteria						
Endogenous variables: LEC TOP LLAB CE EPG PTN						
Exogenous variables: C						
Date: 04/02/22 Time: 12:12						
Sample: 1 41						
Included observations: 38						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	258.8225	NA	6.70e-14	-13.30645	-13.04788	-13.21445
1	506.1681	403.5639	1.02e-18	-24.42990	-22.61994*	-23.78593*
2	544.6865	50.68212	1.03e-18	-24.56245	-21.20109	-23.36650
3	598.3553	53.66882*	6.18e-19*	-25.49239*	-20.57963	-23.74446
* 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

Appendix 7: Co-integration Rank Result

Date: 03/31/22 Time: 08:45						
Sample (adjusted): 5 41						
Included observations: 37 after adjustments						
Trend assumption: Linear deterministic trend						
Series: LEG LTOP LLAB LCA LEEX LREM						
Lags interval (in first differences): 1 to 3						
Unrestricted Co-integration Rank Test (Trace)						
Hypothesize d		Trace	0.05			
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**		
None *	0.873947	219.0829	95.75366	0.0000		
At most 1 *	0.765652	142.4541	69.81889	0.0000		
At most 2 *	0.719622	88.76894	47.85613	0.0000		
At most 3 *	0.547729	41.71911	29.79707	0.0014		
At most 4	0.253862	12.36057	15.49471	0.1404		
At most 5	0.040387	1.525323	3.841466	0.2168		
Trace test indicates 4 co-integratingeqn(s) at the 0.05 level						
* denotes rejection of the hypothesis at the 0.05 level						
**MacKinnon-Haug-Michelis (1999) p-values						
Unrestricted Co-integration Rank Test (Maximum Eigenvalue)						
Hypothesized		Max-Eigen	0.05			
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**		
None *	0.873947	76.62884	40.07757	0.0000		
At most 1 *	0.765652	53.68513	33.87687	0.0001		
At most 2 *	0.719622	47.04984	27.58434	0.0001		
At most 3 *	0.547729	29.35854	21.13162	0.0028		
At most 4	0.253862	10.83525	14.26460	0.1627		
At most 5	0.040387	1.525323	3.841466	0.2168		
Max-eigenvalue test indicates 4 co-integratingeqn(s) at the 0.05 level						
* denotes rejection of the hypothesis at the 0.05 level						
**MacKinnon-Haug-Michelis (1999) p-values						
Unrestricted Co-integrating Coefficients (normalized by b'S11*b=I):						
LEG	LTOP	LLAB	LCA	LEEX	LREM	
74.69803	-8.910135	-192.7309	-26.69735	29.41493	29.18054	
-26.33353	-22.35398	-54.93333	-6.350013	28.26439	24.00331	
46.65697	8.666363	36.15668	-26.02941	-38.79883	0.310715	

-38.51482	-13.09796	-98.45536	31.97149	6.421438	5.966897	
7.021913	-7.889818	47.62816	-4.340359	12.21669	-6.814485	
-52.72707	-12.70826	4.710850	20.50851	-3.461857	-1.080906	
Unrestricted Adjustment Coefficients (alpha):						
D(LEG)	0.000806	0.003387	-0.003802	0.002011	-0.002885	0.000481
D(TOP)	0.011191	0.031934	0.007182	-0.005931	-0.008706	-0.001903
D(LLAB)	-0.001178	-0.000850	0.000147	0.000986	-0.000721	-0.000230
D(LCA)	0.044901	0.009474	0.006153	-0.007771	-0.014309	-0.005964
D(LEEX)	-0.010410	-0.001459	0.013559	-0.005212	-0.013108	0.000848
D(LREM)	-0.007893	0.013671	-0.033203	-0.015450	0.001015	-0.006345
1 Co-integrating Equation(s):		Log likelihood	592.1971			
Normalized co-integrating coefficients (standard error in parentheses)						
LEG	LTOP	LLAB	LCA	LEEX	LREM	
1.000000	-0.119282	-2.580134	-0.357404	0.393785	0.390647	
	(0.03670)	(0.27346)	(0.03071)	(0.07151)	(0.04564)	

Appendix 8: Granger Causality Result

Pairwise Granger Causality Tests			
Date: 04/02/22 Time: 12:36			
Sample: 1 41			
Lags: 3			
Null Hypothesis:	Obs	F-Statistic	Prob.
LTOP does not Granger Cause LEG	38	4.77223	0.0076
LEG does not Granger Cause LTOP	38	1.52663	0.2271
LLAB does not Granger Cause LEG	38	4.38006	0.0111
LEG does not Granger Cause LLAB	38	1.97380	0.1384
LCA does not Granger Cause LEG	38	5.86886	0.0027
LEG does not Granger Cause LCA	38	0.28514	0.8357
LEEX does not Granger Cause LEG	38	3.02953	0.0441
LEG does not Granger Cause LEEX	38	1.51537	0.2300
LREM does not Granger Cause LEG	38	12.7764	1.E-05
LEG does not Granger Cause LREM	38	2.06245	0.1255
LLAB does not Granger Cause LTOP	38	0.73586	0.5386
L TOP does not Granger Cause LLAB	38	1.60578	0.2080
LCA does not Granger Cause LTOP	38	0.88762	0.4584
LTOP does not Granger Cause LCA	38	1.21980	0.3190
LEEX does not Granger Cause LTOP	38	0.29853	0.8262
LTOP does not Granger Cause LEEX	38	2.21933	0.1057
LREM does not Granger Cause LTOP	38	1.26662	0.3029
LTOP does not Granger Cause LREM	38	0.15505	0.9256
LCA does not Granger Cause LLAB	38	7.67282	0.0006
LLAB does not Granger Cause LCA	38	1.25008	0.3085
LEEX does not Granger Cause LLAB	38	1.14058	0.3481
LLAB does not Granger Cause LEEX	38	1.06452	0.3783

LREM does not Granger Cause LLAB	38	2.68869	0.0635
LLAB does not Granger Cause LREM	38	0.80718	0.4995
LEEX does not Granger Cause LCA	38	0.44719	0.7210
LCA does not Granger Cause LEEX	38	2.46156	0.0811
LREM does not Granger Cause LCA	38	6.46682	0.0016
LCA does not Granger Cause LREM	38	0.33509	0.8000
LREM does not Granger Cause LEEX	38	1.11303	0.3588
LEEX does not Granger Cause LREM	38	0.51422	0.6755

Appendix 9a: Vector Error Correction Result

Vector Error Correction Estimates						
Date: 04/20/22 Time: 12:45						
Sample (adjusted): 4 41						
Included observations: 38 after adjustments						
Standard errors in () & t-statistics in []						
Co-integratingEq:	CointEq1	CointEq2	CointEq3	CointEq4		
LEG(-1)	1.000000	0.000000	0.000000	0.000000		
LTOP(-1)	0.000000	1.000000	0.000000	0.000000		
LLAB(-1)	0.000000	0.000000	1.000000	0.000000		
LCA(-1)	0.000000	0.000000	0.000000	1.000000		
LEEX(-1)	7.899095	-23.79181	2.667005	10.58499		
	(1.78829)	(5.08065)	(0.62101)	(2.40622)		
	[4.41712]	[-4.68282]	[4.29465]	[4.39901]		
LREM(-1)	-0.786268	1.296164	-0.332947	-1.394181		
	(0.15345)	(0.43598)	(0.05329)	(0.20648)		
	[-5.12377]	[2.97302]	[-6.24793]	[-6.75213]		
C	9.859448	-42.38784	-1.980373	18.15134		
Error Correction:	D(LEG)	D(LTOP)	D(LLAB)	D(LCA)	D(LEEX)	D(LREM)
CointEq1	-0.314595	0.945658	-0.051767	2.352245	-0.353558	0.138459
	(0.11263)	(0.56250)	(0.03981)	(0.79593)	(0.46033)	(1.00396)
	[-2.79305]	[1.68118]	[-1.30043]	[2.95535]	[-0.76805]	[0.13791]
CointEq2	-0.140547	-0.148855	-0.003605	-0.390363	0.070107	-0.078782
	(0.01501)	(0.07497)	(0.00531)	(0.10609)	(0.06136)	(0.13382)
	[-9.36170]	[-1.98540]	[-0.67937]	[-3.67962]	[1.14260]	[-0.58873]
CointEq3	-0.603478	-0.935144	-0.056194	-5.216582	1.585341	0.288478
	(0.19687)	(0.98315)	(0.06958)	(1.39115)	(0.80459)	(1.75476)
	[-3.06541]	[-0.95117]	[-0.80766]	[-3.74984]	[1.97038]	[0.16440]
CointEq4	0.090729	-0.823369	0.042999	-1.248551	-0.031187	-0.326592
	(0.05079)	(0.25366)	(0.01795)	(0.35892)	(0.20759)	(0.45273)
	[1.78629]	[-3.24602]	[2.39537]	[-3.47865]	[-0.15024]	[-0.72138]
D(LEG(-1))	0.283030	-0.301256	0.037695	-0.885741	0.311556	-2.190100
	(0.11025)	(0.55057)	(0.03896)	(0.77905)	(0.45057)	(0.98267)
	[2.56724]	[-0.54717]	[0.96746]	[-1.13695]	[0.69146]	[-2.22871]
D(LEG(-2))	-0.230397	-1.455108	0.042854	-0.390073	0.365583	1.458205

	(0.12077)	(0.60315)	(0.04268)	(0.85344)	(0.49360)	(1.07651)
	[-1.90767]	[-2.41253]	[1.00398]	[-0.45706]	[0.74064]	[1.35456]
D(LTOP(-1))	0.001288	-0.521035	0.010619	0.350292	-0.193164	-0.196655
	(0.03712)	(0.18536)	(0.01312)	(0.26228)	(0.15169)	(0.33083)
	[0.03471]	[-2.81100]	[0.80954]	[1.33559]	[-1.27341]	[-0.59443]
D(LTOP(-2))	0.087417	-0.101554	-0.017092	0.374605	-0.252210	-0.481797
	(0.04163)	(0.20790)	(0.01471)	(0.29417)	(0.17014)	(0.37106)
	[2.09986]	[-0.48848]	[-1.16174]	[1.27341]	[-1.48237]	[-1.29842]
D(LLAB(-1))	0.509794	2.767708	0.420807	6.099414	-1.063509	8.546596
	(0.57892)	(2.89111)	(0.20460)	(4.09088)	(2.36602)	(5.16014)
	[0.88060]	[0.95732]	[2.05673]	[1.49098]	[-0.44949]	[1.65627]
D(LLAB(-2))	0.105380	0.149496	-0.552167	5.345450	0.406495	-4.610510
	(0.58544)	(2.92366)	(0.20690)	(4.13694)	(2.39265)	(5.21823)
	[0.18000]	[0.05113]	[-2.66872]	[1.29213]	[0.16989]	[-0.88354]
D(LCA(-1))	-0.084198	0.688768	-0.012426	0.192436	0.243141	0.370567
	(0.03962)	(0.19789)	(0.01400)	(0.28001)	(0.16194)	(0.35319)
	[-2.12487]	[3.48063]	[-0.88729]	[0.68726]	[1.50138]	[1.04920]
D(LCA(-2))	-0.034599	0.363635	-0.009951	-0.107582	0.111826	-0.143991
	(0.03098)	(0.15472)	(0.01095)	(0.21893)	(0.12662)	(0.27615)
	[-1.11675]	[2.35025]	[-0.90877]	[-0.49140]	[0.88315]	[-0.52142]
D(LEEX(-1))	-0.111556	0.444208	-0.015506	-0.198817	0.204538	-0.075003
	(0.05768)	(0.28803)	(0.02038)	(0.40756)	(0.23572)	(0.51409)
	[-1.93419]	[1.54221]	[-0.76073]	[-0.48782]	[0.86772]	[-0.14589]
D(LEEX(-2))	-0.121483	0.215994	0.035535	-0.315002	0.537046	0.134770
	(0.05718)	(0.28558)	(0.02021)	(0.40409)	(0.23371)	(0.50971)
	[-2.12438]	[0.75633]	[1.75825]	[-0.77953]	[2.29789]	[0.26440]
D(LREM(-1))	0.021512	-0.393707	0.006877	-0.490383	0.060288	-0.099967
	(0.04069)	(0.20321)	(0.01438)	(0.28754)	(0.16630)	(0.36270)
	[0.52867]	[-1.93743]	[0.47817]	[-1.70544]	[0.36252]	[-0.27562]
D(LREM(-2))	-0.096877	-0.259784	0.012513	-0.466680	0.103386	0.154218
	(0.03354)	(0.16748)	(0.01185)	(0.23698)	(0.13706)	(0.29892)
	[-2.88871]	[-1.55113]	[1.05577]	[-1.96926]	[0.75430]	[0.51591]
C	0.029580	-0.009895	0.014085	0.004014	-0.044378	0.025517
	(0.00927)	(0.04631)	(0.00328)	(0.06553)	(0.03790)	(0.08265)
	[3.18991]	[-0.21367]	[4.29778]	[0.06125]	[-1.17097]	[0.30872]
R-squared	0.906345	0.670208	0.769955	0.701394	0.525569	0.407874
Adj. R-squared	0.834989	0.418937	0.594682	0.473885	0.164098	-0.043270
Sum sq. resids	0.002066	0.051517	0.000258	0.103146	0.034503	0.164111
S.E. equation	0.009918	0.049529	0.003505	0.070083	0.040534	0.088402
F-statistic	12.70175	2.667278	4.392901	3.082926	1.453972	0.904088
Log likelihood	132.6586	71.54567	172.1825	58.35514	79.16217	49.53145
Akaike AIC	-6.087297	-2.870825	-8.167501	-2.176586	-3.271693	-1.712182
Schwarz SC	-5.354693	-2.138220	-7.434897	-1.443982	-2.539089	-0.979577
Mean dependent	0.024512	0.004003	0.014516	0.060275	0.003365	0.081928

S.D. dependent	0.024415	0.064976	0.005506	0.096622	0.044334	0.086549
Determinant resid covariance (dof adj.)		3.98E-20				
Determinant resid covariance		1.13E-21				
Log likelihood		592.8335				
Akaike information criterion		-24.57019				
Schwarz criterion		-19.14029				

Appendix 9b: Vector Error Correction Result

Dependent Variable: D(LEG)				
Estimation Method: Least Squares				
Date: 04/20/22 Time: 12:47				
Sample: 4 41				
Included observations: 38				
Total system (balanced) observations 228				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.314595	0.112635	-2.793051	0.0060
C(2)	-0.140547	0.015013	-9.361699	0.0000
C(3)	-0.603478	0.196867	-3.065409	0.0027
C(4)	0.090729	0.050792	1.786285	0.0765
C(5)	0.283030	0.110247	2.567240	0.0114
C(6)	-0.230397	0.120774	-1.907666	0.0587
C(7)	0.001288	0.037116	0.034714	0.9724
C(8)	0.087417	0.041630	2.099859	0.0377
C(9)	0.509794	0.578918	0.880598	0.3802
C(10)	0.105380	0.585435	0.180003	0.8574
C(11)	-0.084198	0.039625	-2.124872	0.0356
C(12)	-0.034599	0.030982	-1.116748	0.2662
C(13)	-0.111556	0.057676	-1.934189	0.0553
C(14)	-0.121483	0.057185	-2.124382	0.0356
C(15)	0.021512	0.040691	0.528667	0.5980
C(16)	-0.096877	0.033536	-2.888711	0.0046
C(17)	0.029580	0.009273	3.189909	0.0018
Determinant residual covariance	1.13E-21			
Equation: D(LEG) = C(1)*(LEG(-1) + 7.89909499882*LEEX(-1) -				
0.786268258888*LREM(-1) + 9.85944791913) + C(2)*(LTOP(-1) -				
23.7918104241*LEEX(-1) + 1.29616395128*LREM(-1) - 42.38784417)				
+ C(3)*(LLAB(-1) + 2.66700474345*LEEX(-1) - 0.332946842618				
LREM(-1) - 1.98037289235) + C(4)(LCA(-1) + 10.584987019*LEEX(
-1) - 1.39418110268*LREM(-1) + 18.151340674) + C(5)*D(LEG(-1)) +				
C(6)*D(LEG(-2)) + C(7)*D(LTOP(-1)) + C(8)*D(LTOP(-2)) + C(9)				
*D(LLAB(-1)) + C(10)*D(LLAB(-2)) + C(11)*D(LCA(-1)) + C(12)*D(LCA(
-2)) + C(13)*D(LEEX(-1)) + C(14)*D(LEEX(-2)) + C(15)*D(LREM(-1)) +				
C(16)*D(LREM(-2)) + C(17)				
Observations: 38				

R-squared	0.906345	Mean dependent var	0.024512
Adjusted R-squared	0.834989	S.D. dependent var	0.024415
S.E. of regression	0.009918	Sum squared resid	0.002066
Durbin-Watson stat	1.958626		

Appendix 10: Wald Test (EG)

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	6.242036	(2, 21)	0.0075
Chi-square	12.48407	2	0.0019
Null Hypothesis: C(5)=C(6)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)	Value	Std. Err.	
C(5)	0.283030	0.110247	
C(6)	-0.230397	0.120774	
Restrictions are linear in coefficients.			

Appendix 11: Wald Test Result (TOT)

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	2.343335	(2, 21)	0.1206
Chi-square	4.686669	2	0.0960
Null Hypothesis: C(7)=C(8)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)	Value	Std. Err.	
C(7)	0.001288	0.037116	
C(8)	0.087417	0.041630	
Restrictions are linear in coefficients.			

Appendix 12: Wald Test (LAB)

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	0.443938	(2, 21)	0.6474
Chi-square	0.887875	2	0.6415
Null Hypothesis: C(9)=C(10)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)	Value	Std. Err.	
C(9)	0.509794	0.578918	
C(10)	0.105380	0.585435	
Restrictions are linear in coefficients.			

Appendix 13: Wald Test (CA)

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	2.346663	(2, 21)	0.1203
Chi-square	4.693327	2	0.0957

Null Hypothesis: C(11)=C(12)=0		
Null Hypothesis Summary:		
Normalized Restriction (= 0)	Value	Std. Err.
C(11)	-0.084198	0.039625
C(12)	-0.034599	0.030982
Restrictions are linear in coefficients.		

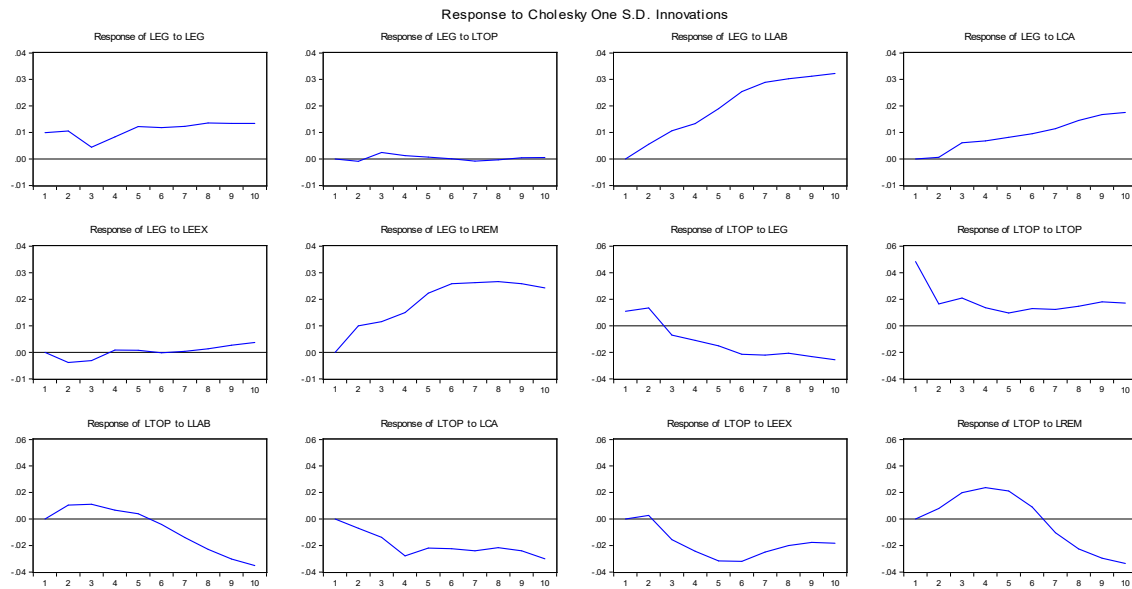
Appendix 14: Wald Test (EEX)

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	3.180998	(2, 21)	0.0621
Chi-square	6.361995	2	0.0415
Null Hypothesis: C(13)=C(14)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)	Value	Std. Err.	
C(13)	-0.111556	0.057676	
C(14)	-0.121483	0.057185	
Restrictions are linear in coefficients.			

Appendix 15: Wald Test (REM)

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	6.490922	(2, 21)	0.0064
Chi-square	12.98184	2	0.0015
Null Hypothesis: C(15)=C(16)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)	Value	Std. Err.	
C(15)	0.021512	0.040691	
C(16)	-0.096877	0.033536	
Restrictions are linear in coefficients.			

Appendix 16: Impulse Response Function Result



Appendix 17: variance decomposition Result

Period	S.E.	LEG	LTOP	LLAB	LCA	LEEX	LREM
1	0.009918	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.018866	58.85612	0.217941	8.727167	0.117547	4.213084	27.86814
3	0.025985	33.89926	0.969960	21.44030	5.513405	3.667958	34.50912
4	0.034553	25.00162	0.680610	26.92210	7.011516	2.129922	38.25424
5	0.047632	19.76190	0.379786	30.07985	6.635656	1.147504	41.99530
6	0.061747	15.40949	0.226033	34.81426	6.331416	0.683598	42.53520
7	0.074970	13.15195	0.165692	38.51183	6.611026	0.466072	41.09343
8	0.087432	12.07711	0.123530	40.30946	7.617976	0.365492	39.50643
9	0.098766	11.31615	0.098769	41.57577	8.852257	0.357132	37.79992
10	0.109003	10.80461	0.083526	42.86970	9.857710	0.408146	35.97630
CholesKy Ordering: LEGLTOP LLAB LCA LEEX LREM							