SCHOOL OF GRAGUATE STUDIES

THE NEXUS BETWEEN GROSS NATIONAL SAVINGS AND ECONOMIC GROWTH IN ETHIOPIA

BY

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ADDIS ABEBA, ETHIOPIA

THE NEXUS BETWEEN GROSS NATIONAL SAVINGS AND ECONOMIC GROWTH IN ETHIOPIA

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DECLARATION

I hereby declare that this thesis is my own work and has never been presented in any other university. All sources of materials used for this thesis has been appropriately acknowledged.

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ENDORSEMENT

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

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Advisor Name Signature

St. Mary's University, Addis Ababa June 2020

APPROVAL OF BOARD OF EXAMINERS

As a member of the Board of Examiners of the Master Thesis open defense examination, we testify that we have read and evaluated the thesis prepared by Mulugeta Negera under the title "The Nexus between Gross National Saving and Economic growth in Ethiopia". We recommended that this thesis to be accepted as fulfilling the thesis requirement for Degree of Master of Arts in Development Economics.

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ACRONYMS

ADF	Augmented dickey-fuller
ALR	Average Lending Rate
ARDL	Autoregressive Distributed Lag
ECM	Error Correction Model
GNS	Gross National Saving
NBE	National Bank of Ethiopia
REER	Real Effective Exchange Rate
VAR	Vector Auto regressive
VECM	Vector Error Correction Model

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ABSTRACT

Higher saving rates cause higher economic growth. Empirical works have shown that the direction of causality between gross domestic savings and economic growth may result in bidirectional causality between gross domestic savings and economic growth or no causal relationship between them. The objective of this study was to find the direction of causality between gross national savings and economic growth of Ethiopia using annual time series data from 1980-2018. To achieve this objective co-integrated VAR approach was employed. For this purpose the time series properties of gross national savings and real gross domestic product were ascertained using the ADF unit root test procedure while the long-run and short run relationships between the series was explored utilizing Johansen Co-integration Test procedure. The result of Johansen Co-integration Test indicated that the series were co-integrated and have a positive and significant long run relationship between the gross national savings and economic growth. The long run and short run relationship between gross national savings and economic growth showed that the effect of gross national saving rate on economic growth rate and the effect of economic growth rate on gross national saving rate are positive and significant. The causal relationship between gross national savings and real GDP was performed using the Vector Error correction (VECM) model and Pair wise Granger Causality Test. The results showed that there was bi-directional causal relationship between gross national savings and real GDP. Thus, policy makers are required to implement policy mixes aiming at increasing savings and growth in Ethiopia.

Keywords: *Gross National Saving, Economic Growth, Vector Autoregressive Model, Granger Causality.*

CHAPTER ONE

INTRODUCTION

1.1. Background of Study

National savings rate in macroeconomic theory is defined as the combination of public and private saving rates of a nation (Abel, 2016). The savings plays an important role in economic growth and development of a country. Classical and neoclassical models are seemed to emphasize on higher savings for long run growth. Positive change in saving rate may promote the growth rate. Therefore, savings play greater role in providing the required amount of finance to the national capacity for investment and production, Low national savings rate is one of the most series obstacles to achieve higher and more sustainable economic growth (Solow and Swan, 1956). According to neoclassical growth models, countries with higher total savings will have higher investments which may lead to higher growth in national output level in the short run. This implies that countries can actually attain a higher economic growth rate by accumulating capital investments which could be achieved by reducing consumption and from whatever income left after expenditures on consumption of goods and services saved (Romer, 1996). In addition to this the neoclassical models specifically the concept of marginal propensity, indicates saving level increases with an increasing level of income. Furthermore the theory points out that when economy growths, the total amount of savings in the economy will also increases. Economic growth is the indicators for an economic progress and it is an issue of primary concern to policy makers in both developed and developing countries. In this regard countries around the world are working to achieve higher economic growth; as a result economic growth is the common key target for the countries to raise their social welfare.

Ethiopia is one of the poorest countries in the world; its economy remains heavenly dependent on agriculture, which accounts 37 % (UNDP, 2016) of the GDP, ACCORDNGLY, 73% of the population gains its livelihood directly or indirectly from agriculture production. Despite the fact that the history of growth performance was poor in the past decades, the country has experienced strong economic growth in the current time. Real GDP growth averaged 9.3% per annum during 2013/14and 2017/2018 period placing Ethiopia among the top performing economics in sub-Saharan Africa (NBE, 2018).

Ethiopian average national savings to GDP ratio has been lower than that of the SSA average in real terms (Dawit 2004).The average GNS to GDP ratio in real terms for the Ethiopia had been 9.7% in the 1990s and 6.4 % for the period of 2000-2008 which is lower than the corresponding average GNS to GDP ratio for SSA (Tassew, 2011). But in 2018, according to the World Bank collection of development indicators, Gross national savings (% of GDP) in Ethiopia was reported at 24.3 %. Low saving rates has been identified as one of the big challenge, for growth process, especially in developing countries like Ethiopia (Schmidt et al, 1992). If the causality is from savings to economic growth, then savings should increase in order to achieve a higher economic growth. On the other hand if the results imply that the economic growth causes savings, then the Keynesian point of view that savings depend on income is dominating. So decision makings will emphasize the demand side of the economy in order to increase economic growth. According to the debatable view about the relationships among consumption, saving, investment and economic growth, one may not refuse to accept that once a country's aggregate saving level increases from the growing income level; it might result in an increased level of investment opportunities and from this a typical country might generate sustainable economic growth. On the other hand, if the economy of a typical country is growing, it might lead to increasing in savings (Solow, 1956). Thus, examining the relationship between gross domestic savings and gross domestic product is important to examine the causal relationship between savings and economic growth, because this may provide useful insights on the variables which should be controlled in order to get the desired level of the targeted variable(s) (Oladipo, 2010).

Therefore, investigating the causality between saving and economic growth help to inspect which variable causes the other variable in which it provided convenient information to policy makers on the variables which should be controlled in order to obtain the desired level of the targeted variable. The existing empirical divergence is mainly in the sign and significance of the linear relationship between the variables. This shows that saving and economic growth are interrelated variables and the effect of variables on each other can be analyzed endogenously by co-integrated Vector Autoregressive (VAR) approach.

1.2. Statement of the Problem

One of major problems facing Ethiopia attempt to accelerate growth and development is lack of capital formation due to low level of saving. At nationwide level, the achievement of sustainable rapid economic growth along with increasing amount of savings is the central policy objective of most countries. Therefore, understanding the existence and nature of relationship between saving and economic growth is also strategically important for the success of economic policy and lack of adequate capital formation results from non-availability of credit to adding to existing ones Therefore, gross domestic savings in Ethiopia is a very critical and reliable factor in capital formation process. Policy-makers and other stakeholders like World Bank have long advocated policies that lead to higher savings in order to boost economic growth for developing countries (Khan and Sehagji, 2001; Ahortor, 2009).

Although the relationship between saving and economic growth is an important one, the direction of causality between the variables has continued to generate series debate controversies among scholars. The controversy concerning the temporal precedence between these two variables is one of the most questioned issues in current macroeconomics, as noted by Schmidt-Hebbel et al. 1996. Nevertheless, the determination of the direction of the causal link between saving and growth is a crucial economic problem as it has important policy implications for developing countries.

Some researchers tried to investigate the relationship between saving and economic growth in their analysis. In this regard Abel Mesfin Hailu (2016) has paid considerable attention towards testing the relation between gross national savings and economic growth in Ethiopia. He used an Autoregressive Distributed Lag Model (ARDL) using time series data from 1975 to 2013 and the study indicates that there is a negative and insignificant impact of savings on economic growth. In addition Granger causality test showed that there is a unidirectional causality from gross national product to National savings.

Another related work was done by Jember (2016) analyzes the relationship between gross domestic saving and economic growth in Ethiopia using time series annual data ranging from 1975 to 2013.The granger causality test reveals that no causality running from gross domestic saving to economic growth. On the contrary, Feyera (2015) to investigate the nexus between gross national saving rate, inflation rate and per capita income growth rate evidence from Ethiopia by using co-integrated VAR approach. Granger Causality test shows that Per Capita income growth rate (PCI) does not granger causes gross national saving rate but gross national saving rate granger-causes Per capita income growth rate. Thus, these contradicting results among the few researches motivate the researcher to do detail analysis using up to date data.

Therefore, this paper attempts to provide some new findings on the nexus between gross national savings and economic growth by employing co-integrated Vector Autoregressive (VAR) approach to fill the above methodology gap. In addition to this, this paper tried to investigate the causality between gross national savings and economic growth by including additional macro variables such as real exchange rate and average lending rate for the fitness of the model.

1.3. Objectives of the Study

1.3.1. General Objective

The general objective of the study is to examine the nexus between gross national saving and economic growth in Ethiopia.

1.3.2. Specific Objectives

- To identify the short run and long run effect of economic growth on gross national saving of the country,
- To analyze the short run and long run effect of gross national saving on economic growth rate of the country,
- To investigate the causality between gross national saving and economic growth in Ethiopia.

1.4. Research Questions

The study has attempted to answer the following research questions:-

- What is short run and long run effect of economic growth rate on gross national saving of the country?
- What is short run and long run effect of gross national saving on economic growth rate of the country?
- Is there causality between gross national saving and economic growth in Ethiopia?

1.5. Significance of the Study

Over the years, the existence of the nexus between gross national saving and economic growth has been the subject of considerable interest and debate at country levels. Economic theories and empirical findings reach a variety of conclusions about the nature of the relationship between these variables. They show that there might be a positive relationship or there might be negative relationship between gross national saving and economic growth. Since the long run and short run nexus of gross national saving and economic growth has been very debatable and this issue in Ethiopia has not been studied only within the framework of VAR model this, sheds a light to the existing knowledge. This study is also very important to policy makers, macroeconomists and central bankers in understanding the causality between these macroeconomic variables and to come up with appropriate polices so as to sustain the existing economic growth of the country.

1.6. Scope and Limitation of the Study

In this study the effect of gross national savings on economic growth of the Ethiopian economy is investigated. The study covered the period from 1980 to 2018 GC. The availability of data was for a limited years for the same economic variables. The data available from different source are not identical or the same value this has made it hard to choose the most reliable data to use for this research.

1.7. Organization of the Study

The thesis is organized in five chapters. The first chapter deals with introduction of the study, statement of problems, research questions, objectives of the research, significance of the study, scope and limitation of the study and finally the organization of the study. The second chapter discusses concepts and theories related to the area of study. The review of the literature includes theoretical as well as empirical review. The third chapter presents the research design and methodology as well as the model specification. Chapter four deal with model estimation and interpretations of results. At the end, chapter five presents the conclusions and policy recommendations of the study.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Theoretical Literatures Review

The theoretical framework section is the starting point for this chapter. It presents the background theories, up on which the study relies.

2.1.1. Classical Growth Theory

The founder of the Classical Growth Theory Adam Smith argued that growth was self-reinforcing and exhibits increasing return to scale. Classical economists believed that saving is a necessary and sufficient condition for securing investment and that the interest rate is the price that equates them. They believed that if savings go up, investment increases, and then economic growth follows. Keynes, on the other hand, did not believe that investors and savers are the same group, but they save or invest for the same reason that is to maximize utility. According to his theory saving is a direct function of national income whereas investment is an indirect function of interest rates.

2.1.2. The Neo-classical Theory

The neo-classical growth model was devised by Solow and Swan (1956). They developed growth model that shows scientific innovations or technological change influence long term economic growth and level of technological change is determined exogenously, that is independent of all other factors including inflation. In neoclassical economics the theory of growth is built on a concept of diminishing returns to labor and capital separately and constant returns to both factors jointly. The determinants of output growth for neo-classical growth theory are technology, labor and capital. Neoclassical growth theories also support the importance of saving in the economic growth process. This implies that when there is higher saving there is higher investment and hence higher economic growth.

2.1.3. Endogenous Growth Theory

Romer (1992) established endogenous growth model, which is an important part of growth theory for developing countries. This growth model assumes that the country's permanent economic growth is determined by the production process, not by outside factors. One of the most important assumptions of endogenous growth model is the problem that neoclassical economists were not able to reply about the question for why countries have different rates of economic growth that have the same technological level. This growth model also assumes that production function exhibits increasing marginal returns on the size of production factors through the external impacts of returns on human capital investment, which will result in generating improvements in productivity.

According to Lucas (1988), economic growth depends on savings and human capital investment on the one hand, and investment in research and development on the other (Romer and Mattana, 2004). Moreover, economists argued that free market system will leads to less than the optimal level of capital accumulation in human capital and research and development. To correct such problems, government may allocate resources to improve the efficiency through human capital investment and encouraging private investment in high-technology industries.

2.1.4. Keynesian Theory

According to Keynesian economic theory, income has been considered the most important factor in the determination of the saving behavior of an individual. More income means, normally, more saving. Different forms of the functional relationship between saving and income have been tested. Some studies found a statistically significant effect of income on saving, and other studies found no significant effects of income on saving.

2.2. Empirical Literatures Review

This study identifies some empirical studies on the relationship between saving and economic growth on other countries experience and in Ethiopia context.

Mashi and Peters (2010) studied the mutual relation between savings and economic growth in Mexico using VAR method and annual data from 1960 to 1996. They concluded that savings have a positive effect on economic growth. . In another study, Singh (2010) studied the causal relationship between domestic savings and economic growth in India. He analyzed the short run and long run linkages of these variables using an ARDL 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. Sheggu (2004) also examined the causal relationship between real economic growth and growth rate of gross national savings for Ethiopia using co-integration and the Vector Error Correction Model (VECM) model. The results of the co-integration tests indicate that there is a long run bi-directionality relationship between real GDP and real savings in Ethiopia

Ekinci and Gül, (2007) analyzed the relationship between domestic savings and economic growth for Turkey by means of VECM model and co-integration test, using the data belonging to the period of 1960 -2004. According to the result of the analysis, there is a long term relationship between saving rate and economic growth. But, the results of Granger causality analysis, in contrast to the traditional view, it shows that there is one-directional causality in Turkey from economic growth to the domestic saving rates.

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 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.

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.

Lean and Song (2009) examined the short-run and long-run relationship between savings and economic growth in China using Granger causality test via time series annual data. 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.

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. They 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.

Abu (2010) studied the relationship between savings and economic growth in Nigeria using Granger Causality techniques and Co-Integration for the period 1970-2007. 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 is from economic growth to savings.

Bassam (2010) has examined the long- run relationship between real gross domestic products (GDP) and real gross domestic saving (GDS) for Morocco (1965-2007) and Tunisia (1961-2007). His results reveal that in Morocco, a long-run relationship exists between the variables, while no evidence of long-run relationship exists in Tunisia. His Granger causality test supports bidirectional causality between economic growth and gross domestic saving growth in Morocco. However, in the case of Tunisia, the results suggest that there is a unidirectional

Granger causality between real GDP and real GDS and runs from gross domestic saving rate to economic growth.

Shimelis (2014) examine the causal relationship between saving, investment and economic growth in Ethiopia using annual time series data from 1970-2011 in a multivariate framework using ARDL approach. The result indicated that economic growth was positively affected by labor and investment in the long run as well as short run but domestic saving was insignificant in the short run. But it was found that economic growth has been found to positively affect gross national saving. The result suggesting unidirectional causal relationship running from economic growth to saving while bidirectional causal relationship between economic growth and investment and investment and domestic saving.

Applying co-integrated VAR approach, Feyera (2015) also empirically investigated the linkages of Inflation rate, Gross national saving rate and Per capita income growth for the period 1980 – 2014 in Ethiopia. The long run test reveals that inflation rate exert positive and significant impact on gross national saving rate whereas gross national saving rate exerts negative and insignificant impact on inflation rate in the long run. In short run the impact of inflation rate on gross national saving rate is negative and gross national savings rate influence inflation rate positively.

Shradha H. Budhedeo (2015) examined the association between savings and economic growth in India over the planned economic era from 1950-2013 by engaging Granger causality (VECM) estimation technique using the co-integration approach. The empirical results indicate a bi-directional mutual causality between saving and income in the short-run. In the long-run, nominal national income Granger causes gross domestic savings unidirectional but savings share a two-way causal relationship with nominal non-agricultural income.

Jagadeesh (2015) explored the relationship between savings and economic growth in 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.

Jember (2016) analyzes the relationship between gross domestic saving and economic growth in Ethiopia using time series annual data ranging from 1975 to 2013.The granger causality test reveals that no causality running from gross domestic saving to economic growth.

Abel Mesfin Hailu (2016) investigated relationship between 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.

2.3 Conceptual Framework

Based on reviewed theoretical and empirical literature the study has developed the following schematic representation of the conceptual framework.

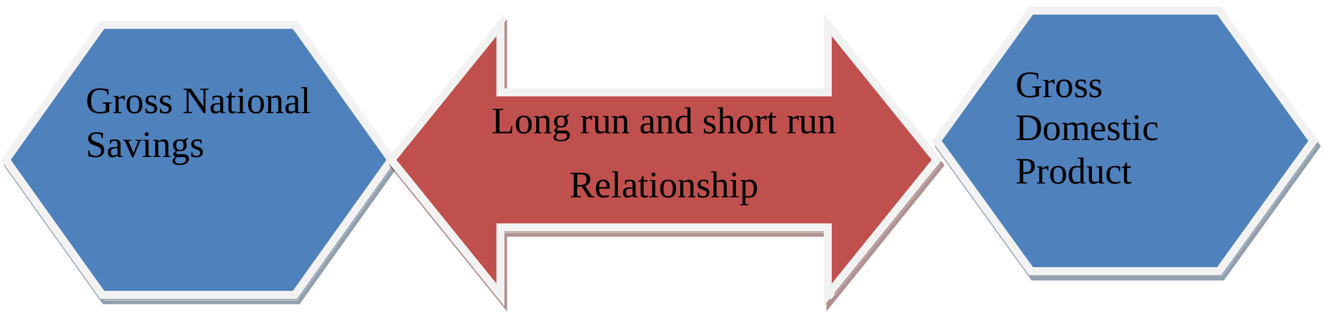

Figure2.1 Conceptual frame work of dependent variables

The above Conceptual frame work shows bi-directional causality between gross national saving and gross domestic product. Gross national saving rate affects economic growth and also economic growth rate affects gross national saving rate of the country.

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. Data Type and Source

To investigate the nexus between gross national saving and economic growth, annual time series secondary data over the period of 1980-2018 G.C, have been used. The data were taken from National Bank of Ethiopia (NBE).

3.2. Research Design

In this study, the researcher used longitudinal research to explaining, understanding, predicting and controlling the relationship between variables since it fits the secondary data that collected from NBE.

3.3. Methods of Data Analysis

In this study both simple descriptive and econometrical methods of data analysis are employed. To analyze the trends of gross national saving and economic growth during the study period, we used tools of descriptive statistical such as trend graphs. To analyze the data, STATA 13 versions have been used as statistical software package for the entire study.

3.4. Model Specification

In line with the theoretical propositions reviewed in the literature, the nexus of gross national saving and economic growth have been examined by specifying the following model.

RGDP t =f (GNS, ALR, REER) -- (1)

GNS t =f (RGDP, ALR, REER) -- (2)

In linear form, equations (1) – (2) can be written as:

$lnRGDP_t = \alpha_0 + \alpha_1 \ lnGNS_t + \alpha_2 \ lnALR_t + \alpha_3 \ lnREER_t + \varepsilon_t$ ------------------(3)

$lnGNS_t = \beta_0 + \beta_1 \ lnRGDP_t + \beta_2 \ lnALR_t + \beta_3 \ lnREER_t + \varepsilon_t$ ----------------(4)

Where α_1 -α_3 and β_1 -β_3 are parameters, RGDP= Real Gross Domestic Product (Proxy for economic growth), GNS= Gross National Saving, ALR=Average Lending Rate, REER=Real Effective Exchange Rate, ln. = Natural logarithm, t= Time, ε t= Residual term.

3.5. Definition of Variables

Real GDP (RGDP):-is the market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real Gross Domestic Product (Abel, 2016).It is expected that countries with high economic growth can have more savings.

Gross National Saving (GNS): -In economics, a country's national savings is the sum of private and public savings. It is generally equal to a nation's income minus consumption and government purchases (Abel, 2016). Gross national saving rate can impact economic growth positively or negatively as theoretically explained above.

3.6. Vector Autoregressive (VAR) Model

In order to catch the direction of causality and to investigate the linkages between gross national saving and economic growth the study employed VAR model. It was introduced by Sims (1980) as a technique that could be used by macroeconomists to characterize the joint dynamic behavior of variables without requiring strong restrictions of the kind needed to identify under structural parameters approach. VAR model is appropriate to investigate the relationship among the variables that are mutually dependent in the model. Hence, unlike single equation model VAR model analyzes relationship between two or more endogenous variables. In this system the endogenous variables of one equation may appear as predetermined variables in the other equation of the system.

3.7. Method of Estimation

To examine the relationship between economic variables, the present study has employed Augmented Dickey-Fuller (ADF) technique to check the stationary level of the variables. The reason is that ADF test is considered superior to the Dickey-Fuller (DF) test since it adjusts appropriately for the occurrence of serial correlation. To find out long run co-integration between variables, co-integrated VAR approach has been used. First unit root test has been performed by Augmented Dickey Fuller test (ADF).

Johansen co- integration test has been performed to check the presence of co-integration of the variables or long run convergence of the variables. Granger causality test was employed to test the direction of causes between variables. Diagnostic check, such as normality, serial correlation and heteroscadasticity test are performed. Besides the regression analysis, tables and graphs were used to examine the trend of the variables over the years and STATA 13 version is selected as an econometrical tool during analysis.

3.7.1. Stationarity Test

The standard classical estimation methods which are used in the applied econometric work are based on a set of assumptions: one of the assumptions is the stationarity of variables. A time series data is said to be stationary if its disturbance term has zero mean, constant variance and the covariance between any two –time periods depend only on the distance or lag between the two periods. According to Harris (1995), currently econometrics has been showing that there are problems related to time series data used in the analysis of variables under investigation. This is due to the non stationary of time series data. To avoid the drawback of wrong implications from the non- stationary regression, the time series data should be stationary. Conducting time series analysis on non stationary data will result spurious or misleading results. According to Gujarati (2003), a time series is strictly stationary if all of the moments of its probability distribution are invariant over time.

3.7.2. Unit Root Tests

A test of stationary or non stationary has been become popular over the past several years. There are several ways of testing for the presence of a unit root: the Dickey-Fuller (DF) test, the Augmented Dickey-Fuller (ADF) test and the Phillips-Peron test. Hence, the emphasis here will be on using this ADF and Phillips-Peron tests to determine the null hypothesis that a series contains a unit root (i.e.it is non stationary) against the alternative of stationary. In both tests the null hypothesis is that the variable is non-stationary against the alternative stationary. The null hypothesis is rejected only when there is strong evidence at the conventional levels of significant. A commonly applied formal test for the existence of a unit root in data is, Augmented Dickey Fuller tests (Harris, 1995). The tests with the ADF and PP methods are performed with different trend assumptions only intercept, both trend and intercept, and no intercept and no trend. Performing the tests under all three alternatives will identify whether only the intercept or both the trend and intercept are significant.

Augmented Dickey-Fuller (ADF) Test

The Dickey and Fuller (1981) unit root test is relay on the assumption that error terms are independently and identically distributed. In order to reduce the problem of correlation among the error terms, Dickey and Fuller developed the Augmented Dickey Fuller (ADF) test. Thus, the augmented dickey and fuller test models depicted as flows.

Equation: 1 when there is only intercepts term

$\Delta Z_t = \theta Z_{t-1} + \alpha_1 \Delta Z_{t-1} + \alpha_2 \Delta Z_{t-2} + \ldots + \alpha_P \Delta Z_{t-p} + \varepsilon$ -- (5)

Equation: 2 when there is no intercept and trend

$\Delta Z_t = \alpha_0 + \theta Z_{t-1} + \alpha_1 \Delta Z_{t-1} + \alpha_2 \Delta Z_{t-2} + \ldots + \alpha_P \Delta Z_{t-p} + \varepsilon$ --- (6)

Equation: 3 when there is intercept and trend

$\Delta Z\ t = \alpha_0 + \theta Z_{t-1} + \alpha\ 1\ \Delta Z_{t-1} + \alpha\ 2\ \Delta Z_{t-2} + \alpha\ 1\ t \ldots + \alpha_P \Delta Z_{t-p} + \varepsilon$--------------------------- (7)

The above equation show three way of calculating the stationery test. The first equation represents ADF stationary test mechanism without constant. Second equation showed how calculating the stationery with constant. The thirds equation is shown how calculating stationary with constant and trend.

Phillips Perron (PP) Test

The Phillips-perron tests are a more comprehensive theory of unit root non-stationarity. Gujarati(2004) states that the Phillips-perron use non-parametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms. The Phillips and perron(1988) test solve the serial correlation problem between error terms by using a correction factor. The same critical values are used for both ADF and Phillips Perron test. There are different techniques that are used for testing the unit root of time series data. But there is no consensus on the type of test to be employed without any demerits. Although there are some demerits of using it, Augmented Dickey Fuller is going to be employed in this study.

3.7.3. Co-integration Test

Many macroeconomic time series are not stationary at levels and are most adequately represented by first difference. Even though, the individual time series are not stationary, a linear combination of these variables could be stationary. If these variables are co -integrated, then they have stable relationship and cannot move too far away from each other. Testing co-integration implies testing for the existence of such long run relationship among economic variables.

3.7.4. Granger Causality Test

Granger causality test is developed by Granger (1969) and advanced by sims (1980). In the Granger Causality test, we observed the direction of cause-effect relationship among the variables. The use of causality test is to identify which variable causes another variable in time series analysis or it provides the basis for determining which variable provide the lead for responses by other variables. Sims (1980) points out that a necessary condition for x to be exogenous of y is that x fails to Granger-cause y. Similarly, variables x and y are only independent if both fail to Granger- cause the other. Causality can be only one direction or both directions. If both x and y variables are granger cause each other, there is a bi-directional causality between x and y.

3.7.5. The Vector Error Correction model (VECM)

A vector error correction (VEC) model is a restricted VAR designed for use with no stationary series that are known to be co-integrated. The VEC has co-integration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their co-integrating relationships while allowing for short-run adjustment dynamics. The co-integration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments.VEC model is just a special case of the VAR for variables that are stationary in their differences. So, the first step in time- series analysis should be to determine whether the levels of the data are stationary. If not, the first differences of the series will be trying again.

3.8. Diagnostic Checks

Last but in no sense least, diagnostic tests were used to establish whether the model was consistent or not. These tests involved test for normality, serial autocorrelation, multi-co-linearity, and heteroskedasticity tests.

3.8.1. Heteroscadasticity Test

One of the basic assumptions of the classical linear regression model is the variance of each disturbance term u_i, is some constant number equal to δ^2. This assumption is known as homoscedasticity. If this condition is not fulfilled or if the variance of the error terms varies as sample size changes or as the value of explanatory variables changes, then this leads to heteroscedasticity problem. The study employs the White's heteroscedasticity test.

Symbolically it is written as

$E(u_i^2) = \delta^2$ (i=1, 2…n).

$V(u_i) \neq \delta^2$, then the problem of heteroscadasticity arises

3.8.2. Residual Vector Normality Test

The disturbance term U_i is assumed to have a normal distribution with zero mean and a constant variance. The test of residual normality is very important after estimation in empirical studies. Jarque-Bera(JB) test will be an important residual normality test in this study. It is a joint asymptotic test and the test statistics is calculated from the skewness and kurtosis of the residuals.

$JB= N/6[S^2 + (\beta_3-3)^2/4]$

Where N is the number of observation; S is the coefficient of skewness, β_3 is a measure of kurtosis; and the test statistic is $\chi2$ distributed. The joint test is based on the null hypothesis that the residuals are normally distributed (i.e., S=0 and β_3=3). Non rejection of the null hypothesis at the standard critical values indicates normality of the residuals.

3.8.3. Autocorrelation Tests

Serial correlation arises when the error terms from different time periods are correlated. In time series studies it occurs when the error associated with observations in a given time period carry over into future time periods. Serial correlation also called autocorrelation. Breusch-Godfrey Langrange Multiplier (LM) test is used in this study to test the presence of serial correlation in the residuals. The test statistic for the chosen lag order (L) is computed by performing an auxiliary regression of residuals (ε_t) on the original variables and the lagged residuals (εt-L).

LM= (T-F) $R^2\varepsilon$^

Where F is degree of freedom $R^2\varepsilon$^ the coefficient of determination obtained from the auxiliary regression, and the LM test is statistic is $\chi 2$ distributed. The LM tests the null hypothesis of no serial correlation against an alternative of auto correlated residuals.

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

This chapter uses annual data for the period between 1980 and 2018 to present and analyze the connection between gross national saving and economic growth based on the econometric framework provided in the previous chapter. In this analysis STATA 13 software was used to evaluate the variables. The chapter contains both the descriptive and econometric analysis. Under the descriptive statistics the trend and overall performances of the variables of interest are presented. The statistical tools such as tables and graphs are used to describe the variables used in the model.

The econometric analysis begins with testing the tests needed, such as stationary tests, diagnostic tests. After passing the required co-integration tests and Granger Causality tests, the long-term and short-run models are calculated using VAR model and Error Correction, respectively. After estimation has been made the interpretation and discussion are continued based on the model results.

4.1. Descriptive Analysis

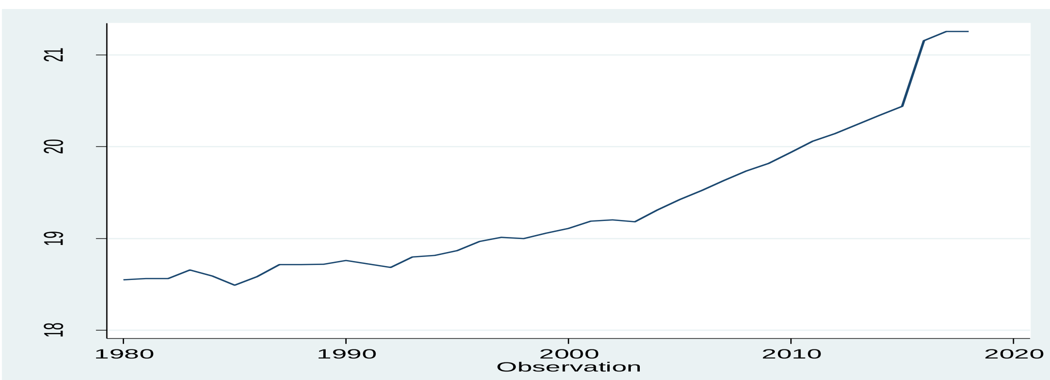

Figure 4.1: Trends of real GDP and its growth in Ethiopia (1980-2018)
Source: Own computation based on NBE data

Figure 4.1 above shows some variations in overall real output from beginning to 2002, whereas from 2002 onwards the graph suggests higher growth rates. This rate of growth is due to a combination of pro-poor growth policies (since 2003) and state lead development program since

2005 on wards and the present government implementing a development program aimed at poverty reduction through rapid economic growth and macroeconomic stability (Zerayehu, 2013).

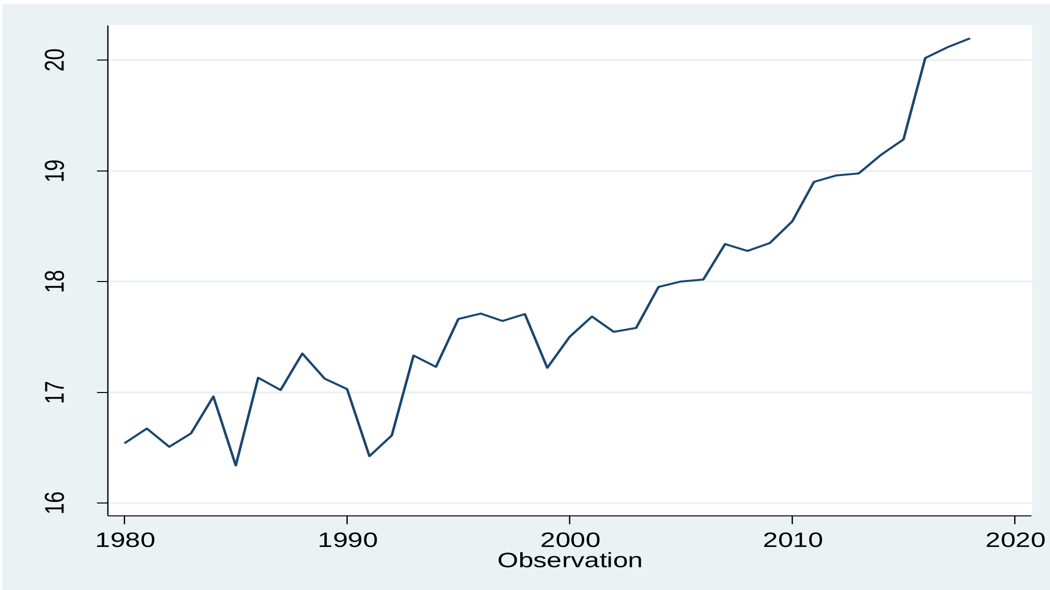

Figure 4.2: Trends of gross national saving in Ethiopia (1980-2018)

Source: Own computation based on the NBE data

As we can see from the above-mentioned graphic representation of gross national saving patterns in Ethiopia fluctuated over the years from the beginning to 2009, while from 2010 onwards the graph shows a sharp rise suggesting a higher saving rate. This growth rate is due to accumulation of domestic savings and tax base rises.

4.2. The Unit Root Test Analysis

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. In order to obtain a consistent and reliable result, we must transform the non-stationary data into stationary data by differencing. There are two main methods to test whether time series are stationary or not, namely graphical method which is informal and then the formal test. This study first presents the visual plot of graphs before the formal test and reported in appendix B of the thesis. The formal tests conducted are ADF and Phillips-Peron tests. The informal method, however, is not enough to conclude that the data is stationary as it is informal, hence the need for a more formal method to complement it. Consequently, other formal tests were conducted to support findings from the graphical findings. In this regard, Augmented Dickey-Fuller tests with the ADF methods are performed with different trend assumptions (only intercept both trend and intercept). After checking its stationarity, we can go for the other tests; because as stated earlier, without checking whether a variable has unit root or not, it probably will lead to spurious regression.

Table 4.1: Augmented Dickey-Fuller (ADF) Stationarity Test Result

Augmented Dickey-Fuller test statistics (ADF Test)						
Variables	With Intercept			Trend and Intercept		
	At level	At First Difference	Order of Integration	At Level	At First Difference	Order of Integration
LnRGDP	2.583	-5.608	I(1) at 1%	-0.231	-6.669	I(1) at 1%
LnGNS	0.188	-6.630	I(1) at 1%	-2.224	-7.977	I(1) at 1%
LnALR	-2.066	-7.104	I(1) at 1%	-2.196	-6.988	I(1) at 1%
LnREER	-1.700	-6039	I(1) at 1%	-1.633	-6.213	I(1) at 1%
MacKinnon (1996) with constant Test critical values 1% -3.621 Test critical values 5% -2.943 Test critical values 10% -2.610				With constant and trend Test critical values 1% -4.227 5% -3.537 10% -3.200		

Source: STATA 13 result

According to the result from the above Table 4.1, all the variables are not stationary in their levels at 5% level of significance. Hence, we take the first difference of the variables and they become stationary. We can also determine the order of integration of the variables in the process. The ADF result reveals that Gross domestic product, Gross national saving, Average lending rate and Real effective exchange rate are stationary at integrated of order 0ne I [1] at first difference.

Diagnostic Tests

Last but in no sense least, diagnostic tests were used to establish whether the model was consistent or not. These tests involved test for normality, serial autocorrelation, multi-co-linearity, and heteroskedasticity tests.

Multi-co-linearity test is one of the pre-estimation diagnostic tests in empirical analysis. If two explanatory variables are perfectly correlated, it would be difficult to identify the independent impact of each explanatory variable on the dependent variable. In this case a formal test of multi-co-linearity has to be conducted to determine which variable to retain and which one to exclude from the final analysis.

The formal test of multi-co-linearity is conducted with the help of variance inflation factor [VIF].If VIF is greater than 10 and 1/VIF (tolerance) is less than 0.1 it indicates the existence of multi-co-linearity among predictor variables. The estimated variance inflation factor (VIF) for this study is reported in appendix part of the thesis. The result shows that the variance inflation factor is less than 10 and tolerance (1/VIF) is greater than 0.10 for all independent variable, which confirms the absence of multi-co-linearity among the independent variables.

The study conducted different post-estimation diagnostic tests to guarantee that the residuals from the model are Gaussian that the assumptions are not violated and the estimation results and inferences are trustworthy. The serial correlation test can be done using the Lagrange multiplier (LM) test. It helps to identify the relationship that may exist between the current value of the regression residuals and lagged values. The study used the LM test to investigate serial correlation.

The Jarque-Bera normality test is used to see whether the regression errors are normally distributed. Econometric theory states that the existence of non-normality does not affect and distort the estimator‘s BLUE and consistency property (Enders 1995).

The heteroscedasticity test helps to identify whether the variance of the errors in the model are constant or not. Residual vector serial correlation LM tests, residual vector normality (Jarque-Bera) tests and residual vector heteroscadasticity tests are performed as follows.

Table 4.2: Diagnostic test results of the variables

Test	Statistics	P-value			
Serial Correlation (LM test)	Lags	LRGDP	LGNS	LALR	LREER
	1	0.92163	0.92163	0.92163	0.92163
	2	0.14184	0.14184	0.14184	0.14184
Normality Test (Jarque-Bera)		0.00000	0.50245	0.00000	0.60382
Heteroscedasticity test (White'sTest)		0.0525	0.0633	0.6522	0.3666

Residual Vector Serial Correlation LM Tests

The Breusch- Godfrey Lagrange Multiplier (LM) serial correlation test is used to check whether the error terms are serially independent. The above tables 4.2 show that there is no symptom of the presence of serial correlation because the p- value is more than five percent. This indicates that the null hypothesis of no serial correlation at lag 1 to lag 2 cannot be rejected.

Residual Vector Normality (Jarque-Bera) Test

The normality test for the residual series is undertaken using the Jarque-Bera (J.B.) statistic. The J.B. test result reveals the presence of normality for the models such as gross national savings and real effective exchange rate. But the normality test result for real gross domestic product and average lending rate indicates the rejections of the null hypothesis of residuals are normally distributed for the reason that the p-value associated with the Jaque-Berra normality test is less than the standard significance level of five percent. This problem may be raised as a result of lack of large sample property of the variables. This problem can be solved by increasing the sample size of variable. This is impossible due to reliable data constraints in concerned institutions of the country.

Residual Vector Heteroskedasticity Test

The last diagnostic test is for heteroscedasticity test. As we have seen from the above table4.2, we can reject at 5% significant level due to its p-value associated with the test statistics are greater than the standard significance level that is 0.05.

4.3. Econometric Analysis

4.3.1. Determination of Optimal Lag Length for Endogenous Variables

The Johansen co-integration test result is very sensitive to the number of lags included for the endogenous variables in the estimation of the VAR. This necessitates the determination of an optimal lag order prior to the test of co-integration. This indicates the importance of determining optimum lag order before the test of co-integration and vector error correction methods. The optimal lag order is determined with the sequential modified Likelihood Ratio test statistics [LR], the Final Prediction Error [FPE], the Akaiki Information Criterion [AIC], the Hannan Quinn Information Criterion [HQ] and the Schwarz Information Criterion [SC].As indicated below in table 4.3Outof five information criteria the maximum appropriate lag order of one was chosen in determining the conditional VAR model indicated by the "*" in the output.

Table 4.3: Optimal lag Order selection criteria

Lag	Log likelihood	LR	FPE	AIC	HQ	SC
0	-1619.43	NA	2.3e+35	92.7674	92.8288	92.9452
1	-1537.06	164.75	5.2e+33*	88.9746*	89.2815*	89.8634*
2	-1524.4	25.305	6.5e+33	89.1659	89.7182	90.7657
3	-1505.16	38.485*	6.0+33	88.9806	89.7783	91.2914
4	-1501.2	7.9257	1.5e+34	89.6685	90.7116	92.6903

Note: * indicates lag order selected by the criterion

4.3.2. The Johansen Co-integration Test Result

We are concerned about the concept of co-integration because if the variables are not co-integration, we construct only the short run VAR model while we are also interested in knowing the long run relationship. Two variables will be co-integrated if they have long run relationships between them. In VAR models the test for co-integration is essential because if there is no co- integration relationship between the variables under consideration then there is no point in estimating VEC model. The guide line is when the trace statistics is more than 5% critical value there is long run relationships among variables.

Table 4.4: Johansen Tests for Co-Integration

Maximum Rank	Eigen Value	Trace Statistics	(5%) Critical Value
0		49.1193	47.21
1	0.49169	23.4062*	29.68
2	0.27863	10.9954	15.41
3	0.22086	1.5120	3.76
4	0.03901		

Note: * denotes rejection of null hypothesis at 5 percent level.

From the given table above, at least one Co- Integrating equation exists. The null hypothesis of no co-integration among the variable is rejected since the trace statistics of 49.1193 is greater than the 5% critical value of 47.21. From this, one can infer the existence of co-integrating relationship between GDP at current price, gross national saving, average lending rate and real effective exchange rate for the Ethiopian economy.

4.3.3. Granger Causality Test

The presence of causality between the variables is tested by Granger causality test. This is performed to understand the bidirectional causality between the variables. The guide line is that the probability is more than five percent we cannot reject the null hypothesis rather we accept the null hypothesis.

Table 4.5: Granger causality Wald test

Equation	Excluded	F	Prob>F
RGDP	GNS	36.711	0.0000
RGDP	ALR	9.8483	0.131
RGDP	REER	10.116	0.120
RGDP	ALL	79.392	0.000
GNS	RGDP	15.834	0.015
GNS	ALR	17.661	0.007
GNS	REER	10.741	0.097
GNS	ALL	65.72	0.000
ALR	RGDP	16.394	0.012
ALR	GNS	22.622	0.001
ALR	REER	11.809	0.066
ALR	ALL	55.888	0.000
REER	RGDP	43.795	0.000
REER	GNS	30.419	0.000
REER	ALR	40.441	0.000
REER	ALL	68.309	0.000

Notes: Average lending rate and real exchange rate added to the variables to increase fitness.

The above result indicates economic growth (RGDP) granger causes gross national saving rate, Average Lending rate and real effective exchange rate it. Gross national saving rate (GNS) granger-causes economic growth rate (RGDP), average lending rate and real effective exchange rate it. Average Lending rate granger causes Gross national saving (GNS) and real effective exchange rate, it does not granger causes economic growth rate (RGDP). Real effective exchange rate (REER) does not granger causes economic growth rate (RGDP), gross national saving rate (GNS) and average lending rate. The above result reveals that bidirectional causality between gross national saving rates (GNS) and economic growth rate (RGDP).

4.3.4. Vector Error Correction Model (VECM)

In the previous analysis, it was found that the data has one co-integrating relationship based on the Johansen co-integration test. Hence, VECM is performed by choosing the optimal lag that is chosen based on the information criterion seen in the previous section and by using the result of the Johansen co-integration test. The VECM consists of two parts: the matrix of long-run co-integrating coefficients that is used to derive the long-run co-integrating relationship, and the short-run coefficients which is for the short-run analysis.

Long-run Relationship

The target of this study is to investigate the impact of gross national savings rate on economic growth rate and the impact of economic growth rate on gross national savings rate. Johansen co-integration test indicates the presence of these one co-integrating equations.

Table 4.6: The Estimated Long- Run Model for LRGDP (Real Gross Domestic Product)

Variables	LGNS	LALR	LREER	C
Coefficients	0.7706006	-0.1668982	0.155565	5.224466
t-statistics	26.43	-1.05	1.37	5.96

R-squared== 0.9613, Adj-R-squared=0.9580

LRGDP t =5.22+ 0.77LGNSt - 0.167LALRt +0.156LREERt+ε t

The adjusted R^2 has approximately a value of 0.9580 which implies that the variations in real gross domestic product are well explained by changes in gross national saving (GNS), real effective exchange rate (REER) and average lending rate (ALR). From the estimation result shown in the above table, LRGDP can be explained by gross national saving, average lending rate and real effective exchange rate. The result shows that gross national saving rate exert significant positive effect on economic growth rate in the long run. The effect of average lending rate on economic growth rate is negative and insignificant, and also the long run effect of real effective exchange rate on economic growth rate is positive and insignificant.

The result showed that 1percent increase in growth of gross national saving increases economic growth rate by 77% assuming other variables are constant. This finding is in line with the theoretical prediction of Classical Growth Theory which states that if savings go up, investment increases, and then economic growth follows. This is expected and is consistent with the previous empirical results such as Sheggu (2004) finds a positive and significant correlation between gross national saving and economic growth in the long run. Similarly, this result strongly supports the study of Mashi and Peters, (2010) that savings have a positive effect on economic growth.

Table 4.7: The Estimated Long- Run Model for LGNS (Gross National Saving)

Variables	LRGDP	LALR	LREER	C
Coefficients	.3424749	0.3216615	-0.1758468	-5.959569
t-statistics	26.43	1.64	-1.22	-4.92

R-squared=0.9645, Adj-R-squared=0.9614

LGNS t =-5.96+0.342LRGDPt +0.321LALRt -0.175LREERt+ε t

The long run regression result in the above table indicated that economic growth are found statistically significant determinants of gross national saving in the long run. The result shows that 1 percent increase in economic growth rate increases gross national saving rate by 34 percent in the long run. This result is in line with the theoretical prediction of Keynesian theory which states that increase in economic growth increases saving. This means the country should encourage economic growth rate to save more.

The impact of average lending rate on gross national saving rate is positive and insignificant in the long run. The impact of real exchange rate is negative and insignificant effect on national saving rate.

Table 4.8: The Estimated Long- Run Model for ALR (Average Lending Rate)

Variables	LRGDP	LGNS	LREER	C
Coefficient	-0.1838318	0.2209336	-0.4020757	3.976806
t-statistics	-1.05	1.64	-3.96	3.55

R-squared=0.5528, Adj-R-squared= 0.5144

LALRt =3.976 - 0.183LRGDPt +0.221LGNSt - 0.402LREERt+ε t

The outcome indicates that economic growth rate exert negative and insignificant and also real effective exchange rate exert negative but significant effect on average lending rate in the long run whereas the long run effect of gross national saving on average lending rate is positive and insignificant. A 1 percent increase in real gross domestic product decreases average lending rate by 18 percent in the long run. Likewise, a 1 percent increase real effective exchange rate reduces average lending rate by 40 percent points. A one percent increase in gross national saving increased the average lending rate by 22 percent.

Table 4.9: The Estimated Long- Run Model for REER (Real Exchange Rate)

Variables	LRGDP	LGNS	LALR	C
Coefficient	0.3274886	-0.2308406	-0.768463	4.581485
t-statistics	1.37	-1.22	-3.96	2.81

R-squared=0.4584, Adj-R-squared== 0.4120

LREER t =4.58+0.327LRGDPt - 0.231LGNSt - 0.768LALRt+ε t

The above equation shows that, in the long run, LREER can be explained by real gross domestic product, gross national saving rate, and average lending rate. The positive sign of the coefficient of LRGDP implies that the existence of a positive long-run relationship between real effective exchange rate and real GDP. The estimated coefficient of LRGDP suggests that, an increase in growth of LRGDP by one percentage point is estimated to boost the growth rate of real exchange rate at 33 percentage point.

According to the estimation result given of the above table, the variations in the real effective exchange rate (REER) are explained by changes in gross national saving rate. The effect of gross national saving rate on real effective exchange rate is negative and insignificant in the long run. An increase in one percentage point in gross national saving decreases the rate of real effective exchange rate by 23 percentage point. Likewise, the impact of average lending rate on real effective exchange rate is negative and significant.

Short Run Error Correction Model

After determining the long run relationship among the variables in the long run model and their long run coefficients, the next step is to determine the coefficients of the short run dynamics. The error correction term (ECM) indicates the speed of adjustment to restore equilibrium in the dynamic model. It is a one lagged period residual obtained from the estimated dynamic long run model.

Table 4.10: Results of short run model when dependent variable is D (LRGDP)

Dependent Variable is D(LRGDP)		
Error Correction	Coefficient	T-Ratio
Co-integration	-1.4321	-3.9842
ECM(-1)	0.063212	2.13241
DGNS(-1)	0.7556	2.24568
DALR(-1)	0.42145	1.62135
DREER(-1)	0.33654	1.47586
Constant	-3.99421	-198453
R-squared =8.89248	R-bar- squared =0.81423	
F-stat. F(10,23)12.9290	DW-statistic =2.1456	

Source: Authors own calculation using STATA 13

The co-integration coefficient, estimated at -1.4321is negative and highly significant. These shows that the existence of long run causality from independent variables to dependent variable. According to Bannerjeeet al. (2003) as cited in Kidanemarim (2014), the highly significant error correction term further confirms the existence of a stable long-run relationship. The coefficients below the co-integration coefficients are short run coefficients. The coefficient of the error term (ECM-1) implies that the deviation from long run equilibrium level of real GDP in the current period is corrected by 6.3% in the next period to bring back equilibrium. The result shows that gross national saving, average lending rate and real effective exchange rate have positive impact on Ethiopian economic growth in the short run.

The impact of gross national saving rate on economic growth is positive and significant. This result is consistent with Lean and Song (2009). As a result a one percent increases in gross national saving will result in 75 percent increase in real GDP in the short run.

Table 4.11: Results of short run model when dependent variable is D (LGNS)

Dependent Variable is D(LGNS)		
Error Correction	Coefficient	T-Ratio
Co-integration	-1. 4367	-2.37231
ECM (-1)	0.65542	-2.45296
DRGDP(-1)	0.58452	1.994523
DALR(-1))	0.22145	1.42135
DREER(-1)	0.113654	1.27586
Constant	-3.9375	-2.16572
R-squared =0.854251		R-bar- squared =0.781254
F-stat.F(10,23) 129290		DW-statistic=2.04125

Source: Authors own calculation using STATA 13

As can be seen from the above table, the impact of economic growth rate on gross national saving rate is positive and significant in the short run. The result is consistent to Shimelis (2014). According to the estimation result; an increase in one percentage point in economic growth rate raises increase the rate of gross national saving rate by 58.5percent. The empirical finding is consistent with Feyera (2015).

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary and Conclusions

The main purpose of this analysis was to investigate the causal relationship between Ethiopia's gross national savings and economic growth over the period 1980-2018. The research employed a method of co-integrated VAR approach or vector error correction to define the short- and long-term relationship between variables.

The required tests such as unit root test were implemented using ADF test before implementing the model. As a result, real GDP (no unit root problem) is stationary at the point, while gross national savings, average lending rates and real effective exchange rates are stationary at first difference. The result of co-integration test indicates the existence of long run relationships between the variables included in the model. Following stationarity test, model stability test was carried out in the study and the result shows the absence of multi-co-linearity, serial correlation, hetroscedasticity problem and abnormal distribution of the residuals.

The findings of this study show that gross national savings rate and real effective exchange rate have a positive and significant effect on economic growth while long-term negative and significant effect on economic growth is the average lending rate.

Economic growth rate and average lending rate have long-term positive effects on gross national savings. While the effect of the economic growth rate on the gross national saving rate is positive and significant, the effect of the average lending rate on the gross national saving rate is long-term positive and insignificant. Moreover, real effective exchange rate has negative and insignificant effect on gross national saving rate in the long run.

The other objectives of this paper is to test the short run relationship between the variables using Vector Error Correction model on time series data of Ethiopia from 1980-2018. The result shows that average lending rate and real effective exchange rate exert positive and insignificant effect on Economic growth rate of the country while Gross national saving rate exert positive and significant effect on economic growth rate in the short run time period in the country.

The effect of economic growth on gross national saving rate is positive and significance while average lending rate and real effective exchange rate exert positive and insignificant. The granger causality test shows that economic growth granger causes gross national saving rate and Gross national saving rate Granger cause economic growth.

5.2. Recommendations

On the basis of the study findings the following recommendations can be made:

- The that emerges from this brief study is that the Ethiopian policymakers should be aware of causality running from gross national savings to real economic growth and from economic growth to gross national savings. Policy makers should put in place measures to boost domestic savings so that savings should be appropriately mobilized and directed towards productive investments and hence growth 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 national savings as well as to a more rapid economic growth.
- Ethiopia has been challenged by a persistent and wide savings gap financed from external sources. And the risk associated with outside funding sources offers the motivation to rely on national savings to finance the investment. The positive short- and long-term effect of the gross national saving rate on the economic growth rate indicates that government should intervene to raise the national saving rate in order to promote long-term economic growth. So the government of Ethiopia can do this by domestic saving mobilization, increase tax base and encouraging private businesses.

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APPENDICES

APPENDIX: A. ADF Unit Root Test Result

Dependent Variable (LRGDP)

Intercept only at level

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller lnrgdp, regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             2.583            -3.662            -2.964            -2.614
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9991

------------------------------------------------------------------------------
    D.lnrgdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnrgdp |
         L1. |   .0666782   .0258182     2.58   0.014     .0143165    .1190398
             |
       _cons |  -1.214211   .4980465    -2.44   0.020    -2.224297   -.2041262
------------------------------------------------------------------------------
```

Intercept only at first difference

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller diff_RGDP, regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        36

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -5.608            -3.675            -2.969            -2.617
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
 D.diff_RGDP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   diff_RGDP |
         L1. |  -.9714587   .1732238    -5.61   0.000    -1.323492   -.6194255
             |
       _cons |   4.28e+07   2.33e+07     1.84   0.074     -4409228    9.01e+07
------------------------------------------------------------------------------
```

Trend and intercept at level

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller lnrgdp, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -0.231            -4.260            -3.548            -3.209
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9910

------------------------------------------------------------------------------
D.lnrgdp     |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnrgdp |
         L1. |  -.0153948   .0666721    -0.23   0.819    -.1507463    .1199568
      _trend |   .0058323   .0043763     1.33   0.191    -.0030521    .0147167
       _cons |   .2541881   1.207002     0.21   0.834    -2.196156    2.704532
------------------------------------------------------------------------------
```

Trend and intercept at first difference

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller diff_RGDP, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        36

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -6.669            -4.279            -3.556            -3.214
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D.diff_RGDP  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   diff_RGDP |
         L1. |  -1.146293   .1718781    -6.67   0.000    -1.495982   -.7966046
      _trend |    5528278    2050677     2.70   0.011      1356144     9700413
       _cons |  -6.23e+07   4.45e+07    -1.40   0.171    -1.53e+08    2.82e+07
------------------------------------------------------------------------------
```

Dependent Variable (LGNS)

Intercept only at level

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller lngns, regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             0.188            -3.662            -2.964            -2.614
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9716

------------------------------------------------------------------------------
     D.lngns |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lngns |
         L1. |   .0099649   .0530003     0.19   0.852    -.0975248    .1174545
             |
       _cons |  -.0805248    .941494    -0.09   0.932    -1.989963    1.828913
------------------------------------------------------------------------------
```

Intercept only at first difference

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller diff_GNS, regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        36

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -6.630            -3.675            -2.969            -2.617
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
  D.diff_GNS |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diff_GNS |
         L1. |  -1.173352   .1769691    -6.63   0.000    -1.532997   -.8137074
             |
       _cons |   1.66e+07    8175256     2.03   0.051    -43141.73    3.32e+07
------------------------------------------------------------------------------
```

Trend and intercept at level

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller lngns, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.224            -4.260            -3.548            -3.209
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.4766

------------------------------------------------------------------------------
D.lngns      |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lngns |
         L1. |  -.2948768   .1326138    -2.22   0.033    -.5640971   -.0256565
      _trend |   .0288098   .0116242     2.48   0.018     .0052114    .0524083
       _cons |   4.764934   2.144259     2.22   0.033     .4118574     9.11801
------------------------------------------------------------------------------
```

Trend and intercept at first difference

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller diff_GNS, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        36

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -7.977            -4.279            -3.556            -3.214
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D.diff_GNS   |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diff_GNS |
         L1. |  -1.334591   .1672988    -7.98   0.000    -1.674963   -.9942195
      _trend |    2112087   693431.5     3.05   0.005     701289.8     3522884
       _cons |  -2.43e+07   1.53e+07    -1.59   0.122    -5.54e+07     6819520
------------------------------------------------------------------------------
```

Dependent Variable (LALR)

Intercept only at level

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller lnalr, regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.066            -3.662            -2.964            -2.614
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.2582

------------------------------------------------------------------------------
     D.lnalr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnalr |
         L1. |  -.2060587   .0997169    -2.07   0.046    -.4082939   -.0038236
             |
       _cons |   .4867557   .2354269     2.07   0.046     .0092879    .9642235
------------------------------------------------------------------------------
```

Intercept only at first difference

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller diff_ALR, regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        36

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -7.104            -3.675            -2.969            -2.617
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
  D.diff_ALR |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diff_ALR |
         L1. |  -1.230262   .1731788    -7.10   0.000    -1.582204   -.8783203
             |
       _cons |   .1538558   .3331606     0.46   0.647    -.5232081    .8309196
------------------------------------------------------------------------------
```

Trend and intercept at level

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller lnalr, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.196            -4.260            -3.548            -3.209
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.4921

------------------------------------------------------------------------------
D.lnalr      |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnalr |
         L1. |  -.2681898    .122125    -2.20   0.035    -.5161166   -.0202629
      _trend |   .0023936      .0027     0.89   0.381    -.0030876    .0078749
       _cons |   .5859927   .2613184     2.24   0.031      .055488    1.116497
------------------------------------------------------------------------------
```

Trend and intercept at first difference

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller diff_ALR, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        36

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -6.988            -4.279            -3.556            -3.214
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D.diff_ALR   |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diff_ALR |
         L1. |  -1.229087   .1758775    -6.99   0.000    -1.586913    -.871262
      _trend |  -.0049121    .031337    -0.16   0.876    -.0686677    .0588434
       _cons |    .253238   .7184987     0.35   0.727    -1.208559    1.715035
------------------------------------------------------------------------------
```

Dependent Variable (LREER)

Intercept only at level

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller lnreer, regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -1.700            -3.662            -2.964            -2.614
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.4313

------------------------------------------------------------------------------
    D.lnreer |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnreer |
         L1. |  -.1449187   .0852639    -1.70   0.098     -.317842    .0280046
       _cons |   .7216378   .4267876     1.69   0.100    -.1439275    1.587203
------------------------------------------------------------------------------
```

Intercept only at first difference

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller diff_REER, regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        36

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -6.039            -3.675            -2.969            -2.617
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
 D.diff_REER |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   diff_REER |
         L1. |  -.9289643   .1538282    -6.04   0.000    -1.241581   -.6163478
       _cons |  -2.502021   5.448117    -0.46   0.649    -13.57393    8.569885
------------------------------------------------------------------------------
```

Trend and intercept at level

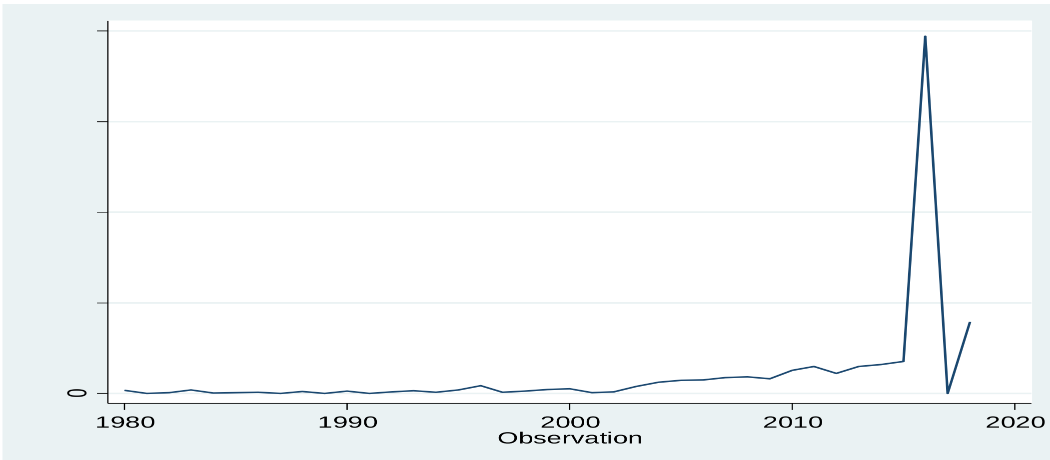
```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller lnreer, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -1.633            -4.260            -3.548            -3.209
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.7793

------------------------------------------------------------------------------
D.lnreer     |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnreer |
         L1. |  -.1564766   .0958249    -1.63   0.111    -.3510116    .0380584
      _trend |  -.0007413    .002661    -0.28   0.782    -.0061434    .0046608
       _cons |   .7938388   .5040928     1.57   0.124     -.229524    1.817202
------------------------------------------------------------------------------
```

Trend and intercept at first difference

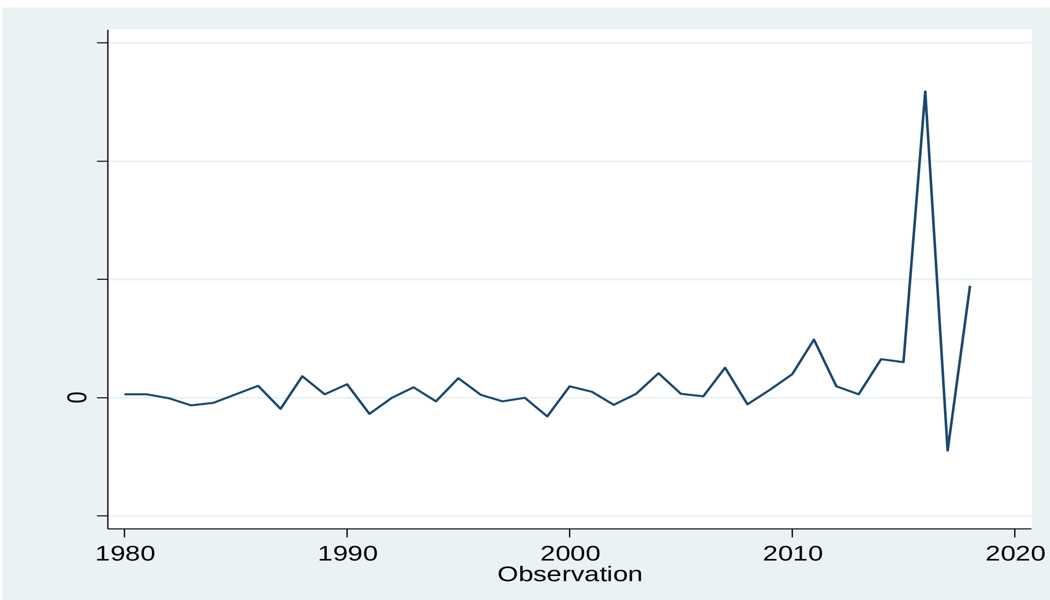
```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. dfuller diff_REER, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        36

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -6.213            -4.279            -3.556            -3.214
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D.diff_REER  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   diff_REER |
         L1. |  -.9568502   .1540168    -6.21   0.000      -1.2702   -.6435006
      _trend |   .6457648   .5076578     1.27   0.212    -.3870726    1.678602
       _cons |  -15.61335   11.63579    -1.34   0.189    -39.28655    8.059849
------------------------------------------------------------------------------
```

B. The graph for time series variables when differenced

LRGDP



LGNS



APPENDIX C. Johansen tests for co-integrations

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. vecrank lnrgdp lngns lnalr lnreer, trend(constant) lags(1)
```

Johansen tests for cointegration

Trend: constant — Number of obs = 38

Sample: 1981 - 2018 — Lags = 1

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	4	61.104005	.	49.1193	47.21
1	11	73.960565	0.49169	23.4062*	29.68
2	16	80.165957	0.27863	10.9954	15.41
3	19	84.907626	0.22086	1.5120	3.76
4	20	85.663641	0.03901		

APPENDIX D. Lag Order Selection Criteria

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2018
                delta:  1 year

. varsoc RGDP GNS ALR REER
```

Selection-order criteria

Sample: 1984 - 2018 — Number of obs = 35

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-1619.43				2.3e+35	92.7674	92.8288	92.9452
1	-1537.06	164.75	16	0.000	5.2e+33*	88.9746*	89.2815*	89.8634*
2	-1524.4	25.305	16	0.065	6.5e+33	89.1659	89.7182	90.7657
3	-1505.16	38.485*	16	0.001	6.0e+33	88.9806	89.7783	91.2914
4	-1501.2	7.9257	16	0.951	1.5e+34	89.6685	90.7116	92.6903

Endogenous: RGDP GNS ALR REER

Exogenous: _cons

APPENDIX E. Granger causality wald tests

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
RGDP	GNS	36.711	6	0.000
RGDP	ALR	9.8483	6	0.131
RGDP	REER	10.116	6	0.120
RGDP	ALL	79.392	18	0.000
GNS	RGDP	15.834	6	0.015
GNS	ALR	17.661	6	0.007
GNS	REER	10.741	6	0.097
GNS	ALL	65.72	18	0.000
ALR	RGDP	16.394	6	0.012
ALR	GNS	22.622	6	0.001
ALR	REER	11.809	6	0.066
ALR	ALL	55.888	18	0.000
REER	RGDP	43.795	6	0.000
REER	GNS	30.419	6	0.000
REER	ALR	40.441	6	0.000
REER	ALL	68.309	18	0.000

APPENDIX F. Vector Error Correction Estimates

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnrgdp						
_ce1						
L1.	-.0783711	.1455948	-0.54	0.590	-.3637316	.2069894
lnrgdp						
LD.	.1389671	.2050771	0.68	0.498	-.2629765	.5409108
lngns						
LD.	-.0112371	.1047253	-0.11	0.915	-.2164948	.1940207
lnalr						
LD.	-.0314476	.1860355	-0.17	0.866	-.3960706	.3331753
lnreer						
LD.	-.0879936	.1477156	-0.60	0.551	-.3775107	.2015236
_cons	.0689808	.028235	2.44	0.015	.0136413	.1243203
D_lngns						
_ce1						
L1.	.8458369	.3156349	2.68	0.007	.2272039	1.46447
lnrgdp						
LD.	.4756039	.4445865	1.07	0.285	-.3957697	1.346977
lngns						
LD.	-.122779	.2270339	-0.54	0.589	-.5677572	.3221992
lnalr						
LD.	-.3978744	.4033064	-0.99	0.324	-1.18834	.3925917
lnreer						
LD.	-.4089319	.3202326	-1.28	0.202	-1.036576	.2187124
_cons	.0207843	.0612106	0.34	0.734	-.0991862	.1407548

APPENDIX G. The Regressed Variables

```
reg lnrgdp lngns lnalr lnreer

      Source |       SS       df       MS              Number of obs =      39
-------------+------------------------------           F(  3,    35) =  290.00
       Model |  22.585863      3   7.528621            Prob > F      =  0.0000
    Residual | .908612894     35 .025960368            R-squared     =  0.9613
-------------+------------------------------           Adj R-squared =  0.9580
       Total | 23.4944759     38 .618275681            Root MSE      =  .16112

------------------------------------------------------------------------------
      lnrgdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lngns |   .7706006   .0291581    26.43   0.000     .7114066    .8297946
       lnalr |  -.1668982   .1585677    -1.05   0.300    -.4888078    .1550114
      lnreer |    .155565   .1134931     1.37   0.179    -.0748382    .3859682
       _cons |   5.224466   .8767439     5.96   0.000     3.444581    7.004351
------------------------------------------------------------------------------
```

```
reg lngns lnrgdp lnalr lnreer

      Source |       SS       df       MS              Number of obs =      39
-------------+------------------------------           F(  3,    35) =  316.59
       Model | 39.5394277      3 13.1798092            Prob > F      =  0.0000
    Residual | 1.45708641     35  .04163104            R-squared     =  0.9645
-------------+------------------------------           Adj R-squared =  0.9614
       Total | 40.9965141     38 1.07885563            Root MSE      =  .20404

------------------------------------------------------------------------------
       lngns |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnrgdp |   1.235765    .046759    26.43   0.000     1.140839     1.33069
       lnalr |   .3216615   .1965745     1.64   0.111    -.0774059    .7207289
      lnreer |  -.1758468   .1445036    -1.22   0.232    -.4692047    .1175111
       _cons |  -5.959569   1.211833    -4.92   0.000    -8.419721   -3.499418
------------------------------------------------------------------------------
```

APPENDIX H: Diagnostic Test

Multicollinearity Test

```
. vif
```

Variable	VIF	1/VIF
lnalr	2.17	0.461394
lnreer	1.75	0.570680
lngns	1.34	0.744812
Mean VIF	1.75	

Breush-Godfrey Serial correlation LM Test

```
. varlmar
```

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	8.7947	16	0.92163
2	22.0422	16	0.14184

H0: no autocorrelation at lag order

Jarque-Bera Normality Test

```
varnorm, jbera
```

Jarque-Bera test

Equation	chi2	df	Prob > chi2
RGDP	844.108	2	0.00000
GNS	0.634	2	0.72819
ALR	55.343	2	0.00000
REER	2.039	2	0.36071
ALL	902.125	8	0.00000

```
varnorm, jbera
```

Jarque-Bera test

Equation	chi2	df	Prob > chi2
GNS	754.040	2	0.00000
RGDP	0.754	2	0.68608
ALR	55.343	2	0.00000
REER	2.039	2	0.36071
ALL	812.176	8	0.00000

APPENDIX I. The Time Series Data Used for the Study

OBS	RGDP	GNS	ALR	REER
1980	113795000	15237000	8.8	177.3
1981	115224000	17413000	8.8	162.6
1982	115111000	14738000	8.8	179.2
1983	126707000	16647000	8.8	194.3
1984	118729000	23275000	8.8	196.4
1985	107221000	12461000	8.8	239.3
1986	117837000	27554000	8.8	246.6
1987	134380000	24681000	6.8	204.8
1988	134309000	34258000	6.8	186.8
1989	134767000	27308000	6.8	188
1990	140248000	24858000	6.8	201
1991	135165000	13565000	6.8	231.4
1992	130177000	16350000	6.8	284.8
1993	145799000	33679000	14.9	170.5
1994	148276000	30407000	14	123.4
1995	156247000	46878000	14.58	112.5
1996	172839000	49085000	15.08	104.5
1997	180911000	46035000	15.5	102.7
1998	178301000	49049000	11.6	119.5
1999	188990000	30167000	11.75	113
2000	198963000	39856000	12	99.5
2001	215629000	47960000	12.75	99.98
2002	218873000	41706000	10.75	93.3
2003	214132000	43220000	10.75	98.9
2004	243526000	62543000	10.75	99.2
2005	272142000	65640000	10.5	94.1
2006	301468000	66922000	10.5	107.4
2007	335919000	92239000	10.5	121.3
2008	372014000	86462000	11.5	136
2009	404338000	93152000	12.25	185.5
2010	455539000	112982000	12.25	141.75
2011	515079000	161984000	11.88	121
2012	559622000	171434000	11.88	150
2013	618842000	174031000	11.88	161.5
2014	682358000	206587000	11.88	173.4
2015	753230000	236702000	11.88	135.9
2016	1541277000	495718000	12.75	159.7
2017	1699582300	545219200	12.75	169.7
2018	1699582300	590222000	9.8	161.8
Source	NBE	NBE	NBE	NBE