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BY

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DECLARATION

This is to certify that the thesis prepared by Tumsido Tirfe**,** entitled: "***The Relationship between Saving and Economic growth in Ethiopia"*** is outcome of my own effort and study and that all sources of materials used for the study have been duly acknowledged.

To the best of my knowledge, this study has not been submitted for any degree in this University or any other University. It is offered for the partial fulfillment of the degree of Masters in economics.

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List of Acronyms and Abbreviations

ADF …….Augmented Dickey-Fuller

AIC……Aikaike Information Criterion

ARDL……Autoregressive Distributed lag model

BIC…….Bayesian information criterion

DW…… Durbin-Watson

ECM……Error Correction Model

FCI……..Foreign Capital Inflow

FDI……..Foreign Direct Investment

FPE ……Final Prediction Error

FY …… Fiscal Year

GDP…….Gross Domestic Product

GDS…… Gross Domestic Saving

HQC ……Hnanan Quinn Criterion

IMF……...International Monetary Fund

IOCR…….Incremental Output Capital Ratio

LDCs……..Least Developed Countries

MoFED……..Ministry of Finance and Economic Development

NBE……National Bank of Ethiopia

OLS……Ordinary Least Square

SIC……..Schwarze Information Criterion

SSA…….Sub-Saharan Africa

VAR……Vector Auto regressive

VECM…….Vector error correction method

ABSTRACT

The objective of this paper is to investigate causal relationship between gross domestic saving and economic growth of Ethiopia by using annual time series data for the period of 1975/76-2017/18. In order to achieve these objectives by using unit roots tests, multivariate Johansen co integration, Vector Autoregressive (VAR), Error correction model (VECM) and Granger Causality tests were undertaken. The result of Johansen Co-integration Test indicates that there is presence of one co-integrating vector in the model. The long run and short run regression results indicates that though there exists positive relationship between gross domestic saving and economic growth, the impact of gross domestic savings on economic growth is statistically significant in both cases. Finally, the result of Granger causality test reviled that unidirectional relationship exists between gross domestic product (GDP) and gross domestic savings; and the causality run from gross domestic product (GDP) to gross domestic savings. So the overall short run results favor Keynesian point of view that savings depend upon level of output. Based on the findings of study, government and policymakers should employ policies that would increase domestic saving to the extent it becomes a driving force for economic growth.

Key Words: Domestic Saving, Economic growth, Granger Causality, Johansson Co-integration, Unidirectional, Vector Error Correction Model, Ethiopia

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

The issue of economic growth remained the main agenda in economic policy formulation for every nation; especially for the Sub-Saharan Africa (SSA) and other developing countries of the world. The main reason is that economic growth is among the most important factors affecting the quality of life in a country. As a result, there is a growing concern among researchers and policymakers over the declining trend in saving rates and its substantial divergence among countries. This is due to the critical importance of saving for the maintenance of strong and sustainable growth in the world economy through its effect on capital formation of any country, which is determined mainly by saving rate. Over the past three decades, saving rates have doubled in East Asia but stagnated in Sub-Saharan Africa, Latin America and the Caribbean (Loayza et al., 2000a).

Development economists have been concerned for decades about the crucial role of domestic saving mobilization in the sustenance and reinforcement of the saving-investment-growth chain in developing economies. As a result, the relationship between savings and economic growth has extensively been studied by researchers, especially for many developing countries. Some authors have found a strong positive relationship between real per capita growth and saving rates (Modigliani, 1970; Bosworth, 1993; and Carrol and Weil, 1994). However, its structural interpretation on the direction of causation is controversial, since it is viewed both as evidence that growth drives saving (Modigliani, 1970; and Carrol and Weil, 1994) and that saving drives growth through the saving-investment link (Levine and Renelt, 1992; and Mankiw et al., 1992). Several empirical studies also found the existence of bi-directional causality response (Greenwood and Jovanovic, 1990; Wood, 1993; Greenwood and Smith, 1997; Al-Yousif, 2002; and Demetriades and Hussein, 1996)

In general, empirical evidences reveal that the direction of causation between saving and economic growth is inconclusive. However, one of four possible relationships can exist between savings and economic growth: saving-led growth (or the capital fundamentalist view or supply side/leading hypothesis); growth driven saving (or the Keynesian view or demand side/following hypothesis); the two-way (or bi-directional) causal relationship termed as feedback, or bi-directional independent (no causation between them).

Ethiopia, the second-populous country in Africa, is among the low-income Sub-Sahara African countries that face a number major development challenges for many decades and has been an example of poverty for a number of decades. Nevertheless, Ethiopia was known for its rapid growing economy with an average of 11.2% between 2004/05 and 2009/10. Though agriculture was the main driver, the economic growth rate was one of the fastest growing economies in the world (MoFED, 2011). IMF (2018) also indicated that Ethiopia has recorded an annual average GDP growth of about ten percent in the last decade, driven mainly by public investment in agriculture and infrastructure. As a result, poverty rate has fallen from 44 percent in 2000 to 23.5 percent in 2015/16. In 2016/17, GDP grew by 9 percent, as agriculture rebounded from severe drought condition in 2015/16 and Industrial activities expanded, with continued public investments in infrastructure and manufacturing. In 2017/18, economic growth was also estimated to stay high at 8.5 percent, supported by continual recovery from drought and export expansion as new manufacturing facilities and infrastructures came online.

Despite marvelous economic growth since 2004/05, still Ethiopia is characterized by low level of national income, which in turn has resulted to low level of domestic savings, severe resource gap, and narrow industrial base (Tsegabirhan, 2010;) (Befekadu 2011) and (IMF 2018), The vulnerability of the economy to drought and inflation shocks, weak financial market infrastructure coupled with limited awareness of the public on the value of saving, high youth and old age dependency have also been the bottle necks for low level of saving. These structural bottlenecks to development are highly interlinked and one re-enforces the other. The implication is thus, with a grave development deficit in every sector of the economy, Ethiopia needs huge financial resources to achieve the objectives of its development plans.

Therefore, the examination of causal relationship between saving and economic growth in Ethiopia is very important because it provides useful information on which economic variable(s) that the government and relevant authorities need to control in order to attain the desired level of saving that stimulate investment and hence rapid and sustained economic growth as argued by Sajid and Sarfraz (2008).

1.2. Statement of the Problem

Nurske (1953) as cited in Loayza et al., (2000b) described the low level of saving in which many developing countries fall, as the saving trap. According to him, the main constraint of developing countries on the supply side is very limited capacity to save, resulting from low level of real income. Furthermore, the low level of real income is regarded as a reflection of low level of productivity, which in turn is largely due to shortage of capital. On the other hand, shortage of capital is the result of limited capacity to save, and so that the vicious circle of saving trap is complete.

Hence, it is clear from the above vicious circle of saving trap that savings play an important role in the economic growth and development process of a nation by determining the national capacity to invest and thus to produce, which in turn, affect economic growth potential of the country. Nevertheless, Ethiopia is among the low-income Sub-Sahara African countries that face a number major development challenges for many decades. Low saving rates have been cited as one of the most serious constraints to sustainable economic growth of Ethiopia. For instance, Dawit (2004) noted that the ratio of domestic saving to GDP during the Imperial Regime (1960/61 – 1974/75) was on average 4.5 % but declined further to an average of 2.4% during the Dergue era (1974/75 -1990/91), which was believed to be one of the reasons for political unrest and economic stagnation in the country.

The ratio shows increment after the free market reform of 1992 and averaged at 7.3% of GDP between 1991/92 and 2009/10. However, this ratio of domestic saving to GDP in Ethiopia was not only by far lower than the average for SSA countries (excluding South Africa and Nigeria) but also fall short to finance investment (Befekadu 2011).

Further, the IMF (2018) prediction on the financial imbalances of the country indicated that both the ratio gross domestic savings and gross domestic investments to GDP showed a declining trend by 2 percentage points to 20.4 percent in 2016/17 and 2017/18 fiscal years from their level in 2015/16; as a result of which the resource gap of the country not only failed to show a sign of improvement but also remained high at about 16 percent of GDP[1].

The empirical evidence seems to suggest that the impacts of saving on Economic growth/Economic growth on saving are mixed and inconclusive. This study is motivated by the need to fill this particular gap by empirically analyzing the case for Ethiopia. And, to fill the saving and level of productivity gap that helps to achieve sustainable growth and development the country is in need of national capacity to invest and thus to produce.

Therefore, realizing the important relationship between saving and economic growth this thesis attempted to investigate the impact of saving on economic growth, and the direction of causality between them in the case of Ethiopia. The study uses annual time series spanning from 1975/76 - 2017/18 and rigorous econometric techniques.

1.3. Objectives of the Study

In light of the above facts, the objective of this study is to investigate empirically the relationship between domestic saving and economics growth in Ethiopia based on the endogenous growth framework. To this end, annual time series data for the period 1975/76 – 2017/18 was used. The macro policy target is real per capita income growth (a proxy for economic growth). More specifically, the study attempts to:

- Analysis the trend of saving, investment, and economic growth in Ethiopia;
- Investigate the long run impact of saving on economic growth in Ethiopia
- Examine the short run effect of saving on economic growth in Ethiopia
- Analyze the causal relationship between saving and economic growth in Ethiopia

[1] *IMF (2018) predicted that the gross domestic savings to GDP ratio tend to decline from 22.4 percent in 2015/16 to 20.4 percent in 2016/17 and 2017/18. On the other hand, the gross domestic investment to GDP ratio was predicted to decline to 36.6 in 2016/17 and to 36.4 percent in 2017/18 from its level of 38.5 percent in 2015/16. As a result, the resource gap to GDP ratio in 2016/17 and 2017/18 fiscal years was 16.1 and 16.2 percent, respectively.*

1.4. Research Hypothesis

Up to now, several studies came with the mixed result on saving-economic growth nexus in various countries. Some argued that saving granger cause economic growth while others argue the reverse. Even some came with inconclusive result and there is no robust evidence at all. Other scholars also found bi-directional causation between saving and economics growth. These results show that there is controversy and heated debate on the saving-growth nexus. Thus, based on the specific objectives of this study, the following testable research hypotheses are formulated for analytical purpose.

- Ho: There is no significant improvement in domestic saving and domestic investment to GDP ratios in Ethiopia in post reform period (1975/76 – 2017/18)
- H_1: There is significant improvement in domestic saving and domestic investment to GDP ratios in Ethiopia in post reform period
- H_0: Domestic saving does not have positive and statistically significant effect on long-run economic growth in Ethiopia
- H_1: Domestic saving has positive and statistically significant effect on long-run economic growth in Ethiopia
- H_0: Domestic saving does not have positive and statistically significant effect on short-run economic growth in Ethiopia
- H_1: Domestic saving has positive and statistically significant effect on short-run economic growth in Ethiopia
- H_0: There is no casual relation between domestic saving to GDP ratio and economic growth in Ethiopia
- H_1: There is a unidirectional casual relation between domestic saving to GDP ratio and economic growth in Ethiopia

1.5. Scope of the Study

The main aim of this research is to investigate the long run, short run, and causal relationship between gross domestic saving and economic growth in Ethiopia. Accordingly, this study focuses on the trend of gross domestic saving as well as domestic investment to GDP ratio; examining whether gross domestic saving transforms the country's economic growth in the long-

run and short-run; and the direction of causation between saving and economic growth in Ethiopia.

Gross domestic saving in this study includes only public savings and private savings in the banking sector. It does not include foreign saving in the banking system. Moreover, gross domestic investment in this study includes only the sum of public investment and private investment but it does not include Foreign Direct Investment (FDI). Both saving and investment variables will be deflated as a ratio of GDP (or GDP at current market value) and extracted from the national account database.

To achieve the objectives of the study secondary data spanning for the period 1975/76 to 2017/18 was used. The methodology employed in this study include descriptive statistics or ratio analysis technique and two distinct endogenous growth accounting econometric techniques namely the multivariate Johansson Co-integration approach and the bivariate Granger casualty test. In both cases log-linear models were used for the models to reflect the elasticity of the dependent variables to a change in the explanatory variables.

1.6. Limitations of the Study

Research work involving time series data is affected by lack of adequate data on some economic variables, at least in Ethiopia and other developing countries. This place is a limitation on the scope of variables that may be incorporated in the model. In Ethiopia, evaluating the quality of data, there is no adequate, consistent data in domestic sources. Even data from the same institution shows different figures for the same year.

1.7. Significance of the Study

The research paper will provides the direction of causality between the gross domestic savings growth and GDP growth rate is also of considerable importance for development policy. Savings drive growth through an automatic translation of savings into capital formation, then the main goal of development policy should be to increase savings, while if growth results less from savings and capital formation and more from other factors such as policies relating to technological innovation, human capital, international trade or foreign direct investment, then they should be the main targets of development policy.

The significance of this study partly arises from the fact that the formulation of development policy aimed at improving the performance of the economy requires an understanding of how domestic saving affects economic growth through rigorous empirical study. Few studies available focus mainly either only on one aspect or two aspects of the relationship between domestic saving and economic growth. Moreover, the studies failed to show explicitly the channels through which domestic saving can affect economic growth in the long-run. These studies include among others the study by Dawit (2004) on the causal relationship between economic growth and gross domestic savings; Befekadu (2011) on the short-run determinants of national saving and causality between them, and Achalu (2012) on the long-run relationship between savings and economic growth in Ethiopia.

Therefore, this study differs from the previous studies mentioned above in terms of focus, methodology followed, data coverage, and showing the channel through which saving affects economic growth. That is, first, the focuses of this thesis are three fold: to examine the long-run and short-run relationship and the causal relationship between gross domestic savings and economic growth in Ethiopia. Secondly, it will adopt/employ the endogenous growth model proposed by Johansson (1988) and Granger-Causality test (1987); and thirdly, it will use adjusted and large (43 years) macroeconomic time series data spanning from 1975/76 to 2017/18. Finally, in addition the long-run growth model, this study attempts to show the channel through which saving affects economic growth.

1.8. Organization of the Study

This research is organized in five chapters. Chapter-one deals with introduction of the study which includes background of the study, this is followed by statement of the problem, objectives of the study, significance of the study, and scope and methodology of the study, Chapter two presents the review of related literature which includes theoretical and empirical related review literature. Chapter three shows the methodology and design of the study which includes the type and source of data, model specification and methods of data analysis. Chapter four shows, presentation, analysis and interpretation of the data are made. Finally, conclusions, summary of main findings and policy implications are presented in chapter five.

CHAPTER TWO

LITERATURE REVIEW

This section focuses on review of existing literature on the subject of study. The first part looks at the theoretical postulations and the second part reviews the empirical research findings by authoritative economic scholars on the global economies.

2.1. Theoretical Literature

Beck et al. (2000) noted that financial development might influence growth via improvements in technology (through better allocation of savings by the financial sectors) or via a more rapid capital accumulation by increasing domestic savings rates and attracting foreign capital). They also suggest that financial development can foster economic growth by rising saving, improving allocative efficiency of loanable funds, and promoting capital accumulation.

Solow's (1956) Growth Model mentioned developing countries with lower capital stock will have more rapid growth than the developed countries through increasing saving and investment rates. This means that high saving rate in the developing countries could stimulate the economic growth rapidly. Due to the potential positive effect of saving, many developing countries especially those in the Third World will make some policies to increase their country's saving rate in order to push their growth rate of real gross domestic production (Liu and Guo, 2002). The theoretical framework for these policies is that high saving rate could increase the amount of creditable capital which will push up the investment, and then the economic development and economic growth rate (Stem, 1991).

Romer (2006) noted that growth is closely related to the level of human capital. Firms directly benefit from knowledge accumulation due to higher rate of technological progress, via new innovations that enhance greater productivity. Increase in saving rate also leads to greater accumulation of human capital via increase education and widespread Research and Development. The additional human capital causes a higher rate of technological progress, via

new innovations. Higher technological progress increases output per capita allowing for unbounded long run growth.

Keynes (1936) observed that savings as the excess of income over expenditure on consumption. Meaning that savings is that part of the disposable income of the period which has not passed into consumption. Given that income is equal to the value of current output; and that current investment (i.e. Gross capital formation) is equal to the value of that part of current output, which is not consumed; savings is equal to the excess of income overconsumption.

Tobin (1965) correctly identified that the development of a monetary sector could be damaging. With the introduction of money balances, agents face the choice of allocating resources not used for consumption either to the purchase of physical capital or to money balances. Since it is physical investment that is the source of economic growth, if money balances are not made available for investment, but rather held as a stock of purchasing power, the equilibrium growth path of an economy will occur at a lower level of per capita output than before.

Levhari and Patinkin (1968) noted that the production function can be written as output, a function of capital, labour and real money supply. Thus, production depends on working capital in the same way as it depends on fixed capital. If money were not productive there would be no point using it in production and the economy would revert to a barter system. Money, being a productive factor of production, allows the economy to realize a higher level of per capita output than in its absence. They also argued that for financial liberalization on the basis saving is complementary to investment in the development process, even with a money economy where saving can go either into the accumulation of money balances or accumulation of physical capital.

According to Mensah (2004), saving is broadly defined as maintaining part of current income for use in the future or it is simply the accumulation of financial and non-financial assets. In its narrow sense, saving generally means putting money aside, for example, by investing in a pension plan or putting money at the bank. In a broader sense, saving is typically used to refer to economizing, cutting costs, rescuing someone or something. Savings, on the other hand, may be defined as accumulated money put aside by saving.

Todaro (2003) defines economic growth as "a long-term rise in capacity to supply increasing diverse economic goods to its population, this growing capacity based on advancing technology and the institutional and ideological adjustments that it demands." According to him, there are three principal components that are inherent in the definition: the sustained rise in the national output is a manifestation of economic growth, and the ability to provide a wide range of goods is a sign of economic maturity; advancing technology provides the basis or preconditions for continuous economic growth; and The realization of the potential for growth inherent in new technology, institutional and attitudinal adjustment that must be made- technological innovation without concomitant social innovation is like a bulb without electricity, the potential exists but without the complementary inputs, nothing will happen.

Hugues Kamewe-Tsafack (2010) noted that low saving rate is hindrance to the economic growth and, saving rate is very low and main reason for this low savings is the low interest rate and high inflation. These negative interest rates encourage people to invest their money in tangible goods instead of investing it in the productive financial sector. And Sache (2004) posed that low national savings rate leads to low or negative economic growth rates, further he suggested that a big push from public investment is needed to improve the productivity.

Carroll and Weil (1994), claim that an exogenous increase in the aggregate growth will make forward looking consumers feel wealthier and thus consume more and save less - thus implying that the impact of income growth on savings could be negative. On the other hand, if consumption is habit based and changes slowly in response to changing income, a larger fraction of increases in income may be saved resulting in the savings rate increasing with income increases.

The financial system is also known to affect the level of economic growth in a country. According to Levine and Zervos (1993), new research suggests that economies with more developed and more efficient financial systems will be able to more effectively allocate savings to the best investments, which in turn leads to increased productivity, potentially higher savings rates, and faster growth. The authors use the ratio of liquid liabilities to GDP to examine the relationship between financial policy and growth. Their results show that countries with larger per capita growth rates tend to have larger financial systems.

2.2. Empirical Literature

Given the importance of controlling for the joint endogeneity of saving and income growth, a panel instrumental-variable approach to estimate the effect of income growth on saving was carried out by Loayza et al. (2000). In their study, they utilized the world saving database, whose broad coverage makes it the largest and most systematic collection of annual time series on country saving rates and saving-related variables, spanning 35 years (1960 – 1994) and 134 countries (112 developing and 12 industrial). The finding of their study indicates that a one percentage point rise in growth rate increases the private saving rate by a similar amount, although this effect may be partly transitory or short-run. Moreover, Nwachukwu (2009) investigated the long-run and short-run determinants of private saving in Nigeria for the period between 1970 and 2007 using the Johansen's Co-integration Test and Dynamic Error-correction models, respectively.

The estimation results for the long run model point to the growth in income as having positive and statistically significant positive influences on domestic saving at the 1 percent level. That is, an increase in the growth rate by one percent leads to a long-run increase in the saving rate by 0.5 percent. The result indicates that, as the incomes of private agents grow faster, their saving rate increases. The implication is that any policy that encourages income growth in the long run will have a strong impact on private saving rate. Given the historical close link between saving and investment rate, a rise in growth rate will lead to a virtuous cycle of higher income and saving rates. Furthermore, though smaller in magnitude, the growth of income also exerts positive and statistically significant effect on private saving rate at 1 percent level in the short - run. The coefficient estimate shows that a unit changes in income growth will bring about a 0.3 percent change in private saving. The implication is that short run changes in private saving rate that correct for past deviations emanate principally from changes in income growth.

Based on neoclassical growth model (Solow, 1956) suggested that savings affected the economic growth since higher savings led to capital accumulation, which in turn led to economic growth. saving has no influence on the long run growth of total and per capital output since capital deepening increase capital labor ratio and also increase the share of output to replace and keep the existing capital but it still positively affects the living standards permanently by increasing

the steady state amount of stock of capital per worker which, in turn, allows an increase in output per worker in the long run. Thus, depreciation of capital may exceed net investments. A growing labor force may accelerate this condition because more workers need to be equipped with capital.

Anderson (1999) conducted a study to investigate the causal relationship between real output and savings for Sweden, UK and USA. The results indicated mutual long run relationship between variables only for Sweden and UK. The result also indicated short run bidirectional causality for USA and unidirectional causality from saving to output for UK. No significant evidence of short run causality was found for Sweden. He concluded that the causal chain linking savings and output might differ across the countries. He also suggested that causality in the long run might go in different directions than causality associated with short-term disturbances.

There is an abundance of empirical studies on the saving-growth nexus in different countries. For instance, Aghevli et al (1990) found that the saving rate and investment in human capital are indeed closely linked to economic growth. The relationship among saving, investment and growth has historically been very close; hence, the unsatisfactory growth performance of several developing countries has been attributed to poor saving and investment. Hence, if a causality test on saving-growth nexus reveals that saving causes economic growth, then the policy option would be to design appropriate policies amenable to enhance savings in order to achieve the desired high growth targets;

Obadan and Odusola (2001) employed both graphical analysis as well as Granger Causality tests to determine the impact of growth on saving in Nigeria for the period from 1970 to 2000. Their results revealed that growth of income does not Granger-cause saving, suggesting that saving is not income-induced in Nigeria. Evidence on the reverse causation argument also shows that saving does not Granger-cause growth. The findings therefore do not show any direct relationship between saving and income growth.

Dawit (2005) investigated the direction of causality between real economic growth and growth rate of real GDS in Ethiopia for the series were co-integrated using time series data spanning from 1960/61-2002/03. The study employed a co-integration test procedure based on vector autoregressive (VAR) and the results of the bivariate causality tests from the VECM indicate that there is a bi-directional causality or feedback between real economic growth and growth rate of real GDS. However, the bi-directional causality findings of the study lend support to the hypothesis that faster growth rate or real gross domestic saving (RGDS) cause higher growth rates of RGDP in Ethiopia and to the lesser extent, a higher rate of growth of RGDP causes a faster growth of RGDS. The policy implication that emerges from this study indicates is that policymakers should be aware of the possibility of causality strongly running from RGDS to real economic growth than otherwise and hence should concentrate on promoting real economic growth via adopting income policies, since such strategies can definitely lead to higher growth of RGDS as well as to a more rapid economic growth.

Aromm (2005) studied the relationship between savings and economic growth in North Africa using a Vector Error Correction Model for 1946-1992. He concluded that private saving has both direct and indirect effects on economic growth. In his view, the direct effect of savings is through private investment. He also showed that economic growth has a positive effect on the private savings rate.

Mohan (2006) investigated the causality relationship between savings and economic growth in 13 countries with different income levels during 1960- 2001. The countries were divided into four different income levels: low income, less than the average, more than the average and high income. He used a Granger Causality method and showed that the causality relation and direction differs among countries depending on income levels. In general, the Keynesian theory of savings as a function of growth was confirmed in countries with low and less than average incomes while the Solow hypothesis that savings is a determinant of economic growth was confirmed in countries with high and more than average incomes.

In India, Verma,(2007) used Autoregressive Distributed Lag (ARDL) Bounds testing technique to analyze the long-run relationship between gross domestic savings, gross domestic investment and economic growth the data for the period 1951-2004. The results revealed that gross domestic savings, gross domestic investment, and economic growth have long-run relationship, with the exception of when economic growth was the dependent variable. The study also indicated that savings do not contribute to growth, but growth leads to savings, savings drive investment both in the short-run and in long-run and that investment is the driver of economic growth in India during the period.

Sinha (2007) examined the relationship between per capita saving and capita GDP for India during the 1950-2004 periods. The authors employed the Toda and Yamamoto tests of Granger causality and discovered that there is no causal relationship between per capita GDP and per capita household saving/per capita corporate saving. On the contrary, the results show the existence of a bi-directional causal relationship between per capita household saving and per capita corporate saving.

Hemmi et al., (2007) studied the relationship between precautionary savings and economic growth. They used an Autoregressive Conditional Heteroskedastic (ARCH) model with annual data from 1955 to 1990. They concluded that increased savings can have a favorable impact on sustainable growth. They also found that stronger shocks on precautionary savings result in the higher levels of savings as a whole.

Sajid and Sarfaraz (2008) analyzed the effect of savings on economic growth by using seasonal data for 1973 to 2003 in Pakistan. The authors assessed the causality relation between savings and economic growth by using co-integration techniques and a Vector Error Correction Model (VECM). Their results show that there is a one-way causal relationship from savings to economic growth. The long run results of this study show the importance of savings in investment creation for Pakistan. The short run results also indicate that there is a relation between domestic savings and GDP. The causality relation only runs from national savings to GDP in the short run. The short and long run results of this study confirmed the Keynesian view that saving is a function of income levels.

Odhiambo (2008) investigated the relationship between savings and economic growth in Kenya. He studied the causality relation between savings, economic growth and the fiscal deficit using Granger causality method with panel data from 1991 to 2005. His emphasis was on two way causality tests which differentiates his work from other studies. The results show that there is Granger causality between savings and economic growth, and that savings are an important driver for development of the financial sector.

Ogoe (2009) investigated on econometric analysis of the causal relationship between gross domestic savings and economic growth in Ghana using secondary data over a period from 1961-2008. He used Granger causality test and found that there was a bi-directional causal relationship between growth rate of gross domestic savings and growth rate of real per capita GDP in Ghana. That is growth rate of gross domestic savings granger causes the growth rate of per capita real GDP and the growth rate of per capita real GDP granger causes the growth rate of gross domestic savings.

In china et al., (2009) examined the short-run and long-run relationship between savings and economic growth by using Granger causality test with time series data from 1955 to 2004. They find bi-directional causality between gross domestic savings and economic growth in the short-run. In the long-run, a unidirectional causality exists running from the gross domestic savings to economic growth.

Odhiambo (2009) also studied the relationship between savings and economic growth in South Africa. He used a multi-variable causality test with data from 1950 to 2005 which showed that there is one-way causality from the savings rate to foreign capital inflows. His results also show that economic growth Granger causes foreign capital inflows. Therefore, he concludes that policies should be directed toward increasing savings and economic growth in the short run.

Dipendra (2009) studied the relation between savings and economic growth in India. The goal of this study was to check the long-run relationship between GDP and savings. An Engel-Granger Co-integrated method was used and the results showed that gross savings of the private sector have a bigger impact on GDP than gross domestic savings. Moreover, gross domestic savings and gross private savings were shown to be co-integrated with GDP. Yet the causality analysis between these variables showed that there is no causality in any direction among them.

Abu (2010) studied the relationship between savings and economic growth in Nigeria using Granger Causality techniques and Co-Integration for the period 1970 to 2007. His results indicate that the variables are co-integrated in such a manner that one can conclude there is a long-run equilibrium relationship between them and that causality runs from economic growth to savings.

Masih and Peters (2010) studied the mutual relation between savings and economic growth in Mexico using a Vector Auto-Regressive (VAR) method and annual data from 1960 to 1996. They concluded that savings have a positive effect on economic growth.

Singh (2010) studied the causal relationship between domestic savings an economic growth in India. He analyzed the short and long run relation between these variables using an Autoregressive Distributed Lag model for the period 1950 to 2002.The results indicate that there is a two-way relationship between savings and economic growth. His results also showed that an increase in savings and capital accumulation will lead to higher income and economic growth.

Bassam AbuAI-Foul (2010) employed an econometric technique to investigate the long run relationship between real gross domestic product and real gross domestic saving for Morocco and Tunisia using time series data during the period 1965-2007 and 1961-2007, respectively. The author used Granger causality method and it was shown that whereas a long-run relationship exists between gross domestic product and gross domestic saving in Morocco, there was no such evidence for Tunisia. Secondly, the Granger causality test indicates the existence of a two-way causal relationship between gross domestic product growth and gross domestic saving growth in Morocco. Lastly, the author observed a unidirectional Granger causality between real gross

domestic product and real gross domestic saving as causality runs from gross domestic saving growth to gross domestic product growth in Tunisia.

Khan and Shahbaz (2010) used Autoregressive Distributed Lag model (ARDL) Bounds test and Johansen co-integration to examine the long run association between savings and economic growth in Pakistan by using annual time series data for the period 1971 to 2007. Their results finally revealed the existence of a long run relationship between domestic savings and economic growth. The authors also found a one-way causality running from economic growth to domestic savings in Pakistan.

Befekadu (2011) examined the relationship between Savings and Economic Growth in Ethiopia using time series data spanning from 1970/71 - 2000/01. To examine the relationship between the two, the study employed multivariate Co-integration analysis using Engel Granger two step procedures and bivariate Granger-Causality test to analyze the short-run dynamics and direction of causality, respectively. In the short-run model, the dependent variable was the ratio of national saving (which includes foreign saving derived from remittance and foreign aid) to disposable income and the five independent variables include economic growth, real interest rate, demography (the ratio of active labour force to total population) and government consumption expenditure as ratio to GDP. The coefficients of short run dynamics estimated following the Engle granger two step procedures indicate that there is positive and statistical significance relationship (at 5 percent level) between economic growth and national saving in Ethiopia.

However, the result of bivariate Granger-Causality test shows that that economic growth is interdependent to national saving; implying neither the supply-leading nor the demand following hypothesis holds true in Ethiopia during the study period. Therefore, he suggests that policymakers should attempt to force up the saving and growth rate directly and establish an environment that facilitates rapid capital accumulation, efficient resource use, high productivity growth, and sustain economic growth.

Misztal1 (2011) analyzed the cause and effect relationship between economic growth and savings in advanced economies and in emerging and developing countries in the 1980-2010 period. Employing co-integration models and Granger's causality test in estimating the relationship, the results confirmed the existence of one-way causal relationship between gross domestic savings and gross domestic product in the case of developed countries as well as in developing and transition countries. At the same time it revealed the absence of causal relationship between gross domestic product and gross domestic savings both in developed economies and developing and transition countries.

Muhammad et al., (2012) have tried to estimate the impact of savings and credit on economic growth in Pakistan by using time series data for the period of 1973 to 2007, based on the autoregressive distributed lag (ARDL) approach. The results showed that one percent increase in credit to private sector, real gross domestic product will increase at 5.59 percent .The estimated coefficient of national saving was 1.015 indicated that one percent increase in national savings, real gross domestic product will increase at 1.015 percent. Thus, the credit to private sector has positive and significant impact on economic growth in the long run and in short run.

Achalu (2012) examined to investigate the causal relationship between saving and GDP growth in Ethiopia by using annual data for the period of 1961 to 2010 by using Engle-granger and Johnson co-integration test, the result indicates that the direction of causality between domestic savings growth and economic growth may run in unidirectional: the causality run from gross domestic product (RGDP) to gross domestic saving. So overall short run results favour Keynesian point of view that savings depend upon level of output.

Mohsen and Maysam (2013) have analyzed the relationship between saving and GDP in Iran by using time series data from the period of 1970-2010, based on ARDL bounds testing approach. The study finds a co-integrating relationship between national real GDP, savings, oil revenues labor force, and education. Compared to the other variables, labor force and human capital (education) have more significant influence on long -run economic growth. Furthermore, in short-run savings and oil revenues have the greatest influence on economic growth.

Mehrara and Musai (2013) deployed Autoregressive Distributed Lag (ARDL) to analyze the relationship between savings and economic growth in Iran during the period of 1970 to 2010. The study established that there exists a long-run relationship among economic growth, gross domestic savings, labour force, oil revenue, and education. It was discovered that gross domestic savings relate positively to economic growth in both long-run and short-run. However, based on the weak influence of savings on economic growth, the study suggested to government and policy makers to put in place policies that would enhance productivity and human capital in order to accelerate economic growth in Iran.

Bankole and Fatai (2013) attempted to use Granger causality and Engle-Granger co-integration tests to examine the causal and effect relationship between the domestic savings and economic growth in Nigeria for the period of 1980-2010. It was revealed that there is a unidirectional running from savings to economic growth in Nigeria. As a result, the study supports the Solow's hypothesis that savings precede economic growth but refuses the Keynesian theory that it is economic growth that leads to higher savings.

Yohannes (2014) studied the macroeconomic determinants of gross national saving in Ethiopia using time series annual data form 1970-2011 by using ARDL approach. He analyzed as that financial development and Current account deficit are significant determinants of gross national saving, but gross national disposable income, dependency ratio, budget deficit and inflation found to be statistically insignificant determinants of gross national saving in Ethiopia in the long run.

Sothan (2014) determined the direction of causality between saving and economic growth in Cambodia, using data for the period 1989-2012. His empirical analysis was based on Granger causality test. It was found that domestic saving does not Granger cause economic growth which contradicts the conventional wisdom that causality moves from savings to economic growth. The study further revealed that there is no causality from economic growth to saving. In effect, economic growth and saving are independent of each other in Cambodia.

Jiang Yuansheng (2015) examined the relationship between savings and economic growth of Pakistan over the period 1977-2013. Using the autoregressive distributed lag (ARDL) approach to co-integration, the results show that the empirical evidence strongly suggests that domestic savings played important role in economic growth and development of Pakistan in the long-run. Thus, domestic saving is positively and significantly associated to growth in Pakistan

Jagadeesh (2015) explored the relationship between savings and economic growth in Botswana, using data for the period 1980-2013. His empirical study the data were stationary and co-integrated and showed that there is a significant relationship between savings and economic growth in Botswana. The results supported that saving rate positively or directly related to the GDP in this country.

Samuel and Abebe (2015) analyze the causal relationship between economic growth and savings in East Africa, in a case of Ethiopia, Uganda and Kenya (1981-2014) using Vector Error Correction (VEC) method and Johnson's approach. The empirical study revealed that a significant relationship between domestic savings and economic growth in the case of Ethiopia and Uganda. However, there is no significant relationship obtained in the case of Kenya over the study period by Johnson co-integration approach. The results of Granger Causality between economic growth (GDP) and gross domestic savings indicated the presence of unidirectional causality between economic growth and gross domestic savings in the case of Ethiopia and Uganda. Gross domestic product does Granger cause gross domestic savings; this means that economic growth accelerates gross domestic savings in the case of Ethiopia and Uganda.

Abel Mesfin (2016) investigated relationship between national savings and economic growth in Ethiopia by using annual data for the period 1975-2013. They used ARDL Model and Granger causality is attributed for the empirical results. The results of Granger causality test showed that there is a unidirectional causality from gross national product to national savings.

In Summary, the evidence from the above theoretical and empirical literature review show that the link between, saving and economic growth is mixed. Theoretically, the conventional wisdom confirms that the causal direction runs from saving to economic growth, but many empirical findings indicate that this conventional wisdom does not hold. This means that findings on the causal relationship between saving and economic growth are still inconclusive. This may be due to the quality of data or the estimation techniques that were used.

This study differs from the studies mentioned above in terms of data coverage that is the first, the focuses of this research to examine the long run and short run relationship and the causal relationship between gross domestic saving and economic growth in Ethiopia. Secondly, it will adopt/employ the endogenous growth model proposed by Johansson (1988) and Granger-Causality test (1987); and thirdly, it will use adjusted and large (43 years) macroeconomic time series data spanning from 1975/76 to 2017/18, Finally, in addition the long-run growth model, this study will attempt to show the channel through which saving affects economic growth.

CHAPTER THREE

DATA AND RESEARCH METHODOLOGY

The main objective of this chapter is to outline the empirical framework employed so as to achieve the specific objectives of the study. This study adopts both descriptive method and econometric method to achieve the objectives of the study. The descriptive statistics is used mainly to analyze the trend of savings and investment in pre-reform and reform era between 1975/76 and 2017/18 based on availability of data.

Moreover, the study uses two econometrics methods namely - the Vector Error Correction (VEC) Model and Granger casualty test to examine the impact of domestic saving on economic growth and direction of causality between them in Ethiopia. The multivariate Johansen co-integration model shall predict the cumulative effects taking into account the dynamic response among variables (domestic saving or liquid liabilities of the banking system) and other examined variables.

Accordingly, section 3.1 describes the data used in this study whereas as section 3.2 deals with the specification of the long-run multivariate vector autoregressive (VAR) Models namely the growth model and domestic capital accumulation model and Section 3.3 outlines the estimation procedures for the long-run and short-run dynamic growth model and domestic capital model and the Granger casualty test for identifying the direction of causality between domestic saving and economic growth finally section 3.4 deals with diagnostic test of model adequacy.

3.1. Data Source and Variable Descriptions

The data used in this study are annual time series data covering the period from 1975/76 to 2017/18 for Ethiopia[2]. The data were sourced from the Ministry of Finance and Economic Corporation-MoFEC (2015/16), National Bank of Ethiopia (2017/18), and IMF-country report (various issues).

[2] *Fiscal year in Ethiopia begins July 1 and ends June 31*

The relevant economic growth variable is real GDP per capita and the data on real GDP, and labour force were obtained from Ministry of Finance and Economic Development-MoFED (2015/16). The data on gross domestic savings and gross capital formation are obtained from NBE (2017/18). The study uses financial indicators: gross domestic savings and gross capital formation/investment to GDP ratio. Both series were obtained from NBE (2017/18). The gross domestic savings ratio is a measure of financial sector activity or the ability of the banking system to provide saving-led growth. The supply of the savings both to the private and public sectors in the form of credit is important for the quality and quantity of investment (Demetriades and Hussein, 1996).

3.2. Model Specification

A number of recent studies have used endogenous growth theory to show the relationship between saving and economic growth. The general idea consists of assuming that domestic saving mobilization improves the efficient allocation of resources, which in the context of endogenous model, implies higher long-run economic growth. These theoretical predictions are confirmed by large body of empirical evidence. Thus, the multivariate vector autoregressive (VAR) model considered below for empirical analysis capitalizes the role of saving on economic growth in Ethiopia through Total Factor Productivity (TFP) growth and capital accumulation equations determining domestic capital along with GDP growth. The econometric framework builds on the endogenous growth accounting model, which models TFP. Using t to denote time period (years) the basic economy wide production function can be written as

$$Y_t = A_t (K_t^d)^{\beta} (L_t)^{1-\beta} \text{ ---------- (3.1)}$$

Where, Y_t, A_t, K_t^d, and L_t denote aggregate real GDP, TFP, stock of gross domestic capital and active labour force, while β is a parameter of the production function. The small d is meant as 'domestic capital'.

Dividing both sides of the production function by L_t, taking log transformation and denoting logs of output per worker, TFP, and domestic capital per worker by $y_t, a_t,$ and k_t^d respectively, yields

$$y_t = a_t + \beta k_t^d \text{ ---------- (3.2)}$$

Domestic saving can influence growth rate of GDP per labour through two channels, namely TFP growth and capital accumulation.

According to Ahmed and MaliK (2009), there are two different approaches for constructing the model that capture the two channels mentioned above through which domestic savings can influence economic growth. The first approach is to estimate the effects of domestic saving along with other control variables on each of the two variables; namely TFP and domestic capital then substituting the estimated equations in the growth accounting equation specified above. The other approach is to substitute the algebraic expressions indicating the relationship of TFP with saving and other variables into the growth accounting equation before estimating the latter.

Following the second approach, we specify the following linear relationship to determine TFP.

$$TFPt = \beta_0 + \beta_1 \ln sse_t + \beta_2 \ln ds_t + \beta_3 \ln gc_t + \beta_4 \ln op_t + e_t \text{ ------ (3.3)}$$

Where $\ln sse_t, \ln ds_t, \ln gc_t,$ and $\ln op_t$ are the natural logarithm of gross secondary school enrollment, gross domestic savings to GDP ratio, government final consumption to GDP ratio, and trade openness (the ratio of exports and imports to GDP), while β_i and e_t indicate is parameter estimates of TFP and random error term, respectively. Equation (3.3) implies that, besides gross domestic investment to labour ratio ($\ln k_t^d$), which includes expenditure on human capital, research and development and infrastructure, gross domestic saving to GDP ratio ($\ln ds_t$) also affect economic growth through their impact on TFP.

The vector of control variables that are assumed to affect TFP are gross secondary school enrollment, government final consumption to GDP ratio, and trade openness to GDP ratio. Romer, (1989) noted that gross secondary school enrollment is a human capital indicator and it obviously affects TFP through accumulation of knowledge, learning ability, and general increase productivity of resources.

Price inflation can adversely affect TFP by causing uncertainty and short term distortions in resource allocation. According to Barro and Sala-i-Martin (1995) this variable indicates macroeconomic stability. Government final consumption indicates the size of the public sector and its effect is generally regarded negative, because as public spending increases it will lead to more taxes and hence less would be domestic saving (Befekadu, 2011); unless it is specifically

meant to improve productivity. Finally, trade openness is expected to raise productivity through increased competition and transmission of technology from the rest of the world (Edwards, 1993, Levine and Zervos, 1998).

Substituting equation (3.3) into (3.2) for α_t and rearranging for the order of the variables yields the following estimable equation for the determinants of economic growth

$$\ln y_t = \beta_0 + \beta_1 \ln k_t^d + \beta_2 \ln sse + \beta_3 \ln ds_t + \beta 4 \ln gc_t + \beta 5 \ln op_t + \varepsilon_t \text{ ----- (3.4)}$$

Now to specify the determinants of domestic capital, the following econometric equation is proposed

$$\ln k_t^d = \rho_0 + \rho_1 \ln sse_t + \rho_2 \ln ds_t + \rho_3 \ln y_t + \rho_4 \ln gc_t + \rho 5 \ln op_t + \upsilon_t \text{ ------- (3.5)}$$

Domestic saving variable is expected to exert favorable influence in the capital accumulation by facilitating the channeling of resource allocation from savers to higher-return activities and increasing the quantity of fund available for domestic investment as explained earlier. According to Mohammed (2000), the significant relationship between the investment ratio and the saving may be a good reason to consider that the nature of the saving-growth link hinges on the investment behavior of the private and public sectors in an economy. In other words, the insignificant correlation between savings and economic growth in developing countries may be explained by the channeling of savings to less productive investment areas such as investment in consumption instead of capital goods.

Real GDP per capita expected to affect capital accumulation through accelerator channel. Empirical evidence is consistent with the accelerator effect and shows that high output growth are associated with higher investment rate (Fielding, 1997). The ratio of government final consumption to GDP is included in the equation to determine whether government spending is conducive to or crowds out capital accumulation. Inflation rate may have positive or negative effect on domestic investment. High and unstable inflation is likely to affect domestic investment adversely by increasing the degree of uncertainty about macroeconomic environment (Fisher, 1993).

However, moderate inflation may promote capital accumulation by shifting portfolio of assets from financial to real components and by providing signals of rising aggregate demand (Tobin

1965). Finally, trade openness can affect domestic capital both through exports and imports. An increase in exports leads to an increase in the supply of foreign exchange necessary for the purchase of imported capital goods and also expands the market for domestic products.

An increase in imports can accumulate domestic capital if it implies greater access to investment goods. But imports can also negatively affect domestic capital if it predominantly consists of consumer goods, which may discourage domestic production.

The above co-integration VAR models (equation 3.4 and 3.5) provide integrated approach for understanding how domestic savings and domestic capital accumulation affect long-run rates of economic growth through TFP and capital accumulation. All computations in this thesis were done using E-views 8.

3.3. Estimation Technique

This section deals with the estimation procedures followed sequentially in this study in order to estimate the VAR models (equation 3.4 and 3.5). Sub section 3.3.1 defines stationary and non stationarity and outlines the procedures for the estimation of unit root of the variables in the growth and domestic capital models. On the other hand, sub section 3.3.2 defines co-integration, discusses the different methods of co-integration, provides justification for choosing the Johansen maximum likelihood method, and outlines the vector autoregressive (VAR) model used in this study. Since the long-run equilibrium may rarely be observed, the procedure for short-run dynamics of the variables under consideration is presented under sub-section 3.3.3. Finally, the Granger casualty test aiming at examining the direction of causation between saving and economic growth is presented in sub section 3.3.4.

3.3.1. Stationarity Test

It is standard to view empirical research in economics is based on time series as the realization of a stochastic process. The two central properties of many economic time series are non-stationarity and time-volatility (Wei, 2006). Recent development in econometrics has shown that there are problems associated with time series analysis due to non-stationarity[3].

Non-stationarity is a property common to many applied time series. This means that a variable has no clear tendency to return to a constant value or linear trend. It is generally correct to assume that economic processes have been generated by a non-stationary process and follow stochastic trends. One major objective of empirical research in economics it to test hypotheses and estimate relationships derived from economic theory, among other such aggregated variables (Pfaff, 2006). It can originate from various sources but the most important one is the unit root. With regards to stationary time series data, Harris (1995:15) noted that "… a data series is said to be stationary if its error term has zero mean, constant variance, and the covariance between any two-time periods depends only on the distance or lag between the two periods and not on the actual time at which it is computed."

The classical statistical methods used in building and testing large simultaneous equation models, such as Ordinary Least Squares (OLS), were based on the assumption that the variables involved are stationary. The problem is that the statistical inference associated with stationary processes is no longer valid if time series are a realization of non-stationary processes. If time series are non-stationary it is not possible to use OLS to estimate their long-run linear relationships because it would lead to spurious regression.

Spurious regression is a situation in which there appears to exist a statistically significant relationship between variables but the variables are unrelated (Gujarati, 1995). Hence, prior to the estimation of the long run model(s) the time series properties of the variables concerned should be distinguished between stationary and non-stationary variables.

[3] *The problem associated with non-stationary series is that all conventional techniques and statistical tests are spurious. Spurious in a sense the regression estimation will yield high R^2, statistically significant coefficients, and low Durbin-Watson'd' statistics (Gujarati, 1995:724).*

3.3.1.1. Unit root

Any sequence that contains one or more characteristic roots that are equal to one is called a unit root process. The simplest model that may contain a unit root is the AR (1) model. Consider the autoregressive process of order one, AR (1), below:

$$Y_t = \phi Y_{t-1} + \varepsilon_t \quad \text{---------- (3.6)}$$

Where ε_t denotes a serially uncorrected white noise error term with a mean of zero and a constant variance. If $\phi = 1$, equation 3.6 becomes a random walk without drift model, that is, a non-stationary process. When this happens, we face what is known as the unit root problem.

This means that we are faced with a situation of non-stationarity in the series. If, however, $\phi < 1$, then the series Y_t is stationary. The stationarity of the series is important because correlation could persist in non-stationary time series even if the sample is very large and may result in what is called spurious (or nonsense) regression (Yule, 1989, Gujarati, 1995). The unit root problem can be solved, or stationarity can be achieved, by differencing the data set (Wei, 2006).

3.3.1.2. Augmented Dickey-Fuller (ADF) Test

In section 3.4.1.1, it was stated that, if $\phi = 1$, equation 3.6 becomes a random walk model without drift, which is known as a non-stationary process. The basic idea behind the ADF unit root test for non-stationarity is to simply regress Y_t on its (one period) lagged value Y_{t-1} and find out if the estimated ϕ is statistically equal to 1 or not. Equation 3.6 can be manipulated by subtracting Y_{t-1} from both sides to obtain

$$Y_t - Y_{t-1} = (\phi - 1)Y_{t-1} + \varepsilon_t \quad \text{---------- (3.7)}$$

which can be written as

$$\Delta Y_t = \varpi Y_{t-1} + \varepsilon_t \quad \text{---------- (3.8)}$$

where $\varpi = (\phi - 1)$, and Δ is the first difference operator.

In practice, instead of estimating equation 3.6, we shall estimate equation 3.8 and test for the null hypothesis of $\varpi = 0$ against the alternative of $\varpi \neq 0$. If $\varpi = 0$, then $\phi = 1$, meaning that we have a unit root problem and the series under consideration is non-stationary.

It should be noted that under the null hypothesis $\varpi = 0$, the t-value of the estimated coefficient of Y_{t-1} does not follow the t-distribution even in large samples (Erdogdu, 2007). This means that the t-value does not have an asymptotic normal distribution. The decision to reject or not to reject the null hypothesis of $\varpi = 0$ is based on the Dickey-Fuller (DF) critical values of the τ (tau) statistic. The DF test is based on an assumption that the errors of term ε_t are uncorrelated.

However, in practice, the errors of the term in the DF test usually show evidence of serial correlation. To solve this problem, Dickey and Fuller have developed a test know as the Augmented Dickey-Fuller (ADF) test.

In the ADF test, the lags of the first difference are included in the regression equation in order to make the error term ε_t white noise and, therefore, the regression equation is presented in the following form:

$$\Delta Y_t = \varpi Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \text{ ---------- (3.9)}$$

To be more specific, the intercept may be included, as well as a time trend t, after which the model becomes

$$\Delta Y_t = \beta_1 + \beta_2 t + \varpi Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \text{ ---------- (3.10)}$$

The testing procedure for the ADF unit root test is applied to the following model

$$\Delta y_t = \alpha + \beta t + \delta y_{t-1} + \alpha_i \sum_{j=1}^{p} \varpi_j \Delta y_{t-j} + \varepsilon_{it} \text{ ---------- (3.11)}$$

where α is a constant, β the coefficient on a time trend series, δ the coefficient of Y_{t-1}, ρ is the lag order of the autoregressive process, $\Delta y_t = y_t - y_{t-1}$ are first differences of y_t, y_{t-1} are lagged values of order one of y_t, y_{t-1} are changes in lagged values, and ε_{it} is the white noise. Thus, the ADF test can be tested on at least three possible models:

(i) A pure random walk without a drift. This is defined by using the constraint $\alpha = 0, \beta = 0, \& \delta = 0$ in equation 3.11. This leads to the equation

$$\Delta y_t = \Delta y_{t-1} + \varepsilon_t \text{ ---------- (3.12)}$$

Equation 3.12 is a non-stationary series because its variance grows with time (Pfaff, 2006).

(ii) A random walk with a drift. This is obtained by imposing the constraint $\beta = 0, \& \delta = 0$ in equation 3.11, which yields to the equation

$$\Delta y_t = \alpha + \Delta y_{t-1} + \varepsilon_{it} \text{ ---------- (3.13)}$$

(iii) A deterministic trend with a drift. For $\beta \neq 0$, equation 3.11 becomes the following deterministic trend with a drift model

$$\Delta y_t = \alpha + \beta t + \Delta y_{t-1} + \varepsilon_{it} \text{ ---------- (3.14)}$$

The sign of the drift parameter (α) causes the series to wander upward if positive and downward if negative, whereas the size of the absolute value affects the steepness of the series (Pfaff, 2006).

Therefore, the discussion above entails that the pre-requisite of co-integration test is the stationarity of each individual time series over the sample period. Ever since the seminal paper by Engle and Granger (1987), co-integration analysis has increasingly become the favored methodological approach for analyzing time series data containing stochastic trends. Hence, before turning to the analysis of the long-run relationships between the variables the unit root properties of the single series is checked, as non-stationary behavior is a prerequisite for including them in the co-integration analysis. The modeling procedure of unit root test of the series at their level is described as follows:

$$\Delta Y_t = \alpha_0 + \alpha_2 Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \varepsilon_t \text{ ---------- (3.15a)}$$

Where Y is the variable of choice; Δ is the first- difference operator; α_i (for i = 1 and 2) and δ_i (for $i = 1,2,..., p$) are constant parameters; and ε_t is a stationary stochastic process. p is the number of lagged terms chosen by Akaike Information Criterion (AIC) to ensure that ε_t is white noise. The hypotheses of the above equation form are:

$H_0 : \alpha_2 = 0$, i.e., there is a unit root – the time series is non-stationary.

$H_1 : \alpha_2 \neq 0$, i.e., there is no unit root – the time series is stationary.

If the calculated ADF test statistic is higher than McKinnon's critical values, then the null hypothesis (H_0) is accepted this means that a unit root exists in Y_{t-1} and ΔY_{t-1}, implying that the series are non-stationary or not integrated of order zero, i.e., I (0).

Alternatively, the rejection of the null hypothesis implies stationarity of the underlying time series. Failure to reject the null hypothesis leads to conducting the test on the difference of the time series, so further differencing is conducted until stationarity is achieved and the null hypothesis is rejected (Harris, 1995).

Hence, in order to determine the order of integration of a particular series, equation (3.15a) has to be modified to include second differences on lagged first and k lags of second differences. This is as follows:

$$\Delta^2 Y_t = \psi_1 \Delta Y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta^2 Y_{t-i} + \xi_t \text{ ---------- (3.15b)}$$

In this case, the hypotheses to be tested are:

$H_0 = \psi_1 = 0$, i.e., there is a unit root – the time series is non-stationary.

$H_1 = \psi_1 \neq 0$, i.e., there is no unit root – the time series is stationary.

If the time series are stationary in their first differences(that is $\psi_1 \neq 0$), then they can be said integrated of order one, i.e., I (1); if stationary in their second differences, then they are integrated of order two, i.e., I(2). The order of integration of the variables in equations (3.15a) and (3.15b) is investigated using the standard Augmented-Dickey-Fuller (ADF) [Dickey and Fuller, 1981] and Phillips-Perron (PP) [Phillips and Perron, 1988] unit-root tests for the presence of unit roots.

An important aspect of empirical research based on VAR is the choice of the lag order, since all inference in the VAR model depends on the correct model specification. Hence, the optimal lags required in the co-integration test were chosen using the most common traditional information criteria being the Akaike Information Criteria (AIC), Schwarz Criterion (SC), Hannan and Quinn's (HQ) and the likelihood ratio (LR).

3.3.2. Co-integration Test

The necessary criterion for stationarity among non-stationary variables is called co-integration. Testing for co-integration is necessary step to check if our modeling empirically meaningful relationships (Gutierrez et.al, 2007). In economics, two variables are said co-integrated when they have long-term or equilibrium relationship between them (Engle and Granger, 1987).

Co-integration is an econometric concept which mimics the existence of a long-run equilibrium among economic time series. If two or more series are themselves non-stationary, but a linear combination of them is stationary, then they are said to be co-integrated (Wei, 2006). As mentioned in the previous section model builders should be concerned about co-integration because it is a possible solution to non-stationarity found in many economic time series, and if time series are non-stationary the assumptions upon which OLS estimation rest are violated, rendering its application inappropriate.

Previously, the usual procedure for testing hypotheses concerning the relationship between non-stationary variables was to run OLS regressions on data which had initially been differenced. Data are differenced in order to reduce non-stationary series to stationarity. Although this method is correct in large samples, it may give rise to misleading inferences or spurious regressions in small samples. Moreover, estimation of a single equation framework with integrated or non-stationary variables tends to create the following problems: non-standard distribution of the coefficient estimates generated by the process not being stationary, explanatory variables generated by the process that display autocorrelation, the existence of more than one co-integrated vector and tendency to weak exogeneity (Banerejee et al., 1993).

On the basis of the theory that integrated variables of order one, I (1), may have a co-integration relationship, it is crucial to test for the existence of such a relationship. If a group of variables are individually integrated of the same order and there is at least one linear combination of these variables that is stationary, then the variables are said to be co-integrated. The co-integrated variables will never move far apart, and will be attracted to their long-run relationship. Testing for co-integration implies testing for the existence of such a long-run relationship between economic variables.

The remedy for problematic regressions with integrated variables is to test for co-integration and to estimate a vector error-correction model to distinguish between short-run and long-run responses, since co-integration provides more powerful tools when the data sets are of limited length. The technique of co-integration and the error-correction model have both been used before in modeling the short-run dynamics between savings and economic growth by many scholars. In these studies, the multivariate Johansen (1988) co-integrating framework was used to ascertain the co-integrating rank.

The Johansen's procedure builds co-integrated variables directly on maximum likelihood estimation instead of relying on OLS estimation. This procedure relies heavily on the relationship between the rank of a matrix and its characteristic roots. In fact, Johansen's procedure is nothing more than a multivariate generalization of the Dickey-Fuller test. Consequently, he proposes two different likelihood ratio tests namely the trace test and the maximum eigenvalue test.

Thus, next to the stationarity test, the Johansen (1988) maximum likelihood, which nested the original Engel-Granger (1987)[4] procedure, is adopted for the co-integration tests and estimation of the long-run and short-run relationship between bank credit and economic growth in Ethiopia. The choice for this method is that because it helps us to test whether integrated variables sharing common stochastic trend are co-integrated so that a meaningful long run relationship can be established[5].To this end, an unrestricted VAR can be formulated to estimate the long run relationship among jointly endogenous variables. The vector autoregressive (VAR) model considered in this study is:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_p Y_{t-p} + BX_t + \varepsilon_t \text{ ---------- (3.16)}$$

[4] *.The original Engle-Granger (1987) has the following weaknesses among others. 1) this test for co-integration is likely to have lower order against alternatives; 2)its finite samples of long run relationships are potentially biased; and 3)inference cannot be drown using standard t-statistics about the significance of the parameters of the static long run model.*

[5] *The practical problem of Johansen's procedure is the choice of a correct combination of lags and dummies to make the residuals white noise.*

Where Y_t is a k -vector of non-stationary I(1) endogenous variables; X_t is a d -vector of exogenous deterministic variables; $A_1 ... A_p$ and B are matrices of coefficients to be estimated and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right hand side variables. Since most economic time series are non-stationary, the above stated VAR model is generally estimated in its first-difference form as:

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + BX_t + \varepsilon_t \text{ ---------- (3.17)}$$

Where, $\Pi = \sum_{i=1}^{p} A_i$ and $\Gamma_i = -\sum_{j=i+1}^{k} A_j$

In the Johansen (1988) procedure, determining the rank of Π (i.e., the maximum number of linearly independent stationery columns in Π) provides the number of co-integrating vector between the elements in z. In this connection, there are three cases worth mentioning. (i) If the rank of Π is zero it points that the matrix is null which means that the variables are not co-integrated. In such case the above model (equation 3.17) is used in first difference, void of long run information. (ii) If the rank of Π equals the number of variables in the system (say n) then Π has full rank which implies that the vector process is stationary. Therefore, the VAR can be tested in levels. (iii) If Π has a reduced rank (i.e., $1 < r(\Pi) < n$) it suggests that there exists $r \leq (n-1)$ co-integrating vector where r is the number of co-integration (or the co-integrating rank) in the system. Therefore, the Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank $r < n$, then there exists nxr matrices of α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' Y_t$ is $I(0)$ where each column of β' is the co-integrating vector (co-integration parameters) with α showing their corresponding feedback (error correction parameters) that measures the speed of adjustment in ΔY_t to equilibrium (i.e., it shows the speed with which disequilibrium from the long run path is adjusted). The Johansen approach to co-integration test is based on two test statistics, viz., the trace test statistic, and the maximum eigenvalue test statistic, as suggested by Johansen (1988) and Oseterwald Lenum (1992).

In identifying the number of co-integrating vectors, the Johansen procedure provides n eigenvalues denoted by λ (also called characteristics roots) whose magnitude measures the extent of correlation of the co-integration relations with the stationery elements in the model. In general, to identify the number of co-integrating vectors in the system, the Johansen approach to co-integration test is based on two test statistics, viz., the trace test statistic (λ_{trace}) and the maximum eigenvalue test statistic ($\lambda_{\max}$) as suggested by Johansen (1988) and Oseterwald Lenum (1992). They are obtained from the following formulas.

Trace Test Statistic: The likelihood ratio statistic (LR) for the trace test (λ_{trace}) as suggested by Johansen (1988) can be specified as:

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{k}\log(1-\hat{\lambda}_i) \text{ ---------- (3.18a)}$$

Where, $\hat{\lambda}_i$ is the i^{th} largest eigenvalue of matrix Π and T is the number of observations. In the trace test, the null hypothesis is that the number of distinct co-integrating vector(s) is less than or equal to the number of co-integration relations (r). In this statistic λ_{trace} will be small when the values of the characteristic roots are closer to zero.

Maximum Eigenvalue Test: The maximum eigenvalue test ($\lambda_{\max}$) as suggested by Johansen (1988) examines the null hypothesis of exactly r co-integrating relations against the alternative of $r+1$ co-integrating relations with the test statistic:

$$\lambda_{\max}(r, r+1) = -T\ln(1-\hat{\lambda}_{r+1}) \text{ ---------- (3.18b)}$$

Where $\hat{\lambda}_{r+1}$ is the $(r+1)^{th}$ largest squared eigen value. In the trace test, the null hypothesis of $r=0$ is tested against the alternative of $r+1$ co-integrating vectors. If the estimated value of the characteristic root is close to zero, then the λ_{trace} will be small.

After detecting the number of co-integration, the normalized co-integration coefficients of growth and domestic capital models along with the test of significance of the variables is examined by imposing a general restriction on each variable($\beta_i = 0$) in the regression models.

3.3.3. Vector Error Correction Model (VECM)

Since the long run equilibrium (steady state) may rarely be observed the short run dynamic/evolution of the variables under consideration is considered. For this reason, an ECM is extended to the multivariate scenario by defining all the variables to be potentially endogenous. In order to arrive at the short run final preferred model, a one period lag of the co-integration vector saved from the long run estimation enters in ECM estimation using OLS.

An error correction model is defined as a dynamic model in which the movement of a variable in any period is related to the previous period's gap from the long-run equilibrium. Although it may be possible to estimate the long-run or co-integrating relationship, $y_t = \beta x_t + \varepsilon_t$ economic systems are rarely in equilibrium, as they are affected by institutional and/or structural changes that might be temporary or permanent. For example, extra income in the form of a birthday bonus may raise someone's expenditure pattern in one or two months and then his/her expenditure gradually goes back to equilibrium. Since equilibrium is rarely observed, the short-run evolution of variables (short-run dynamic adjustment) is important. A simple dynamic model of a short-run adjustment model is given by

$$y_t = \alpha_0 + \delta_0 x_t + \delta_1 x_{t-1} + \alpha_1 y_{t-1} + \varepsilon_t \text{ ---------- (3.19)}$$

where y_t is the dependent variable, x_t is the independent variable, y_{t-1} and x_{t-1} are lagged values of y_t and x_t respectively, $\alpha_0, \alpha_1, \delta_0, \& \delta_1$ are parameters, and ε_t is the error term assumed to be $\varepsilon_t \sim iN(0, \sigma^2)$.

The next step is to specify and estimate a vector error correction model (VECM) including the error correction term to investigate dynamic behavior of the model. Once the equilibrium conditions are imposed, the VECM describes how the examined model is adjusting in each time period towards its long-run equilibrium state. The dynamic specification of the model allows the deletion of the insignificant variables, while the error correction term is retained. The final form of the vector error-correction model (VECM) was selected according to the general to specific methodology suggested by Maddala, (1992), and Harris (1995).

The size of the error correction term indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium state (Engle and Granger, 1987). The general form of the vector error correction model (VECM) for the growth model is specified as follows:

$$\Delta \ln y = \alpha_0 + \sum_{i=1}^{k} \beta_1 \Delta \ln y_{t-i} + \sum_{i=1}^{k} \beta_2 \Delta \ln k_t^d + + \sum_{i=1}^{k} \beta_3 \Delta \ln sse_t +$$

$$\sum_{i=1}^{k} \beta 4 \Delta \ln gc_t + \sum_{j=1}^{k} \beta 5 \Delta \ln op_t + \gamma ECT_{t-1} + \varepsilon_t \quad \text{---------- (3.20)}$$

Moreover, the vector error correction model (VECM) for the determinants of domestic capital is:

$$\Delta \ln k_t^d = \rho_0 + \sum_{i=1}^{k} \rho_1 \Delta \ln k_{t-1}^d + \sum_{i=1}^{k} \rho_2 \Delta \ln y_t + \sum_{i=1}^{k} \rho_3 \Delta \ln gc_t + \sum_{i=1}^{k} \rho 4 \Delta \ln op_t + \gamma ECT_{t-1} + v_t \text{ -- (3.21)}$$

*W*here Δ is the first difference operator, ECT_{t-1} is the error correction term lagged one period, γ is the short-run coefficient of the error correction term $(-1 < \gamma < 0)$, ε_t and v_t are the white noise terms of respective models.

3.3.4. Granger Casualty Test

In this sub-section the causality between domestic saving and economic growth in Ethiopia is tested using the Granger Causality test. This study uses Granger Causality test for testing the direction of causation between domestic saving and economic growth in Ethiopia.

The Granger procedure is selected because it consists the more powerful and simpler way of testing causal relationship (Granger, 1986). This test in the VAR framework formulates the null and alternative hypotheses as:

H_0 : No causal relation between domestic savings and economic growth

H_1 : There is causal relationship between domestic savings and economic growth

The above hypotheses are tested in the context of the VAR of the form:

$$\ln y_t = \alpha_1 + \sum_{i=1}^{p} \beta_i \ln y_{t-i} + \sum_{i=1}^{p} \delta_i \ln ds_{t-i} + \varepsilon_{1t} \text{ ---------- (3.23a)}$$

$$\ln ds_t = \alpha_2 + \sum_{i=1}^{p} \lambda_i \ln ds_{t-i} + \sum_{i=1}^{p} \psi_i \ln y_{t-i} + \varepsilon_{2t} \text{ ---------- (3.23b)}$$

where y is the dependent and ds (domestic saving) is the explanatory variable in log form and ε_t is the white noise error term in (3.23a) while ds (domestic saving) is the dependent and y is the explanatory variable in (3.23b).

Moreover, t is the sample size and p is the lag length of the unrestricted VAR model. According to Seddighi et al. (2000: 310), there exists a unidirectional causality if only $\{\delta_{11}, \delta_{12}, ..., \delta_{1k}\} \neq 0$) and $\{\psi_{21}, \psi_{22}, ..., \psi_{2k}\} = 0$ in equation (3.23a) and (3.23b) and both coefficients of gross domestic saving and real economic growth are statistically significant then there is bidirectional causality or if both $\{\delta_{11}, \delta_{12}, ..., \delta_{1k}\} \neq 0$ and $\{\psi_{21}, \psi_{22}, ..., \psi_{2k}\} \neq 0$ in the two equations, respectively.

3.5. Diagnostic Tests

Diagnostic tests are performed to assess the performance of the VAR model or VECM used in running the regression. These tests include autocorrelation test, Normality test and stability test

3.5.1. Autocorrelation Test

The model assumes that successive values of the random variable u are temporally independent and that the value which u assumes in anyone period is independent from the value it assumed in any previous period. This implies that the covariance of u_i and u_j equals zero. If this assumption is not satisfied, then the value of u in any particular period is correlated with its own preceding value (or values). This is known as autocorrelation or serial correlation of the random variable u.

Where the random term is auto correlated, the parameter estimates are still statistically unbiased but the variances of the parameter estimates are likely to be larger or the variance of the random term may be seriously underestimated or the predictions based on the parameter estimates will be inefficient in the sense that the variance is large.

The null hypothesis of no serial correlation at lag order "h" is tested against alternative hypothesis of serial correlation is the VAR model. If the result is insignificant, the null hypothesis is accepted; if the result is significant, the null hypothesis is rejected implying the presence of serial correlation.

3.5.2. Normality Tests

The model assumes that the random variable u has a normal distribution. Symbolically: U~N (0, δ^2u) which reads: u is normally distributed around zero mean and constant variance & u. This means that small values of u's have a higher probability to be observed than large values.

This assumption is necessary for conducting statistical tests of significance of the parameter estimates and for constructing confidence intervals. If the assumption of normality is violated, the estimates of parameters are still unbiased but the statistical reliability by the classical tests of significance (t-statistic and F-statistic) of the parameter estimates cannot be assessed because these tests are based on the assumption of normal distribution of the u's. The null hypothesis is that the u's have normal distribution against the alternative hypothesis that the u's are not normally distributed.

3.5.3. Stability Test

Stability test is conducted to assess the stability of the coefficients of the model. Two tests CUSUM Test and CUSUM of Squares test are conducted in the form of graph. The null hypothesis is that the test results satisfy the stability condition against the alternative hypothesis that the test results do not satisfy the stability condition.

3.6. Test of Volatility

There are two approaches, impulse response function and variance (forecast error) decomposition, variance decomposition technique suggested by Sims (1980) is useful devices in the VAR framework for testing the sources of variability. The impulse response function can trace the response of the endogenous variables to a shock in another variable. The variance decomposition breaks down the variance of the forecast error for each variable into components that can be attributed to each of the endogenous variables. Following Sims' (1980) seminal paper, dynamic analysis of VAR model is routinely carried out using the "orthogonalzed"

impulse responses, where the underlying shocks to the VAR model are orthogonalized using the Cholesky decomposition method. This method assumes the system is recursive and the estimations of impulse response function and variance decomposition are orthogonalized so that the covariance matrix of the resulting innovations is lower triangular (Chen and Patel, 1998). As a result, the Choleski decomposition method is criticized as an arbitrary method in attributing a common effect and changing the order of the equation may dramatically change the impulses.

3.7. Definitions of the Variables

The variables that this study uses are described as the following:

Growth in Real GDP (RGDP):- Gross Domestic Product is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. The unit of the data is in Ethiopian Birr at constant price. Source: World Bank, 2016.

Gross Capital Formation (GCF):- is formerly gross domestic investment which consist outlays on addition to fixed assets of the economy plus net change in level of inventories. It includes land improvements and constructions. Inventories are stock of goods held by firms to meet temporary or unexpected fluctuations in productions or in work progress. It measures the investment and growth in economy. It is proxied by capital stock/investment in this study. In this study gross domestic investment includes only the sum of public and private investment but it does not include foreign direct investment.

Total Labor Force (TLF):-is the labor inputs and labor force more than 15 years and below 60 years. It is one of the key inputs in production of output yet. According to (Ubogu, 1985) higher rate of growth in money supply brings about an increase in effective demand for goods and services resulting increase in real output. Increased output can come from increased employment which is the effect of an increase in the demand of labor force. Because of this empirical evidence we expect the positive relationship between real GDP growth and labor force. But if it couldn't be used efficiently and if it is less productive, it may be burden for the economy because of high rate of unemployment.

Saving (SAV):- is maintaining part of current income for use in the future, and It is the accumulation of financial and non-financial assets. **Gross Domestic Saving** is GDP minus final consumption expenditure. It is expressed as a percentage of GDP. And it consists of savings of household sector, private corporate sector and public sector. But gross domestic saving in this study includes only public and private saving in the banking sector.it does not include foreign saving.

Trade openness (TOP): - The ratio of trade to GDP - an indicator of trade 'openness' - has increased for most trading nations, and is a result of globalization and trade liberalization; however it refers to the inward or outward orientation of a given country's economy. Outward orientation refers to economies that take significant advantage of the opportunities to trade with other countries. Inward orientation refers to economies that overlook taking or are unable to take advantage of the opportunities to trade with other countries, (World Bank, 2015).

In this study trade openness is the ratio of exports and imports to GDP, it can be calculated the sum of exports and imports to GDP in Ethiopian economy during the study period.

Government final consumption expenditure to GDP ratio (GFC): - government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditure on national defense and security, but excludes government military expenditures that are part of government capital formation. It consists of expenditure, including imputed expenditure, incurred by general government on both individual consumption goods and services and collective consumption services (World Bank, 2016)

Gross secondary school enrollment (GSSE): - Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Secondary education completes the provision of basic education that began at the primary level, and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instruction using more specialized teachers.

Table-1:- Variables and Their Expected Signs

No	Variables	Expected sign
1	Real GDP	Positive(+)
2	Gross Capital Formation	Positive(+)
3	Government Final Consumption	Positive (+)
4	Gross Domestic Saving	Positive (+)
5	Trade Openness	Inclusive
6	Gross secondary school enrollment	Positive (+)

Source: Own design (2019)

CHAPTER FOUR

PRESENTATION AND INTERPRETATION OF RESULTS

4.1. Introduction

In this chapter, the study analyses the economic growth and gross domestic saving using annual time series data from 1975/76 to 2017/18 in Ethiopia. And the results obtained from the various tests and the model are presented and analyzed. We need to first employ the unit root test to check whether the time series is stationary or not, and after identifying the optimal lag length, the presence of the multivariate Johonsan co- integration test, the pair wise Granger causality test from the VAR model and the Vector Error Correction Model was employed to find the relationship between gross domestic saving and economic growth and its confirmation by the Pairwise Granger Causality test as well as diagnostic tests. Finally, the long run and the short run relationship also identified. The variables are measured in natural logarithms.

4.2. Descriptive Statistics

Prior to examining the relationship between domestic saving and economic growth, attempt was made to analyze the trend of gross domestic saving and domestic investment as a ratio of GDP using descriptive statistics or ratio analysis technique. The ratios were first depicted graphically for analysis and interpretation purpose. Then, the means of the ratios for the period 1975/76 to 1990/91 and 1991/92 to 2017/18 were compared, more importantly, to analyze the hypothesis, whether there is significant improvement in domestic saving and domestic investment to GDP ratios in Ethiopia in post reform period or not.

Ethiopia, one of the poorest countries in the world, has witnessed broadly, three policy regimes: the imperial regime (prior to 1975), the socialist (or Derge) regime (1975/76-1990/91), and the present liberalized regime (1992 onwards). The first regime adopted non-interventionist approach, the second followed rigid inward looking strategy and the third initiated economic reforms to address the long-term structural problems of under development.

Beginning in 1992, the Ethiopian government began to implement an economic reform program with a view to revive the economy. Various policy measures, some homebred, others imposed by the IMF and the World Bank, have been undertaken (Sukar and Ramakrishna, 2002). In this section, an attempt is made to review the experience of Ethiopia relating savings and investment based on the available data and literatures (1975/76-2017/18) collected from various sources such as World Bank, IMF and MOFED etc. The data are rearranged to represent the above mentioned sub periods broadly.

In Ethiopia the data for the period, 1975/76-2017/18 exhibits a wide gap between gross domestic savings (GDS) and gross domestic investment (GDI) in Ethiopia. However, during 2016/17, Ethiopia has registered an exceptionally high saving rate (27.01 %). The share of gross domestic investment in the GDP for the same period is found to be 25.68%, while the minimum being 13.36 % (1991/92) and a maximum was 42.89% (2014/15). The resource gap (measured as the difference between gross domestic investment and saving) is about 13% during this period and reached a maximum of 16.88% during 1991.

Figure 4.1 reveals that for the entire period, saving rate has been lower than Investment, and both have declined during the period. These are the pen ultimate years of Derge regime, during which the civil war in the country has been intensified. The socialist regime desperately tried everything to contain the war but ultimately had to succumb. However, in the later period, the gross domestic investment has significantly risen.

During the period, 1975/76 -1990/91(the last Derge regime), However, during 1987/88, Ethiopia has registered an exceptionally high saving rate (19.30 %). Then average saving rate was about 10.6%, the minimum being 4.32(1984) and the maximum was about 19.30% (1987). The average rate of investment was about 19.6%, the minimum and the maximum were 14% and 30.5% respectively. In this sub period both gross domestic saving and gross domestic investment have become maximum in the same year (1987) and both subsequently declined later. The average resource gap for this sub period was about 9%.

However, the liberalized regime (1991/92- 2017/18) presented a remarkable recovery of the rate of investment which increased from 13.36% during 1991 and 42.89% during 2014/15. The average investment rate for this sub period was 29.43. The relative improvement in the rate of investment in this regime was mainly due to the end of civil war and the policy reforms that have been initiated. However, the share of gross domestic saving in the GDP in the years of this regime was not satisfactory when it is compared to the last the military regime.

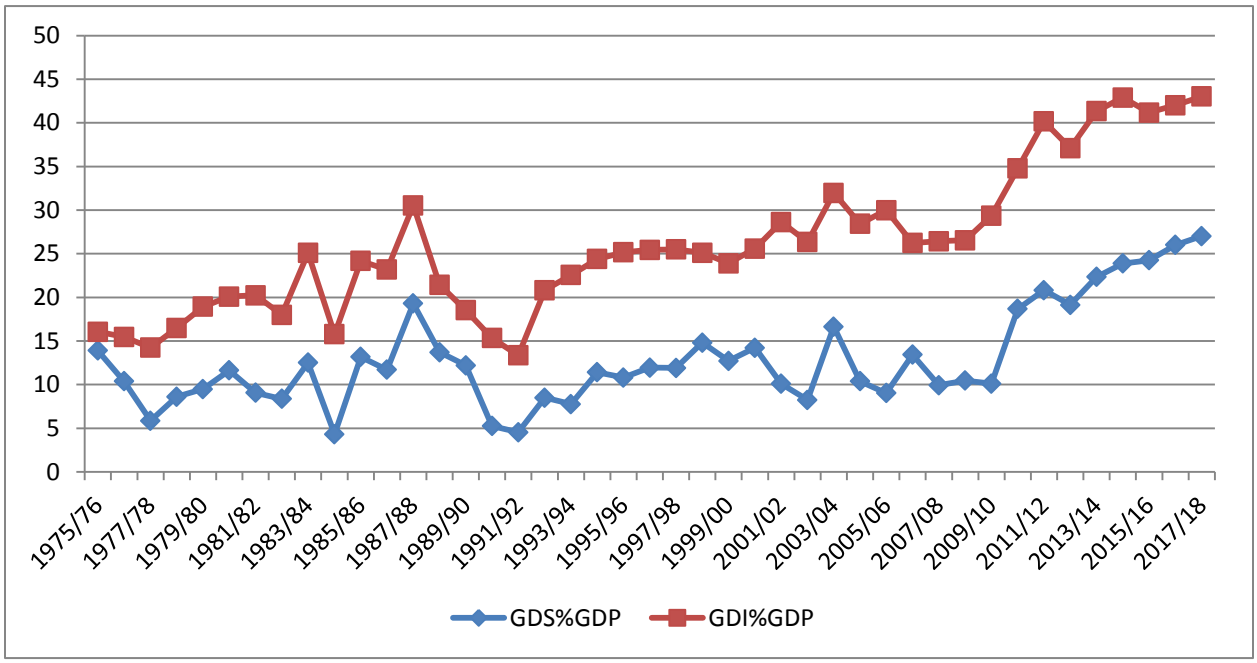
This may be due to an increase in the public expenditure and the inflationary situation prevailing in the economy. The average saving rate in the economy was about 14.42% (2006/7). The deterioration of saving rate in this period has lead to a huge resource gap, which is about 15.51%.

Table 4.1: Gross domestic saving and investment (as % GDP) in Ethiopia, 1975/76-2017/18

Period	Variable	Average	Minimum	Maximum
1975/76 - 1990/91	GDS	10.59	4.32	19.30
	GDI	19.6	14.23	30.53
	Resource gap	-9.01	-9.91	-11.23
1991/92 - 2017/18	GDS	14.42	4.53	27.01
	GDI	29.43	13.36	43.89
	Resource gap	-15.51	-8.83	-16.88
1975/76 – 2017/18	GDS	12.65	4.32	27.01
	GDI	25.68	13.36	43.89
	Resource gap	-13.03	-9.04	-16.88

Source: Own computation from World Bank. Data (2019)
Note: GDS = gross domestic saving (GDS) as % of RGDP, GDI = gross domestic investment (GDI) as % of RGDP, GDP = gross domestic product, and Resource gap = the difference between gross domestic saving and investment.

Figure 4.1: Gross domestic saving and investment (as % GDP) in Ethiopia, 1975/76-2017/18

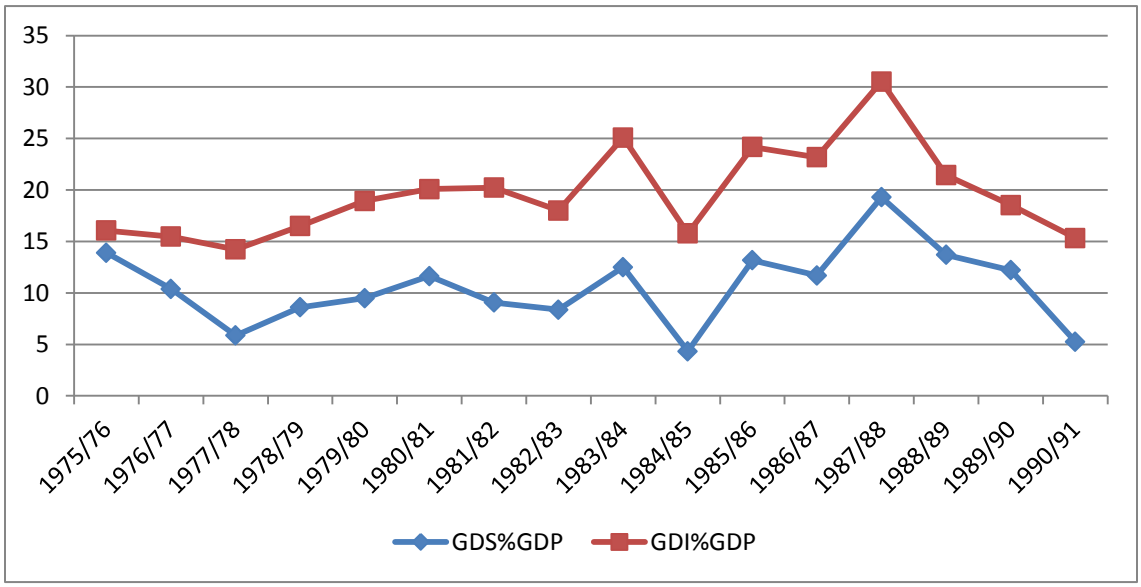


Source: own computation from national bank database (2019)

As it shown in the above figure 4.1 the growth rate of gross domestic saving and investment in Ethiopia go up and down. During 1977/78 and 1984/85 Ethiopia faced the big drought because of that the gross domestic saving become negative and gross domestic investment decreased.

And in 1990/91 when there was over thrown of regime the country domestic saving become decline. In 2002/2003 face down the growth rate of gross domestic saving investment became increased and decreased up to 2017/18.

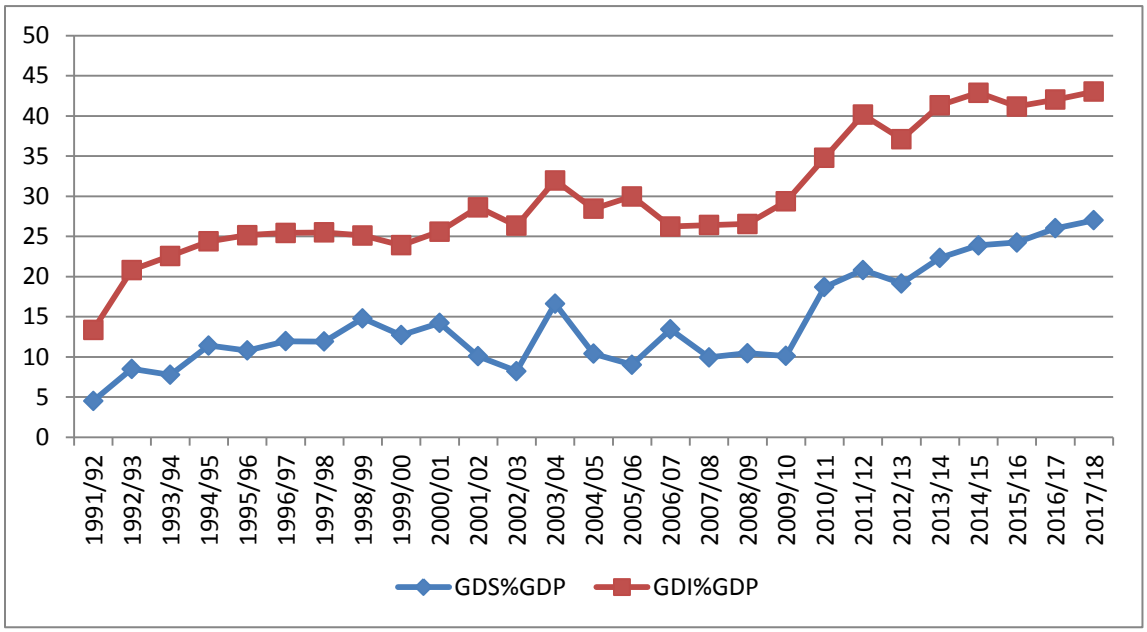
Figure 4.2: Gross domestic saving and investment (as % GDP) in Ethiopia, 1975/76-1990/91



Source: own computation from national bank data base (2019)

As it shown in figure 4.2, the total real GDP of Ethiopia during the regime show permanently, it was increased up to 1982/83 in small ratio and declined during 1984/85 and starts to increase up to 1986/87 but at the end of the regime it started to decline gradually and the gross domestic saving during the period of 1977/78 and 1984/85, we have seen that gross domestic saving and investment to GDP ratio become highly decline. However, during 1987/88, Ethiopia has registered an exceptionally high saving rate (19.3 %). Then from the above figure we have seen that growth rate gross domestic saving declined in the same time, the domestic investment also decline, that means without saving the gross domestic investment cannot go far away because they are interlinked relationship between the two variables.

Figure 4.3: Gross domestic saving and investment (as % GDP) in Ethiopia, 1991/92-2017/18



Source: own computation from national bank database (2019)

As it indicated in the figure 4.3, the gross domestic saving as % GDP and gross domestic investment as % of GDP during the period of EFDRE (1991/92 to 2016/17) during the first time both of them show similar up to 2000/2001 and oscillates and growing up gradually.

In view of the severe development deficit in the country, in general, the rate of investment in Ethiopia has remained very low. Investment should and could have increased persistently and substantially had it not been for the short supply of finances. Throughout the last four decades, irrespective of differences in policy regimes, the critical bottleneck on the investment rate has been the severe shortfall in savings. Even the low investment rate may not be sustainable, as it hinges on external resources.

4.3. Results of Unit Root Tests

Before any meaningful regression is performed with the time series variables, it is essential to test the existence of unit roots in the variables and to establish their order of integration. The variables used in the analysis need to be stationary and or should be co integrated in order to infer meaningful relationship from the regression. In other to find the causal relationship between growth rate domestic savings to GDP ratio and growth rate of economic growth, the first thing to determine is the order of integration of the variables to determine whether they are stationary or non-stationary, that is, whether they follow a stochastic trend or follow a random walk.

Since unit root tests are sensitive to the presence of deterministic regressors, three models are estimated. The most general model restrictive models i.e. with a constant is estimated first and with a drift and time trend and without either constant and trend, respectively, are estimated. A unit root test for each variable is performed on both levels and first differences. The result of the unit root test for the variables at level and first difference was presented in table 4.3.1 and 4.3.2 below.

Table 4.3.1: Unit root test results for variables at level

Variables	Augmented Dickey-Fuller			
	With drift	With drift and trend	Without drift and trend	Order of integration
LNRGDP	2.184145	-1.248918	1.587409	I(0)
LNDST	-2.451979	-2.838455	-1.276764	I(0)
LNKT	-0.24090	-1.743669	1.438505	I(0)
LNGC	-2.574884	-2.914066	-1.379635	I(0)
LNOP	-1.744750	-2.334934	-0.492939	I(0)
LNSSE	-1.540112	-1.951403	-0.901069	I(0)

MacKinnon (1996) with drift	MacKinnon (1996) with drift and trend	MacKinnon (1996) without drift and trend
Test critical values 1% = -3.596616 5% = -2.933158 10% = -2.604867	Test critical values 1% = -4.192333 5% = -3.520787 10% = -3.191277	Test critical values 1% = -2.621185 5% = -1.948886 10% = -1.611932

Source; own computation (2019)

The ADF test results show that all the variables (that means, growth rate of gross domestic product (RGDP), domestic saving to GDP ratio, government final consumption to GDP ratio (GC), gross capital formation to labour ratio (KT), trade openness to GDP ratio (OP) and gross secondary school enrollment (SSE) are non-stationary (there is a unit root) at levels with the three different specifications. That is, the test conducted fails to reject the null hypothesis of unit root in the three different specifications.

But growth rate gross domestic product (RGDP) without drift and trend has ADF test statistics is greater than critical values but positive implies non rejection of null hypothesis. Positive ADF statistic shows non stationarity. As it can be seen from the above table (large p-values and Positive ADF test statistics indicates non rejection of H0) variables do not satisfy the stationarity assumption.

Therefore, to avoid spurious regression all these variables have to be differenced to transform them to stationarity. In the second stage, the order of integration of the non-stationary variables were performed proceeding in the same way by means of ADF tests applied to all series in first differenced form.

First difference of the each variable was generated by deducting one period lag from the variable of itself of successive period. After making the first difference of each series the usual unit root test of ADF were applied to determine their order of integration. The result of the test was presented below.

Table 4.3.2: Unit root test results for variables at (1st difference)

variables	Augmented Dickey-Fuller			
	With drift	With drift and trend	Without drift and trend	Decision
DLNRGDP	-4.8508558**	-5.982352**	-5.401178**	Stationary (I(1))
DLNDST	-9.600987**	-9.557829**	-9.696767**	Stationary (I(1))
DLNKT	-4.978680**	-4.957965**	-4.367013**	Stationary (I(1))
DLNGC	-5.269711**	-5.204311**	-5.32888**	Stationary (I(1))
DLNOP	-6.824871**	-6.762295**	-6.860054**	Stationary (I(1))
DLNSSE	-6.270887**	-6.263133**	-5.091591**	Stationary (I(1))
MacKinnon (1996) with drift Test critical values 1% = -3.600987 5% = -2.935001 10% = -2.605836		MacKinnon (1996) with drift and trend Test critical values 1% = -4.205004 5% = -3.526609 10% = -3.194611		MacKinnon (1996) without drift and trend Test critical values 1% = -2.625606 5% = -1.949603 10% = -1.611593

Source: Own computation (2019)
Note that: ** denote rejection of null at 1%, 5% and 10% significance level respectively.

ADF test statistics greater than critical values imply rejection of null hypothesis. D is the first difference operator. As it can be seen from the above table (small p-values and large ADF test statistics indicates rejection of H0) all variables satisfy the stationarity assumption.

The first differences of the variables (growth rate of gross domestic product (RGDP), domestic saving to GDP ratio, government final consumption to GDP ratio (GC), gross capital formation to labour ratio (KT), trade openness to GDP ratio (OP) and gross secondary school enrollment (SSE) are investigated for a unit root test and the test result proved that all of them are stationary in the three different specifications. Therefore, it can be conclude that all variables are integrated of order one. Therefore the first difference of all variables is used for estimation.

4.4. Optimum Lag Length Selection

In the Johanssen approach, the first step is testing for co-integration and estimating a VAR is to determine the optimal lag length of the VAR. And Johansen co-integration analysis is very sensitive to the number of lags included in the model, the more lags we include the more initial values we lose. If we include too few lags, the size of the test will be incorrect (wooldrige, 2000). The stability of VAR and VECM is shown that the VAR and VECM are stable.

The optimal is determined with sequential modified the Final prediction Error (FPE), the Akaike information criterion (AIC), the Schwarze information criterion (SIC) and Hannan-Quinn information criterion (HQ) lag that provides the minimum value is chosen as the optimal lag length that means. However, the optimal lag length selection will be made based on the lag that minimizes the AIC. Accordingly, the AIC indicates that the appropriate lag for our model is one lag orders at 5% level of significance, among the SIC that provides majority lag has been choose as optimal lag length. While checking up to four lag orders to include the 5% level of significance suggest that lag 1 be the optimum lag length. The smaller the value of the information criterion (SIC), the better the model is, and the lag length one is selected for this study. Thus, the next step is to estimate Johannsen test of the co-integration, VAR, VECM, Granger causality and finally to test stability test to check robustness of variables.

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Table 4.4:- VAR Lag Order Selection Criteria

Endogenous variables: LNRGDP LNOP LNKT LNGC LNDST LNSSE
Exogenous variables: C
Date: 07/16/19 Time: 10:53
Sample: 1975 2017/18
Included observations: 39

Lag	LogL	LR	FPE	AIC	SC	HQ
0	509.6894	NA	1.24e-19	-26.50997	-26.25140	-26.41797
1	747.7852	388.4721*	2.14e-24*	-39.04757*	-35.33662*	-36.50262
2	780.1529	42.58909	4.27e-24	-36.95541	-33.59405	-35.75947
3	828.4424	48.28956	3.40e-24	-37.60223	-32.68947	-35.85431
4	891.9039	43.42100	3.05e-24	-37.14659	-32.58342	-36.74768*

* 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

Source: Own computation (2019)

Co-integration test is usually preceded by a test of optimal lag length as the result of the test is affected by the number of lags included in the VAR model. The Likelihood ratio test (LR), the Final prediction Error test (FPE), the Akaike information criteria (AIC), the Schwarz information criteria (SIC), and the Hannan-Quinn information criteria (HIC) are used to determine the optimal of one lag length of the VAR model for co-integration test. Table 4.4 shows that all criteria suggest a lag length at 5% level of significance.

4.5. Multivariate Co Integration Test Results (long relationship)

This approach developed by Johansen (1988, 1991) and extended by Johansen and Juselius (1990) and Engel-Granger (1987). Once the ADF unit root test result revealed that the series is I (1), a co-integration test is performed to determine the rank of the co integrating vector. The rank of the co integrating vector is determined using the Johansen's maximum likelihood method.

The existence of the same order of integration, therefore, allows us to test for co-integration among the variables, to determine the number of co-integrating vectors two set statistics called the maximum Eigen value (λmax) and trace statistics (λ trace) are computed. The trace test the null hypothesis of r co-integrating vectors against the alternative hypothesis of k co-integrating vectors, where k is the number of endogenous variables, for r=0,1,2,……..,k-1. The maximum Eigen value test, on the other hand, tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of r+1 co-integrating vectors.

The results of trace and the maximum-Eigen tests are reported in the table respectively. The trace statistics test confirmed the existence of one (1) co-integrating equations among the variables at 5% significant level. However, maximum-Eigen statistics also indicated that there exists one (1) co-integrating equation among the variables at 5% significant level.

Table 4.5: Johansen's Co integration test results

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.748444	178.6962	95.75366	0.0036
At most 1	0.521588	69.81889	97.56320	0.0742
At most 2	0.486201	47.85613	53.02369	0.1514
At most 3	0.331638	26.38676	29.79707	0.1175
At most 4	0.224578	10.26972	15.49471	0.2605
At most 5	0.002393	0.095831	3.841466	0.7569

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.748444	81.13296	40.07757	0.0078
At most 1	0.521588	33.87687	44.53950	0.1219
At most 2	0.486201	26.63694	27.58434	0.3657
At most 3	0.331638	16.11703	21.13162	0.2181
At most 4	0.224578	10.17389	14.26460	0.2008
At most 5	0.002393	0.095831	3.841466	0.7569

Max-eigenvalue test indicates 1 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Own computation (2019)

The Johansen's co-integration result is presented and determined the number of co-integrating vector in the above table 4.5.1. The null hypothesis is that there is no co-integrating vector: H0: r =0 is rejected, but the null that there exist at most one co-integrating vector (H0: r =1) is not. From the trace statistics results, for Ho: r = 0, the reported trace statistic is 178.6962 which is greater than the 5% critical value of 95.75366, thus suggesting that the null hypothesis is rejected. But, for Ho: r<=1, r<=2, <= 3…<=5, the reported trace statistics are less than the critical value at 5% significance level.

And Max-Eigen statistic also confirms the existence of one co-integrating relationship at the 95 per cent confidence level in this system (estimated Max-Eigen statistic, 81.13296 > 40.07757, and 5% critical value).

We can conclude that this study, therefore, used (trace and max-Eigen) statistics that there exists a meaningful long run relationship between the growth rates of economic growth, gross domestic saving to GDP ratio, gross secondary school enrollment, trade openness to GDP ratio, government final consumption to GDP ratio and gross capital formation/investment to labour ratio.

4.6. VECM Estimation in Long Run Relationship

In VECM both long run and short run elasticities of variables should be estimated and Long run elasticities were exactly identified and the Johnson normalization restrictions were imposed too. Short run effects are captured through individual coefficients of the differentiated terms. That is captures the impact while the coefficient of the VECM variable contains information about whether the past values of variables affect the current values of the variables under study. . In the Johansen approach we checked the presence of at least one co-integrating vectors in the given real GDP model, this implies that to precede VECM model should be appropriate in this study. This helps to remove any inconsistency that may happen in the short run since it may be possible for short run equilibrium not to occur in spite of the presence of a long-run equilibrium.

4.6. VECM Long-Run Impacts of Economic Growth

Table 4.6: VECM Estimated result of long run model

Standard errors in ( ) & t-statistics in [ ]

Co-integrating Eq:	CointEq1
LNRGDP(-1)	1.000000
LNOP(-1)	0.219332
	(0.04198)**
	[5.22518]
LNKT(-1)	-0.425357
	(0.13900)**
	[3.06004]
LNGC(-1)	0.549781
	(0.05427)**
	[10.1296]
LNDST(-1)	-0.076951
	(0.03767)**
	[-1.98947]
LNSSE(-1)	-0.797511
	(0.41490)
	[-4.33242]
C	-1.140380

Source: Own computation (2019)

The long run relationship is derived by normalizing growth in real GDP from the table 4.6. The normalized co-integration equation can be written as:

LNRGDP = 0.076951LNDST + 0.425357LNKT – 0.549781LNGC – 0.219332LNOP + 0.797511LNSSE + 1.140380…….. (4.6)

The numbers in parenthesis under the estimated coefficients are asymptotic standard errors. For the coefficients that are normalized to 1, standard errors will not be shown. Where, c is constant and it exerts a positive effect on growth in RGDP.

From the above equation, gross domestic saving has positive and significant relationship with Ethiopian economic growth in the long run. And also Masih and Peters (2010) have found empirical evidences of confirming a positive relationship between economic growth and saving (saving have positive effect on economic growth).

And gross Capital formation which is proxied by gross investment has a positive impact on Ethiopian economic growth and statistically significant at 5% level of significance. The coefficient of gross capital formation (KT) is 0.425. This indicates that, in the long run, holding other things constant, a one percent change in gross capital formation about 42.5 percent change in real GDP during the study period.

From the above equation it can be observed that the long run, coefficient of trade openness to GDP ratio has negative impact on Ethiopian economic growth and statistical significant at 5% significance level. As the result a one percent change in trade openness will result 21.9% decline in real GDP in long run respectively.

4.7. VECM Estimation in Short-Run Relationship

After doing the co-integration test, if variables are found integrated then follows ECM. Here, the first difference of the dependent variable is regressed on the first difference of explanatory variables and the first lag of the residual obtained from the long run model. This is done because there may be disequilibrium in the short-run. ECM is used to tie short run behavior to its long run dynamics.

Table 4.7: VECM Estimated result of short run model (Economic growth)

Included observations: 40 after adjustments

D(LNRGDP) = C(1)*(LNRGDP(-1) + 0.425356994263*LNKT(-1) + 0.549780721355*LNGC(-1) - 0.0749511049418*LNDST(-1) + 0.219331761668*LNOP(-1) - 1.79751082756*LNSSE(-1) - 1.14037966477) + C(2)*D(LNRGDP(-1)) + C(3)*D(LNRGDP(-2)) + C(4)*D(LNKT(-1)) + C(5)*D(LNKT(-2)) + C(6)*D(LNGC(-1)) + C(7) *D(LNGC(-2)) + C(8)*D(LNDST(-1)) + C(9)*D(LNDST(-2)) + C(10) *D(LNOP(-1)) + C(11)*D(LNOP(-2)) + C(12)*D(LNSSE(-1)) + C(13) *D(LNSSE(-2)) + C(14)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.427068	0.242607	3.202984	0.0036
C(2)	0.457331	2.185829	0.666718	0.5108
C(3)	-0.145957	2.205483	0.519595	0.0177
C(4)	0.597267	0.264778	2.255729	0.0327
C(5)	0.385275	0.203313	1.894982	0.0693
C(6)	-0.301773	0.175599	-1.718527	0.0576
C(7)	-0.135906	0.160169	-0.848520	0.0039
C(8)	0.164463	0.060532	2.716975	0.0116
C(9)	0.032031	0.060265	0.531503	0.5996
C(10)	-0.130797	0.118031	-1.108157	0.2779
C(11)	0.159192	0.115969	1.372716	0.1816
C(12)	-0.470452	0.566476	-0.830490	0.4138
C(13)	-1.388642	0.462202	-3.004407	0.0058
C(14)	0.006817	0.005423	1.257123	0.2199

R-squared	0.585582	Mean dependent var	0.016832
Adjusted R-squared	0.428373	S.D. dependent var	0.027865
S.E. of regression	0.019136	Akaike info criterion	-4.805235
Sum squared resid	0.009521	Schwarz criterion	-4.214128
Log likelihood	110.1047	Hannan-Quinn criter.	-4.591509
F-statistic	4.360956	Durbin-Watson stat	2.043587
Prob(F-statistic)	0.000687		

The goodness of fit of the above models (R^2) shows that 58% of the total variation in the dependent variable (LNRGDP) is explained by the independent variables in the model. The results of the ECM [-0.427] or 42.7%, which measures the adjustment to restore equilibrium in the dynamic model, appear with negative sign and it is statistically significant at 5% level of significance, ensuring the long run equilibrium can be attained. Therefore, the speed of adjustment is -0.427, which implies that around 42.7% deviations from long-term equilibrium are adjusted every year.

Gross capital formation to labour ratio is significantly affect Ethiopian economic growth during the study period, despite their relationship is positive in short run. From this we can understand that under the study period, whether in the long run or in the short run, generally gross capital formation has positive and significant impact on the Ethiopian economic growth.

In short run gross domestic saving has positively and significantly affect gross domestic product during the study period and although their relationship is positive in long run. From this we can understand that under the study period, whether in the long run or in the short run, generally gross domestic saving has significantly positive impact on the Ethiopian economic growth. That means, in short run and long run gross domestic saving has positive and significant effect on economic growth in Ethiopia.

Government final consumption has negatively and statistically insignificant impact on Ethiopian economic growth in short run during the study period, and also in the long run negatively and statistically insignificant impact on economic growth. Trade openness has negatively and statistically insignificant impact on economic growth in short run to a given period of time.

Then, again in short run Gross secondary school enrollment has negatively and insignificantly affected gross domestic product/economic growth in Ethiopia, which indicates there is the negative relationship between secondary school enrollment and economic growth in Ethiopia.

Since R-squared is less than Durbin-Watson stat (0.585582 < 2.043587) and the coefficient of error correction term is also significant and negative, which confirms the existence of co-integration or long-run equilibrium between the respective explanatory variables and real GDP.

4.8. Result of Pairwise Granger Causality Test

The long run causalities among variables entered the model of real economic growth have been examined by employing the VAR model Granger causality test approach. Then, the VAR model Granger-causality test is very sensitive to the number of lags included in the regression; all Information Criteria have been used in order to find an appropriate number of lags. After that these requirements have been satisfied, Granger-causality tests are computed. We have employed Granger causality test using the VAR model to further investigate the causal relationship between gross domestic saving and real economic growth.

Table 4.8: Results of the Pairwise Granger Causality test

Pairwise Granger Causality Tests			
Sample: 1 43(1975 2017/18)			
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Prob.
LNDST does not Granger Cause LNRGDP	42	1.93330	0.1434
LNRGDP does not Granger Cause LNDST		4.47312	0.0096

Source: Own computation (2019)

The null hypotheses are in two forms: growth rate of domestic savings does not granger cause the growth rate real GDP, and the growth rate of real GDP does not granger cause the growth rate of domestic savings; against the alternative hypotheses that the growth rate of domestic savings granger causes the growth rate of real GDP and the growth rate real GDP granger causes the growth rate of domestic savings.

From the results, the null hypothesis that the growth rate of GDP does not granger causes the growth rate of domestic savings is rejected at 5% significance level. Thus, the alternative hypothesis holds that the growth rate of GDP granger causes the growth rate domestic savings. However, the null hypothesis that the growth rate of Growth rate of GDP does not granger causes the growth rate domestic saving is accepted.

The findings of this study fail to accept the null hypothesis that there is no causal relationship between growth rate of domestic savings and growth rate of GDP. The findings, however, fail to reject the alternative hypothesis that there is a causal relationship between growth rate of real GDP and the growth rate of domestic saving.

And also finding of this study finds a unidirectional causality between growth rate of GDP and the growth rate of domestic savings; therefore, this indicates that the granger causality run one way from growth rate of domestic product (RGDP) to growth rate of domestic saving (DST). This means that economic growth accelerates and augments gross domestic saving in Ethiopia and thus the classical view that saving as the engine of growth is refuted in Ethiopian context.

Again, the findings of this study consistent with the findings of Anoruo and Ahmed (2002), Abu (2010), Achalu (2012), and Samuel et al. (2015) who found the direction of causality running from the growth rate of real GDP to the growth rate of gross domestic savings for the sample countries, namely Ethiopia, Ghana, Kenya, Nigeria, and Zambia.

4.9. Results of Model Stability and Diagnostic Test

Model checking is very important to the economic study because they validate the parameter evaluation of the outcomes achieved by the model. We test and check the validity of the VAR/VECM model formulated for both short run and long run diagnostic for stability, normality, heteroscedasticity and serial correlation.

4.9.1. Result of Autocorrelation Test

From the Table 4.9.1 it is found that the null hypothesis of no serial correlation (Brush God fray LM test) is failed to reject for the reason that that the p-values associated with test statistic is greater than the standard significant level [I.e. 0.3538 > 0.05]. Brush‟s LM test used for testing serial correlation is applied since unlike the traditional Durbin Watson test statistic which is totally inapplicable when the lagged dependent variable appear as a regressors, LM test avoid such limitation of DW test.

Table 4.9.1: Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.892527	Prob. F(1,25)	0.3538
Obs*R-squared	1.378818	Prob. Chi-Square(1)	0.2403

Source: Own Computation (2019)

4.9.2. Result of Hetroscedasticity Test

Table 4.9.2: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.073298	Prob. F(18,21)	0.4342
Obs*R-squared	19.16634	Prob. Chi-Square(18)	0.3816
Scaled explained SS	12.49579	Prob. Chi-Square(18)	0.8206

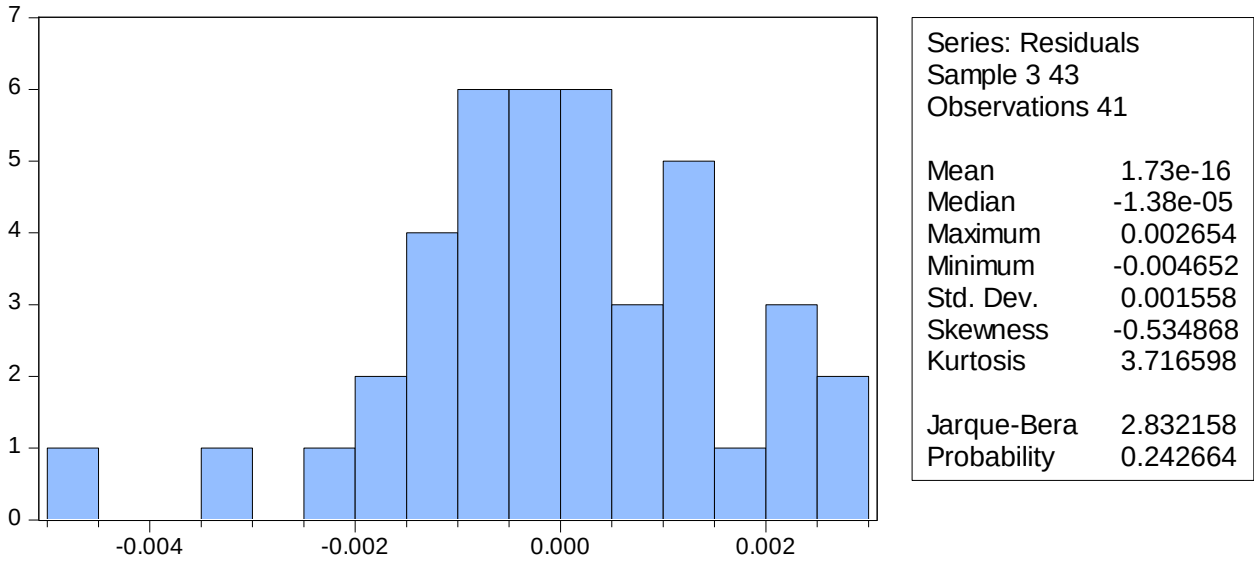
Source: Own Computation (2019)

Indicated from the table 4.9.2, we can see there is no heteroscedasticity, since p-value is greater than 5% (43%). Therefore we fail to reject the null hypothesis which says that there is no heteroscedasticity.

4.9.3. Results of Normality Test

As the result indicates that we could not reject the null hypothesis which says that the residuals are normally distributed, as a result, that the p-value associated with the **Jarque-Berra** normality test is larger than the standard significance level [i.e. 0.242 > 0.05], And normality showed in figure 4.4. Thus, the null hypothesis of normal distribution of the residuals is not rejected, that means it is normally distributed for the period of the study since the p-value is greater than 5% (24%).

Figure 4.4 Result of Normality Test for VAR MODEL



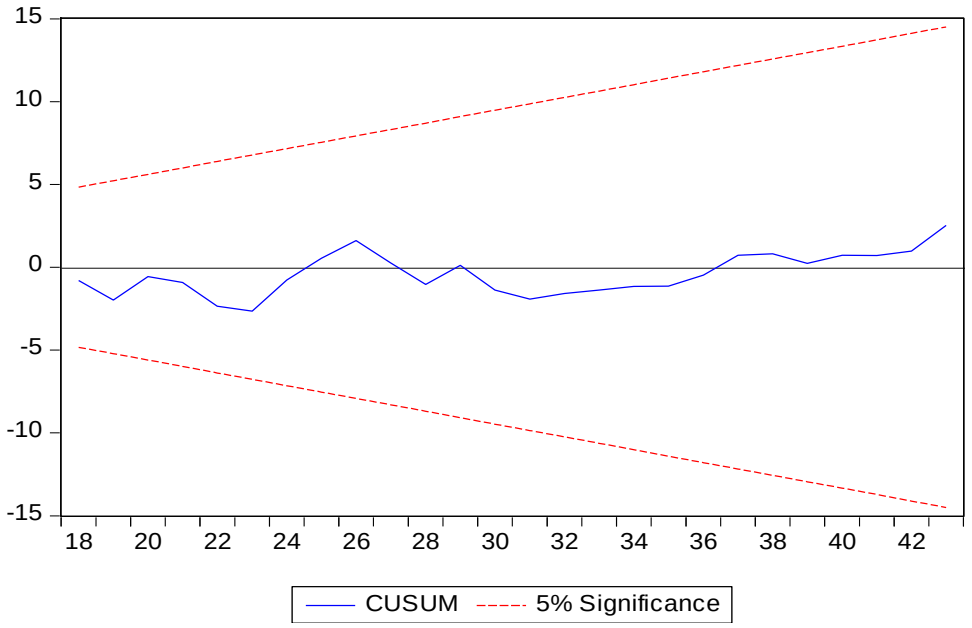
Source: Author's Computation (2019)

4.10. Result of Stability Test

The CUSUM test and CUSUMSQ test (Brown, Durbin, and Evans, 1975), pesaran and shin (1997) is based on the cumulative sum of the recursive residuals. This option plots the cumulative sum together with the 5% critical lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines.

The results of both CUSUM and CUSUMSQ test are reported in Figures 4.5 and 4.6. And they indicate that the model satisfies the stability condition. Thus, the stability tests reveal that the parameter estimates of the model are stable at least over the sample period. As can be seen from the first figure, the plot of CUSUM test did not cross the critical limits. Similarly, the CUSUMSQ test shows that the graphs do not cross the lower and upper critical limits. So, we can conclude that long and short runs estimates are stable and there is no any structural break. Hence the results of the estimated model are reliable and efficient.

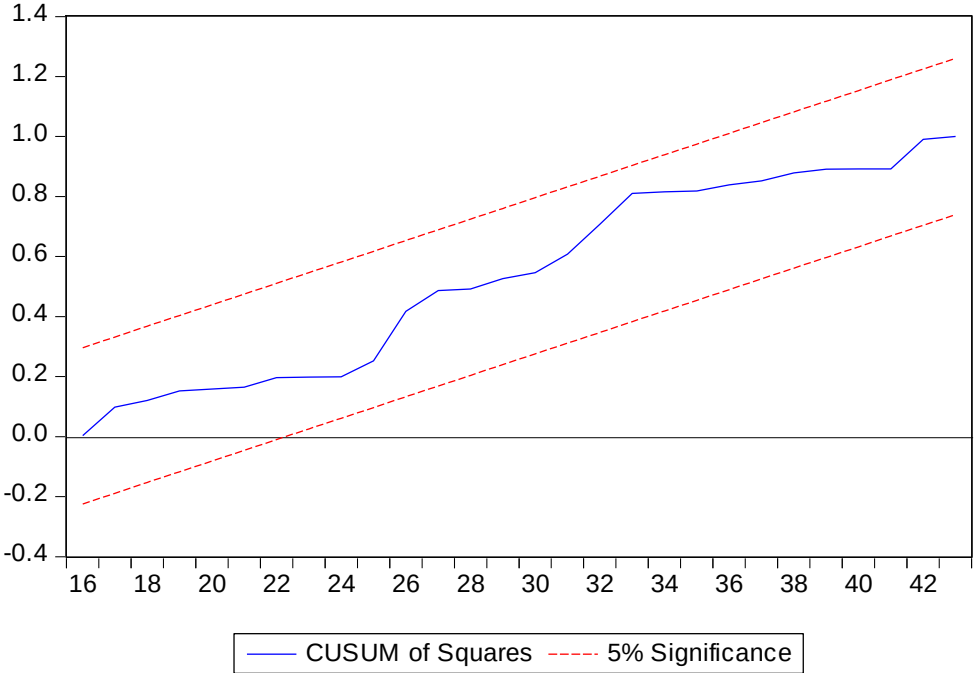
Figure 4.5: Plot of Cumulative Sum of Recursive Residuals



Source: own computational (2019)

Note that: The straight lines represent critical bounds at 5% significance level.

Figure 4.6: Plot of Cumulative Sum of Squares of Recursive Residuals



Source: Own design (2019)

The two plots disclose that the plots of CUMSUM and CUMSUMSQ stay within the lines, and, therefore, this confirms the equation is correctly specified and the model is stable. Furthermore, the results reveal that there is no structural instability in the model during the sample period. The selected model adopted in study seem to be good and robust in estimating the short run and long run relationship between national saving and economic growth (RGDP).

In conclusion, the model stability test using cumulative sum (CUMSUM) and (CUMSUMSQ) control chart also confirmed that the null hypothesis of parameter stability cannot be rejected at the 5% critical bound. Thus, the parameters of the estimated saving model do not suffer from any structural instability over the period of study.

4.11. Test of volatility: Impulse response and Variance Decomposition

Impulse response is a method of assessing the interaction among the variables in the VAR. it can be used either to assess the dynamic behavior of the VAR or to investigate the policy impact of the variables that constitute the VAR.

The variance decomposition helps in identifying the degree to which one variable influences the other. And also to make clear it shows the portion (or the relative importance) of variance in the prediction for each variable in the system that is attributable to its own innovations and to shocks to other variables in the system.

The coefficient of VAR models only shows the direct effect. They do not consider the lagged explanatory variables in each equation are interlinked. That is both with the lag and contemporaneously and thus do not reflect the full impact of one variable on the other. Due to this, the analysis relies to a great extent on impulse response function to estimate the total short run and long run an increase in gross domestic saving on economic growth

4.11.1. Impulse Responses

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. In order to interpret the impulses, it is common to apply a transformation to the innovations so that they become uncorrelated. In this study, the cholesky transforming approach which uses the inverse of the cholesky factor of the residual covariance matrix to orthogonalize the impulses was employed. This approach imposes

an ordering of the variables in the VAR and attributes all of the effect of any common component to the variable that comes first in the VAR system.

Table 4.10.1:- Impulse Responses of GDP Growth

:	Impulse form					
Period	LNKT	LNGC	LNDST	LNOP	LNSSE	LNRGDP
1	0.000612	0.000225	0.000679	0.000604	1.20E-05	0.001489
	(0.00030)	(0.00033)	(0.00031)	(0.00026)	(0.00024)	(0.00018)
2	0.001017	-0.000161	0.000178	0.000399	4.06E-05	0.001521
	(0.00047)	(0.00055)	(0.00048)	(0.00046)	(0.00024)	(0.00041)
3	0.000966	-0.000622	0.000491	0.000651	-6.62E-06	0.001604
	(0.00061)	(0.00064)	(0.00055)	(0.00055)	(0.00029)	(0.00046)
4	0.001016	-0.000787	0.000962	0.001024	-4.27E-05	0.001410
	(0.00074)	(0.00078)	(0.00073)	(0.00064)	(0.00031)	(0.00055)
5	0.001209	-0.000787	0.001281	0.001188	-6.17E-05	0.001417
	(0.00088)	(0.00096)	(0.00096)	(0.00079)	(0.00034)	(0.00064)
6	0.001363	-0.000673	0.001448	0.001273	-9.67E-05	0.001432
	(0.00103)	(0.00114)	(0.00119)	(0.00093)	(0.00037)	(0.00073)
7	0.001508	-0.000531	0.001586	0.001400	-0.000122	0.001440
	(0.00124)	(0.00133)	(0.00138)	(0.00110)	(0.00041)	(0.00080)
8	0.001658	-0.000427	0.001702	0.001547	-0.000133	0.001451
	(0.00147)	(0.00152)	(0.00161)	(0.00131)	(0.00044)	(0.00088)
9	0.001782	-0.000382	0.001828	0.001707	-0.000139	0.001456
	(0.00170)	(0.00172)	(0.00189)	(0.00157)	(0.00049)	(0.00097)
10	0.001864	-0.000395	0.001977	0.001880	-0.000144	0.001502
	(0.00196)	(0.00192)	(0.00225)	(0.00188)	(0.00054)	(0.00108)

Source: Own computation (2019)

According in the above table 4.10.1 indicates the following results; In response to a one standard deviation disturbance output (LNRGDP) itself future output increase by 0.001489 in the first year and increased up to 0.001604 in the third year and decreased 0.001417 in fourth year, and also continue to increase to 0.001502 in the 10^{th} year.

The value GDP growth responds by almost 0.000612 to one standard deviation innovation of growth capital formation growth in the initial period. Besides, GDP growth responds by about 0.001489 to one standard deviation innovation of GDP growth itself in the first period. And also in response to a one standard deviation disturbance of gross capital formation (LNKT) itself future gross capital by 0.000612 in the first year and it is increase to 0.001017 in the second year and also decrease to 0.000966 in the third year and shows in fluctuation but never die out in the long run and reaches 0.001864 at the 10^{th} year. The results show that gross capital formation has impact on economic growth.

A one standard deviation disturbance originating from gross domestic saving results in an appropriately 0.000679 percent decreased in output in first year and it decreased to 0.000178 in the second year and increase to 0.000491 in the third year, further continue to increase consequently it reaches 0.001977 in the 10^{th} year. The result shows that the impact gross domestic saving and economic growth is permanent.

A one standard deviation disturbance originating from LNGC produces a 0.000225 decrease in the first year, continuously fall to -0.000787 in the fifth year. Its effect continues to fall as the forecast zone is extended and reaches to -0.000395 at the 10^{th} year.

4.11.2. Variance Decomposition

Variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR. Also it highlights the proportion of the movements in the dependent variables that are results of their own shocks, against shocks from the other variables.

Table 4.10.2:-Variance Decomposition of Real GDP growth

Period	S.E.	LNKT	LNDST	LNGC	LNOP	LNSSE	LNRGDP
1	0.001863	10.80543	14.50010	0.258648	10.51249	0.004173	64.91916
		(8.94092)	(9.48579)	(3.64838)	(8.16258)	(2.40501)	(10.8315)
2	0.002652	20.03608	7.266709	0.830479	7.444889	0.025535	63.39631
		(13.2481)	(6.58033)	(4.89038)	(7.10876)	(2.53585)	(12.6108)
3	0.003405	20.21257	8.798087	1.527339	8.173493	0.015874	61.27264
		(14.0229)	(7.06369)	(6.06565)	(8.19224)	(2.50076)	(12.8318)
4	0.004179	19.33505	14.22018	1.486189	11.42772	0.020961	53.50991
		(13.8491)	(9.28784)	(6.76356)	(9.49791)	(2.33202)	(13.5421)
5	0.004960	19.65891	19.19262	1.143483	13.84083	0.030323	46.13383
		(14.1311)	(11.3226)	(7.26686)	(10.3253)	(2.22663)	(14.7356)
6	0.005712	20.51863	22.28570	0.864704	15.40294	0.051548	40.87648
		(14.7179)	(12.8289)	(7.75433)	(10.9606)	(2.17532)	(15.8345)
7	0.006454	21.52874	24.05549	0.788896	16.76670	0.076077	36.78410
		(15.2958)	(14.0546)	(8.37959)	(11.5714)	(2.13958)	(16.5572)
8	0.007205	22.56812	24.98638	0.882984	18.06152	0.095288	33.40572
		(15.8640)	(14.8669)	(9.05196)	(12.1769)	(2.11952)	(17.0259)
9	0.007977	23.40370	25.53991	1.047576	19.31427	0.108103	30.58645
		(16.4358)	(15.4825)	(9.74889)	(12.7336)	(2.10867)	(17.3770)
10	0.008774	23.85789	26.05332	1.203181	20.55513	0.116386	28.21409
		(16.8364)	(15.8661)	(10.3615)	(13.2202)	(2.09919)	(17.6035)

Source: Own computation (2019)

Table 4.10.2 reports that the results of the variance decomposition of output growth in Ethiopia with in a 10-period horizon. The variance estimates indicate that a greater proportion of the variation in LNRGDP is due to its own innovations. The variation to other variables is smaller. When we look the partial effect of factors inputs, LNDST (26%), as a percent of LNRGDP, LNSSE (0.11%), as percent of LNRGDP, (1.2%) of future changes in RGDP due to in governmental final consumption and LNOP (20.55%), as a percent of LNRGDP showing it has

important impact on future growth rate of output in Ethiopia. LNKT, LNDST, LNGC, LNOP and LNSSE have permanent effects on over all period.

According to Cholesky estimation the variance decompositions of output growth, as reported in in the above table 4.10.2 indicates that policy shock best explains the forecast error variance of GDP growth next to GDP itself, which significantly explains more than 28.21% of the forecast error variances of GDP growth. The other variables together explain approximately 71.79% of the future variation in growth of Ethiopia. The growth rate in gross domestic saving, gross capital formation, government final consumption, trade openness and gross secondary school enrollment alone significantly explains more than 26%, 25%, 1.2%, 20.55%, and 0.11% respectively of the forecast error variances of GDP growth during all time horizons of the forecast error variances of GDP growth. From this gross domestic saving, gross capital formation shows significant effect on real economic growth. Therefore, this finding is similar with the result of short run dynamics and it suggests policy variables have significant influence on real economic growth at study period.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

In this chapter the researcher have given the highlights of the whole thesis through conclusion and policy recommendation for the country based on the time series analyzed using econometrics and Eview8.0.

5.1. Conclusions

The main purpose of this study is to analyze the relationship between economic growth and gross domestic saving in Ethiopia during the specified study period. To determine the long run and short run relationship among the variables, Multivariate vector autoregressive model was applied. Before applying the VECM and VAR model, all the variables are tested for their time series properties (stationarity properties) using the ADF. Moreover pairwise Granger causality test also applied in order to find out the directional causation between gross domestic saving and economic growth. Real GDP and gross domestic saving variable is stationary [no unit root problem] whereas, gross capital formation, trade openness to GDP ratio, government final consumption, gross domestic saving and secondary school enrollment are stationary at first difference with drift and all the variables are stationary in first difference with drift and trend.

The results of the research concerning the correlation between gross domestic savings and economic growth in Ethiopia are generally consistent with economic growth theories. From the point of view of a standard theory of economic growth, positive cause and effect relation between gross domestic savings and economic growth may appear in advanced economies, in which quite high domestic savings may constitute an essential source of financing domestic investment and an economic growth factor, without the necessity of using foreign investment.

For the same reason, in the poorest countries like Ethiopia there should not be any relation between domestic savings and economic growth, as these countries, in order to finance their investment, use mostly foreign savings as their domestic savings are quite scarce.

The study carry out the model stability tests and the result shown that no evidence of serial correlation, no functional form problem (the model is correctly specified), the residual is normally distributed and no evidence of Hetroscedasticity problem. Additionally, the study revealed that the causality between real GDP and gross domestic saving is unidirectional indicating that economic growth as the cause for domestic saving during the study period. The study is also consistent with the finding of Abu (2010), Achalu (2012), the causality running from real GDP to gross domestic saving.

The coefficient of the error correction term for the LNRGDP is negative and statistically significant, it implies that 42.7% per cent of the disturbance in the short run will be corrected each year and the system will be stable.

In short run gross domestic saving has positively and significantly affect gross domestic product during the study period and although their relationship is also positive in the long run. From this we can understand that under the study period, whether in the long run or in the short run, general gross domestic saving has significantly and positive impact on the Ethiopian economic growth. Gross capital formation has positively and significantly affected Ethiopian economic growth during the study period in both short run and long run. And trade openness has negatively and significantly affected economic growth in long run to a given period of time but in short run negatively and insignificantly affected economic growth.

On the other hand, the study found that gross secondary school enrollment has positively and statistically insignificant impact on Ethiopian economic growth in the long run and negatively and statistically insignificant impact on economic growth in Ethiopia in the short run.

The variance decomposion result indicate that policy shock best explains the forecast error variance of GDP growth next to GDP itself, which significantly explains more than 28.21% of the forecast error variances of GDP growth. On the other hand the other variables together explain approximately 71.79% of the future variation in growth of Ethiopia.

5.2. Recommendations

The recommendation that arises from this study is that the authorities should be aware of the possibility of causality running from economic growth to gross domestic savings and impact of dependent and explanatory variables. To this effect, policymakers should formulate and implement policies that promote economic growth, since such strategies will lead to higher economic growth in domestic savings. And also the empirical results suggested that the growth rate of real GDP granger causes growth rate domestic saving in Ethiopia. In this study, the direction of causality in the empirical result was unidirectional. And given the results of regression show positive effect of gross domestic saving, gross capital formation and secondary school enrollment on the long run growth, policy should focus to improve these variables. The government should encourage saving and secondary school enrollment (human capital accumulation of knowledge, learning ability, and productivity of resources) by designing and implementing policies that encourages the citizens to save and creating conducive environment for learning equipment.

Policy makers should put in place measures to boost gross domestic product so that economic growth should be appropriately mobilized and directed towards productive investments and hence saving would be accelerated And also policy makers should focus on promoting real economic growth by adopting income policies, since such strategies can definitely lead to higher growth of gross domestic savings as well as to a more rapid economic growth.

To this end, we recommend that government and policy makers should employ policies that would accelerate economic growth so as to increase saving. These include among others the following. Firstly, government should increase its investment in the provision of infrastructure like power, roads, education and so on. This will help to reduce the costs of doing business as well as increase the profitability of firms, thereby raising the economy's production of goods and services. Secondly, government should encourage the monetary authority like the central bank of Ethiopia to reduce interest rate so that prospective investors can increase their investment and raise the nation's production capacity. Others measures include sustenance of political stability that country current enjoys; encouragement of inflows of foreign direct investment; and sustenance of the war on corruption.

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APPENDIX

Appendix 1:- **Result of Residual Serial Correlation Test VECM Residual Serial**

VEC Residual Serial Correlation
LM Tests
Null Hypothesis: no serial
correlation at lag order h
Date: 07/30/19 Time: 15:41
Sample: 1 43
Included observations: 40

Lags	LM-Stat	Prob
1	37.02801	0.4213
2	52.72972	0.5355
3	28.40985	0.8123
4	29.87416	0.7542
5	36.21966	0.4584
6	44.48915	0.1566
7	24.13088	0.9345
8	40.85976	0.2654
9	32.35822	0.6425
10	40.43930	0.2806
11	25.83250	0.8950
12	38.64152	0.3512

Probs from chi-square with 36 df.
Source: Own design (2019)

Appendix 2:-VAR Residual Serial Correlation LM Tests

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.031833	Prob. F(1,27)	0.8597
Obs*R-squared	0.048281	Prob. Chi-Square(1)	0.8261

Source: Own design (2019)

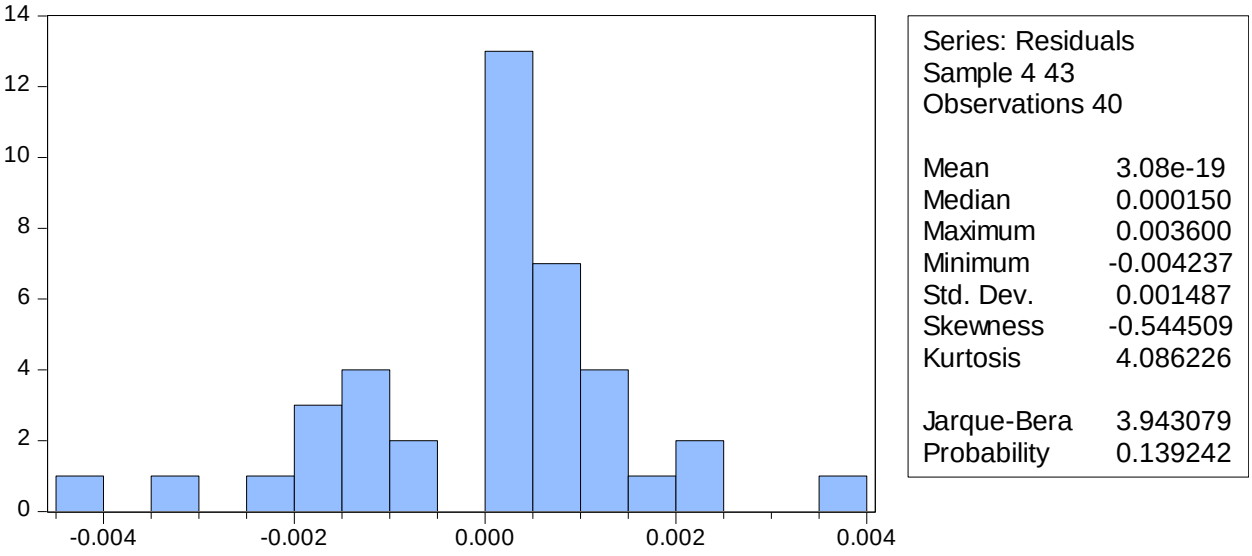
Appendix 3:-VAR Heteroskedasticity Test: Breusch-Pagan-Godfrey

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.763470	Prob. F(12,28)	0.1056
Obs*R-squared	17.64846	Prob. Chi-Square(12)	0.1268
Scaled explained SS	11.18023	Prob. Chi-Square(12)	0.5135

Source: Own design (2019)

Appendix 4:- VECM Normality Test



Source: Own design (2019)