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THE NEXUS AMONG SAVING, INFLATION AND ECONOMIC GROWTH INETHIOPIA: TIME SERIES ANALYSIS

BY

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THE NEXUS AMONG SAVING, INFLATION AND ECONOMIC GROWTH IN ETHIOPIA: TIME SERIES ANALYSIS

A THESIS SUBMITTED TO THE DEPARTMENT OF ECONOMICS IN PARTIAL FULFILLMENT OF REQUIREMENTS FOR THE DEGREE OF MASTERS OF ARTS I N DEVELOPMENT ECONOMICS

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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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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 Melsew Belay under the title “The Nexus among Saving, Inflation and Economic growth inEthiopia”. 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
BOP	Balance of Payment
CPI	Consumer Price Index
CSA	Central Statistical Agency
ECM	Error Correction Model
EIC	Ethiopia Investment Commission
GNS	Gross National Saving
MoFEC	Ministry of Finance and Economic Cooperation
NBE	National Bank of Ethiopia
OLS	Ordinary Least Square
REER	Real Effective Exchange Rate
2SLS	Two-Stage Least Square
VAR	Vector Auto regression
VECM	Vector Error Correction Model

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ABSTRACT

At national level the achievement of sustainable rapid economic growth along with increasing amount of savings with optimal inflation is the central policy objective of most countries. The objectives of this study is to investigate the nexus amongsaving, inflation and economic growth in Ethiopia for the period 1980 to 2017.Time series econometrics model were used to analyze the data. To achieve this objective co-integrated VAR approach was employed. The estimated models enable to understand the long run and short run nexus of the variables. The long run test show that gross national saving rate and inflation rate exert positive and significant impact on economic growth; economic growth rate exert positive and significant impact on gross national saving rate; economic growth rate exert positive and significant impact on inflation rate while the impact of gross national saving rate is positive and insignificant.Economic growth rate exert positive and significant impact on gross national saving rate while inflation rate exert positive and insignificant impact on gross national saving rate. The short run test results reveals that the impact of gross national saving rate on economic growth rate is positive and significant where as inflation rate exert positive and insignificant impact on economic growth rate of the country; economic growth exert positive and insignificant impact on gross national saving rateWhere as inflation rate exert negative and insignificant impact on gross national saving rate. The granger causality test shows that economic growth granger causes gross national saving rate; it does not granger causes inflation rate. Gross national saving rate does not granger cause economic growth and Inflation rate. Inflation rate granger causes economic growth rate and national saving rate. From a policy point of view, the government of Ethiopia should target appropriate optimal level of inflation rate to encourage national saving and economic growth. Moreover to increase gross national saving rate, it should encourages private businesses, increase tax base and domestic saving mobilization.

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

1. INTRODUCTION

1.1Background of the study

One of the fundamental macroeconomic variables found in every nation's economy, though at different levels, is inflation. It is defined as the continuous and sustained rise in general price level of goods and services in an economy. It refers to a situation where the volume of money chasing the available goods and services in an economy is too much, consequently resulting in a persistent rise in general price level. From theoretical literatures, it is a generally accepted phenomenon that high Inflation in an economy has dire consequences and particularly on the stability of prices of goods and services unless there is a corresponding risesinincomeand saving level. Inflation has turned into one of the most essential topic for research for the duration of the last various decades because it plays a very important function for the determinant of economic growth and the income distribution. The basic objective of the macroeconomics policymakers is to get high and sustained economic growth with low inflation (Ahortor and Adenutsi, 2009).

Along with economic growth national saving rate is one of macroeconomic variables that relate with economic growth. National savings rate in macroeconomic theory is defined as the combination of public and private saving rates of a nation. It plays very important role in economic growth and development. Low national savings rate is one of the most series obstacles to achieving higher and more sustainable economic growth. 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. For that reason saving is one of the factors for economic growth, accumulated saving is the source for capital stock which leads to increase investment, output and more employment these would enhance economic growth (Solow and Swan, 1956).

However, as argued in many literatures the effect of inflation on the saving level is unclear in both theoretical and empirical level. Theoretically, Mundell (1963) and Tobin (1965) have successfully explained the effect of inflation on economic growth and saving based on neo-classical growth theory. They believe increased nominal interest caused by inflation will make people option to save and investment instead of consumption. This will result in increasing capital accumulation which will stimulate saving and economic growth. The empirical findingalso revealsthat higher macroeconomic uncertainty (inflation) causes adverse effect on

saving or dampens the incentive to save (Khalil A. et al., 2013). Hence, a country with macroeconomic uncertainty (inflation) has low rate of savings which exerts low capital accumulation and lower investment leading to lower economic growth. On the other hand, monetarists argue that future expectation about inflation reduces people's wealth on the premises rate of return on real money balance falls. Hence, people save money converting to assets until the price of the asset increases, reducing the real interest rate and accumulate desired wealth; thus, increasing capital accumulation causes higher investment inducing higher output growth.

There is a debate among the economist and policy makers about the relationship between inflation and economic growth. Some economists say that there is positive relationship between inflation and economic growth while others are in the favors of opposite relationship between inflation and economic growth (Dholakia, 1990). In this context, Mubarik (2005) found that low and stable inflation promotes economic growth and high economic growth can cause inflationary problem. Philip's curve also shows that there exist a positive relationship between inflation and economic growth. On the contrary, another study showing that high inflation rate increase the cost of production and risk of future profitability of investment projects which may force to divert funds to less productive investments evading against inflation; and along with managed exchange rates lead to trade imbalances and speculative capital outflows affecting the economy's growth (Edeme and Ifelunini, 2015).

As mentioned above, there is a huge disagreement on the relationship between saving- inflation and inflation-economic growth both on theoretical and empirical basis. The existing empirical divergence is mainly in the sign and significance of the linear relationship between the variables. This shows that saving, inflation 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 major problem facing Ethiopia in achieving accelerated growth and development is low level 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 with optimal inflation is the central policy objective of most countries. Therefore, understanding the existence and nature of relationship between inflation, saving and economic growth is also strategically important for the success of economic policy (Khan and Sehagji, 2001; Ahortor, 2009).

Although the relationship between saving, inflation and economic growth is an important one, the direction of causality between the variables has continued to generate series debate among scholars. There are a lot of conflicting ideas regarding the impact of inflation on saving and economic growth. The argument is that whether inflation is necessary for economic growth or it is detrimental to growth through saving and investment. Some of the literature report that inflation has no impact on national saving Mundell (1963) and Tobin (1965).Some studies show that there is negative effect of inflation on saving (Ahimad and Muhamood,2013).

To determine the impact of high inflation on economic growth of Pakistan both in the short-run and long-run, Faria and Carneiro (2001) employed VAR model and they found that inflation had negative impact on economic growth in the short run while no relationship was found between inflation and economic growth in the long run. Similarly, Fekadu (2012) examined the relationship between inflation and economic growth in Ethiopia using time series annual data from 1980-2011 by using VAR model and the result reveals that an increase in economic growth decreases inflation whereas inflation does not have significant effect on economic growth in the short run.

Most of the studies in Ethiopia focus on the relationship between saving-economic growth and inflation-economic growth. However, some researchers tried to investigate the relationship between saving, inflation and economic growth simultaneously in their analysis. In this regard Lambamo (2015) have paid considerable attention towards testing the linkages of saving, inflation and economic growth. He used Simultaneous equations model using time series data from 1981 to 2015 and found that significant and positive bi-directional relationship between economic growth and inflation. The study has also found statically significant inverse

relationship between inflation and domestic saving. In fact, the methodology used was not problem but, long run and short run relationships of saving, inflation and economic growth were not studied.

Another related work was done by 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. The long run test results show that per capita income growth rate and inflation rate exert positive and significant impact on gross national saving rate; inflation rate and gross national saving rate exerts positive and significant impact on per capita income growth rate; per capita income growth rate exerts positive and significant impact on inflation rate whereas gross national saving rate exerts negative and insignificant impact on inflation in the long run.

The short run test results show that the impact of per capita income growth rate on gross national saving rate is positive and insignificant whereas the impact of inflation rate on gross national saving rate is negative and insignificant; inflation rate and gross national saving rate exerts positive and significant impact on per capita income growth rate; gross national savings rate and per capita income growth rate influence inflation rate positively in the short run. Likewise, the Granger Causality test shows that Per Capita income growth rate (PCI) does not granger causes inflation rate and gross national saving rate but Inflation rate and gross national saving rate granger-causes Per capita income growth rate.

On the contrary, Fekadu (2012) analyzes the relationship between economic growth and inflation in Ethiopia for the period 1980 to 2011 by using VAR model. The granger causality test shows that economic growth rate granger-causes inflation rate while inflation rate does not granger causes economic growth rate. Likewise, 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. 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 evidence on the nexus between saving, inflation and economic growth by including additional macro variables such as average lending rate and real effective exchange rate for the fitness of the model.

1.3 Research questions

The study has attempted to answer the following research questions.

- What is short run and long run impact of inflationrate and gross national saving rate on economic growth rate of the country?
- What is short run and long run impact of inflation rate and economic growth rate on gross national saving rate of the country?
- What is the short run and long run impact of economic growth rate and gross nationalsaving rateon inflation rate of the country?

1.4 Objectives of the study

1.4.1 General objective

The general objective of the study is to examine the nexus among saving, inflation and economic growth.

1.4.2Specific objectives

The study seek to achieve the following specific objectives

- To identify the short run and long run impact of inflation rate and gross national saving rate on economic growth of the country,
- To analyze the short run and long run impact of inflation rate and economic growth rate on gross national saving rate of the country,
- To investigate the short run and long run impact of economic e growth rate and gross national saving rate on inflation rate of the country.

1.5 Significance of the Study

Over the years, the existence of the nexus between these three variables 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 saving, inflation and economic growth. They show that there might be a positive relationship, there might be negative

relationship or there might be no relationship between saving, inflation and economic growth. Studies on inflation further fail to reach a consensus on the direction of causality between saving and economic growth.

Since the long run and short run nexus of saving, Inflation and economic growth has been very debatable and this issue in Ethiopia has been studied only to some extent simultaneously within the framework of VAR model this, sheds a light to the existing knowledge. This study is also very vital to policy makers, macroeconomists and central bankers in understanding the causality between the three major macroeconomic variables and to come up with appropriate polices so as to sustain the existing economic growth of the country.

1.6 Scope and limitations of the Study

The aim of this study is focused only on investigating the nexus among inflation, gross national saving and economic growth in Ethiopia using annual data from 1980 to 2017.The first greater challenge of this study is the one associated with data availability. The second challenge while doing this study is the inconsistency of data from different organizations. So as to avoid such inconsistency attempts made to stick to the same source of data as much as possible even the data that are found in the same source is not consistent over time.

1.7 Organization of the study

This study 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 theorganization 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.

2. LITERATURE REVIEW

2.1 Theoretical and Empirical Literature Review

In the literature, while there are a number of studies investigating the relationship between saving-economic growth and inflation-economic growth, there are a few studies considering the triple relationship between these variables. This chapter presents the relevant theoretical and empirical literatures on the nexus between gross national saving, inflation and economic growth. The first section explores the theoretical framework of the study and the second section examines empirical literatures.

2.2 Theoretical Literatures Review

The following sub-sections present Mercantilists, Classical, neo-classical, Monetarist, Endogenous,Keynesian andNew-Keynesian growth theories which have relation with the variables.

2.2.1 The Mercantilists Theory of Inflation

The mercantilists view was popular from 1650 up to 1776, until Adam Smith's book "Wealth of Nations" was published. According to the mercantilist's theory of inflation, high economic growth will be achieved by encouraging export surplus and discouraging import. The precious metals were used as money in most places of the world during that period. Export surplus was considered as an accumulation of gold and coins. Theypropound that balance of payment (BOP) deficit was considered as a negative growth factor while export surplus is a source of growth.

William Petty was one of the first Mercantilist philosophers to identify the negative effects of the rise in inflow of gold bullions in a given country. According to petty, an increase in inflow of gold bullions results inflation which in turn reduces economic growth of a given country. He explains further that inflation reduces international competitiveness of a nation. The rise in inflation makes locally produced goods expensive in the international market and that reduces the demand for the product overseas. In such cases, exports decline followed by reduced economic growth (Abis, 2013)

2.2.2 Classical Growth Theory

The founder of this growth theory was Adam Smith who 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.

Real exchange rate is expected to influence the inflation rate locally. This is because a large amount of consumer and capital goods are imported from abroad. An increase of the exchange rate of local currency to foreign currency leads to an increase in local price level even if the price of the good does not change in the foreign country. Thus, any observed change in the real exchange rate has a direct impact on the local general price level (Salvatore, 2004).

2.2.3 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.

Mundell (1963) is the first to point up the expected inflation has a real economic effect by depicting IS-LM curves. The money rate of interest rises by less than the rate of inflation and hence the real rate of interest falls during inflation. According to Mundell's model, an increase in inflation or Inflation expectations immediately reduce people's wealth. This works onthe premise

that the rate of return on individual's real money balances falls. To accumulate the desired wealth, people save more by switching to assets,increasing their price, thus driving down the real interest rate. Greatersavings means greater capital accumulation and thus faster output growth.

Tobin (1965) is another neoclassical economist who developed additional Mundell'smodel.He assumes that money as astore of value and inflation has a positive effect on economic growth.Tobineffect propose that inflation causes individuals to change money into other assets and obtain more capital than holding money because money and capital ratio depends negatively on the inflation rate, that leads to greater capital strength and promotes economic growth. Tobin supports that higher inflation rate rises the level of output. But, the positive effect of inflation on economic growth is only temporary. Initially inflation motivates capital accumulation so as to contribute to higher growth. But this trend works only until the return on capital falls.

Contrary to Mundell (1963) and Tobin (1965) Stockman (1981), developed a model that shows a negative relationship between inflation and economic growth. Stockman's model shows that an increase in the inflation rate results in a lower steady state level of output because inflation decreases the purchasing power of money that force individuals to reduce holding cash and purchase of capital as inflation rate rises. Likewise the steady state level of output falls in response to an increase in inflation rate. From this review we can easily understand that there are inconsistent result between different theories about the relationship between inflation and economic growth. Tobin observes a positive relationship between the two economic variables. On the contrary, stockman obtains a negative relationship.

2.2.4The Monetarist Theory

Friedman (1963), who coined the term "Monetarism", mentioned several key long run properties of the economy. Friedman proposed that inflation was the product of an increase in the supply or velocity of money at a rate greater than the rate of growth in the economy. The theory of monetarism linked inflation and growth by equating the total amount of spending in the economy to the total amount of money in existence.

Monetarists argue that the effect of money supply in the short run and long run is different. The influence of money supply in the long run is on nominal variable and price level where as in the

short run the influence of money supply is on real variables like employment and Gross Domestic Product (GDP).Formonetarist there is a positive short-run relationship between inflation and economic growth. In general monetarist suggest that in the long run prices are mainly affected by the growth rate of money, while having no real effect on growth and if the money supply growth is higher than the economic growth, then inflation will occur.

2.2.5 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.

2.2.6Keynesian Theory

In 1936, John Maynard Keynes wrote the book "The general theory of employment, Interest and Money" which established the foundation of Keynesianism. Keynesians believes on the interventions of government to reach full production. They believe that intervention in economy by government through expansionary economic policies will boost investment and promote demand to reach full production. The Keynesian model consists of overall demand and supply curves. This relationship is appropriately shows the relationship between inflation and growth. In

the Keynesian theory, the aggregate supply is upward sloping and unlike the classical economists who assume that aggregate supply is vertical. If the aggregate supply were in the way classical assume, only prices were affected. But if aggregate supply were in the way Keynesians assumes, both output and prices will be affected. So, according to Keynesians theory, factors that affect inflation can affect output in the short-run.

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. In Keynesian theory, the upward sloping curve shows that the increase in demand due to government intervention not only increases inflation but also output. Hence, there is positive relationship between inflation and economic growth in Keynesian theory.

2.2.7New-Keynesian

According to New Keynesians to achieve rapid economic growth and to bring macroeconomic stability there must be stableinflation. For New Keynesians reducing of money supply to decrease inflation leads to recession due to price rigidities. Thus, in order to implement monetary policy there has to be prior information about future values of inflation and output. In inflation targeting monetary policies, credibility of the policy is very important and hence the Central Bank's independence plays a crucial role in this case. Inflation entails costs in the economy. These costs are anticipated or unanticipated. For New Keynesians whether the inflation is anticipated orunanticipated, it has an overall negative impact on economic growth (Abis, 2013).

2.3 Empirical Literatures Review

This study identifies some empirical studies on the relationship between saving, inflation and economic growth on other countries experience and in Ethiopia context.Along with economic growth savings is considered as a major macroeconomic factor which has a strong relation with inflation.

Chaudhry et al. (2010) studied the monetary and fiscal determinants of national saving by using Autoregressive Distributed Lag (ARDL) and co-integration approach and their result show that Inflation rate is positively related with national saving in short run. In Ethiopian context,Haile (2013) analyzed the macroeconomic determinants of gross national saving in Ethiopia using time series annual data form 1971-2011 by employing ARDL bounds testing approach to analyze short run and long run relationship of the variables. The result shows that the impact of inflation on gross national saving was found to be insignificant in the long run.

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

Mashi and Peters (2010) studied the mutual relation between savings and economic growth in Mexico usingVAR method and annual data from 1960 to 1996. They concluded that savings have a positive effect on 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. 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.

Michael (2008) has examined the basic factors that determine the rate of inflation and has also assessed the long-run and short-run relationships between inflation and economic growth in Ethiopia for the period 1971 – 2006. To see the long-run and short-run relationships between inflation and growth, he employed co-integration and error correction model. The findings of the study show that statistically significant long-run negative relationship exists between inflation and growth in Ethiopia on the other hand, Mallik and Chowdhury (2001) examines the relationship between inflation and economic growth in four South Asian countries namely Bangladesh, India, Pakistan and Sri Lanka. The long-run and short-run relationship between the two variables is examined using Error Correction Model (ECM) and the empirical finding reveals that the two variables are co-integrated showing a positive long-run relationship between them for all four countries.

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.

Various strands of literature also exist on the nexus among inflation, savings and economic growth. Ilyas et al. (2014) investigated inter relationship among economic growth, saving and inflation for Pakistan for the period of 1973-2010 usingTwo-Stage Least Square (2SLS) estimation method. The study revealed that economic growth is negatively affected by inflation and real interest rate whereas positively affected by depreciation rate. Another related work was done by Chaturvedi et al. (2008) for south-east and south Asia in a simultaneous equation framework to investigate the linkages between savings, inflation and economic growth using 2SLS method with panel data. They found positive bidirectional relationship between saving and economic growth but inflation has significantly negative effect on economic growth and positive

effect on saving rate. They also found that economic growth has insignificant effect on inflation in the analyzed countries.

To determine the impact of high inflation on economic growth of Pakistan both in the short-run and long-run, Faria and Carneiro (2001) employed VAR model and they found that inflation had negative impact on economic growth in the short run while no relationship was found between inflation and economic growth in the long run. Similarly, Fekadu(2012) examined the relationship between inflation and economic growth in Ethiopia using time series annual data from 1980-2011 by using VAR model and found that an increase in economic growth decreases inflation whereas inflation does not have significant effect on economic growth in the short run.

Edeme and Ifelunini (2015) examined the linkage among economic growth, saving and inflation in the economic performance of Nigeria using 2SLS method from 1980-2013. The study shows that inflation and interest rate were harmful to economic growth while exchange rate was beneficial. The study also indicated that inflation rate was negatively affected by economic growth in the long run.

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.

Finally, Lambamo (2015) investigated the link between savings, inflation and economic growth within the framework of Simultaneous equation model for Ethiopia using time series data from 1981 to 2015.The result shows that domestic saving and economic growth has been one directional and positive; growth causing saving. The study has also found significant and positive bi-directional relationship between economic growth and inflation.

2.4 Conceptual Framework

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

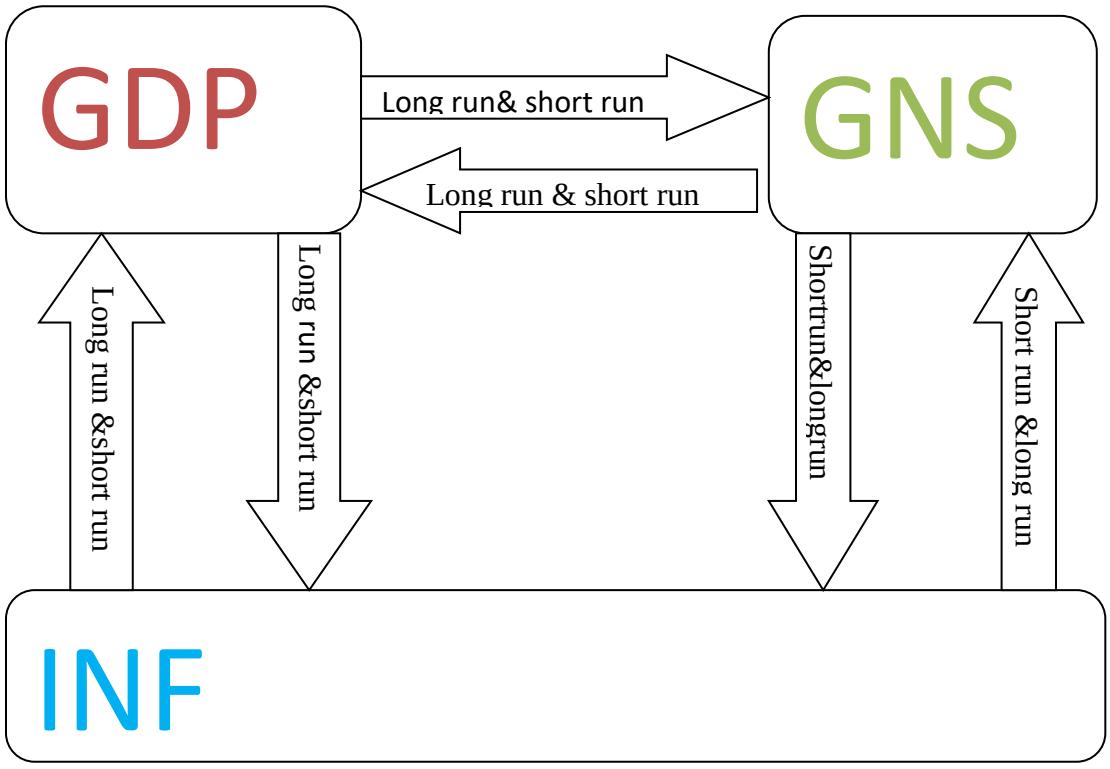


Figure2.1 Conceptual frame work of dependent variables

The above Conceptual frame work shows bidirectional causality among gross domestic product, gross national saving and inflation rate.Inflation rate and gross national saving rate affectseconomic growth; inflation rate and economic growth rate affects gross national saving rate;economic growth rate and gross national saving rate affects inflation rate of the country.

3. RESEARCH METHODOLOGY

3.1 Data Type and Source

To investigate the nexus between saving, inflation and economic growth, annual time series secondary data over the period of 1980-2017, have been used. The data were taken from National Bank of Ethiopia (NBE) and Central Statistics Agency (CSA).

3.2 Research Design

The study usedlongitudinal research design since it fits the secondary data that will be collected from NBE and CSA.

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 economic growth, gross national saving and inflation rate 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 linkages of inflation, saving and economic growth has been examined by specifying the following model.

$RGDP_t=f$ (GNS, CPI, ALR, REER) ---------- (1)

$GNS_t=f$ (RGDP, CPI, ALR, REER) ---------- (2)

$CPI_t=f$ (RGDP, GNS, ALR, REER) ---------- (3)

In linear form, equations (1) – (3) can be written as:

$$\ln RGDP_t=\alpha_0+\alpha_1 \ln GNS_t+\alpha_2 \ln CPI_t+ \alpha_3 \ln ALR_t +\alpha_4 \ln REER_t+\varepsilon_t \text{----------(4)}$$

$$\ln GNS_t =\beta_0+ \beta_1 \ln RGDP_t + \beta_2 \ln CPI_t + \beta_3 \ln ALR_t+ \beta_4 \ln REER_t+\varepsilon_t \text{----------(5)}$$

$$\ln CPI_t =\Theta_0+ \Theta_1 \ln RGDP_t + \Theta_2 \ln GNS_t +\Theta_3 \ln ALR_t + \Theta_4 \ln REER_t+\varepsilon_t \text{----------(6)}$$

Where α_1-α_4, β_1-β_4 and Θ_1- $\Theta_4$are parameters, RGDP= RealDomesticProduct (Proxy for economic growth), GNS= Gross National Saving, CPI= Consumer Price Index (proxy for Inflation), ALR=Average Lending Rate, REER=Real Effective Exchange Rate,ln. = Natural logarithm, t= Time,ε_t=Residual term.

3.5Definition 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 and can impact inflation positively or negatively.

Inflation (INF): - which is a general rise in prices measured against a standard level of purchasing power. The consumer price index (CPI) measures the percentage change through time in the cost of purchasing a constant basket of goods and service representing the average pattern of purchases made by a particular population group in a specific time period(Haberler ,1960).Inflation is expected to have positive or negative impact on saving and economic growth.

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 inflation and economic growth positively or negatively as theoretically explained above.

3.6VectorAutoregressive (VAR) Model

In order to catch the direction of causality and to investigate the linkages between national saving, inflation 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.Johansen co- integration test has been performed to check the presence of co-

integration of the variables. To find out long run co-integration between the variables, VAR and Vector Error Correction Model (VECM) approach has been used.Granger causality test was employed to test the direction of causality between variables. Diagnostic check, such as Multicollinearity test, normality, serial correlation and heteroscadasticity test are performed.

3.7.1Stationarity 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 stationary 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- stationaryregression, 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 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, ADF 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

$$\Delta Z_t = \theta Z_{t-1} + \alpha_1 \Delta Z_{t-1} + \alpha_2 \Delta Z_{t-2} + \ldots + \alpha_P \Delta Z_{t-p} + \varepsilon \quad (7)$$

Equation: 2when there is no intercept and trend

$$\Delta Z_t = \alpha_0 + \theta Z_{t-1} + \alpha_1 \Delta Z_{t-1} + \alpha_2 \Delta Z_{t-2} + \ldots + \alpha_P \Delta Z_{t-p} + \varepsilon \quad (8)$$

Equation: 3when there is intercept and trend

$$\Delta Z_t = \alpha_0 + \theta Z_{t-1} + \alpha_1 \Delta Z_{t-1} + \alpha_2 \Delta Z_{t-2} + \alpha_1 t \ldots + \alpha_P \Delta Z_{t-p} + \varepsilon \quad (9)$$

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-stationary. 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 among 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, ADFtests are going to be employed in this study.

3.7.3 Johansen Co-Integration Test

We are concerned about the concept of co-integration because making a variable stationary by differencing only gives the short run dynamics while we are also interested in knowing the long run relationship. Economically speaking, two variables will be co-integrated if they have long run relationships between them. 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 thevariables. The use of causality test is to identify which variable causes another variable in time series analysisor 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 (VECM) model

In order to capture both the short and long-run relationships in the model the study uses Vector Error Correction Model (VECM)**.**VECM is a restricted VAR designed for use that are known to be co-integrated. The VEC specification restricts the long-run behavior of the endogenous variables to converge to their co-integrating relationships while allowing a wide range of short-run 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.

3.8 Diagnostic Checks

3.8.1Heteroscadasticity 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

3.8.2Residual 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, $\beta_3$is a measure of kurtosis; and the test statistic is $\chi 2$ 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 Auto Correlation Tests

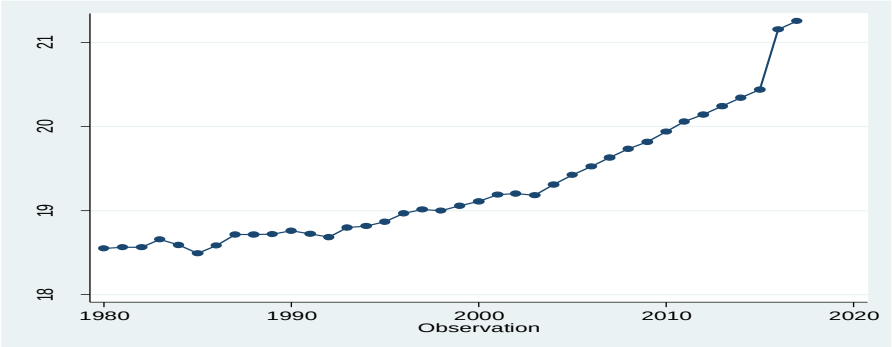
Serial correlation arises when the error terms from different time periods are correlated. In time series studies it occurs when the error associated with observations in a given time period carry over into future time periods. Serial correlation also called autocorrelation.Breusch-GodfreyLangrange Multiplier (LM) test is used in this study to test the presence of serial correlation in the residuals.

4. RESULTS AND DISCUSSIONS

This chapter analyzes the nexus between gross national saving, inflationand economic growth based on the econometric framework given in chapter three using annual data for the period between 1980 and 2017.STATA 13 software has been used for analysis of the variables in this study. This 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 by testing the necessary tests such as stationary tests, diagnostic tests. After passed the necessary testsofco-integration and Granger Causality Tests, both the long run and short run models are estimated using VAR model and Error Correction respectively. After estimation has been made the interpretation and discussion are continued based on the model results.

4.1Descriptive Analysis

Descriptive analysis is the first step in this research. Before conducting time series analysis, it is advisable to analyze the data using descriptive statistics. This helps to identify the presence of any trending behavior in the variables in question over time. Thesevariables are shown as follows.



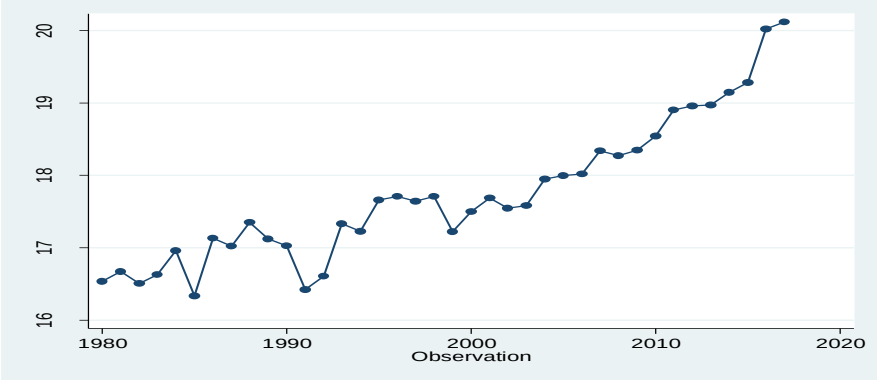
Source: Own computation based on NBE and CSA data

Figure 4.1: Trends of real GDP and its growth in Ethiopia (1980-2017)

According the above figure 4.1, the Ethiopian economic growth has shown various changes in different political regime. The changes in government structure created a problem of

inconsistency in implementing the polices by previous regimes including external and internal wars as well as natural disaster like famine and drought had a depressing effect on the history ofeconomic growth of the economy (Tewodros,2015).

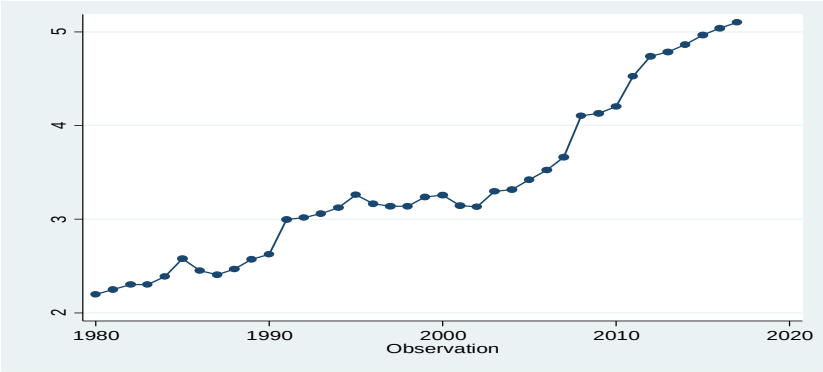
The figure 4.1 above shows some fluctuations of total real output from the beginning up to 2002 whereas from 2002 onwards the graph is sharply upward indicating higher rate of growth. This growth rate is attributed due to a combination of pro poor growth policy (since 2003onwards)and state lead development 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).



Source: Own computation based on the NBE and CSA data

Figure 4.2: Trends of gross national saving in Ethiopia (1980-2017)

As we can see from the above graphical representation of the trends of gross national saving in Ethiopia have been fluctuate over the years from the beginning up to 2009 whereas from 2010 onwards the graph is sharply upward indicating higher rate of saving. This growth rate is attributed dueto domestic saving mobilization and increases of tax base.



Source: Own computation based on the NBE and CSAdata

Figure 4.3: Trends of consumer price index in Ethiopia (1980-2017)

Trends of inflation which is proxied by consumer price index the above figure 4.3, showmoderate ups and downs from 1980 to 2002whereas from 2003 onwards the graph is sharply upward indicating higher rate of consumer price index.Since the country depends on rain fed agriculture as a main source of income, the drought diminished output growth which in turn has a significant influence on the increment of inflation.

4.2 The Unit Root Test Analysis

Prior to direct estimation of the model, it is advisable first to conduct the unit root test to check whether the time-series is stationary or not. 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-Fullertests with the ADF methods are performed with different trend assumptions (only intercept both trend and intercept). Performing the tests under all two alternatives will identify whether only the intercept or both the trend and intercept are significant.

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	3.363	-5.057	I(0) at 5%	0.687	-6.536	I(1) at 1%
LnGNS	0.227	-7.967	I(1) at 1%	-2.250	-8.316	I(1) at 1%
LnCPI	0.994	-5.349	I(1) at 1%	-1.146	-5.554	I(1) at 1%
LnALR	1.879	-6.239	I(1) at 1%	-2.334	-6.239	I(1) at 1%
LnREER	-1.660	-5.253	I(1) at 1%	-1.554	-5.199	I(1)) at 1%
MacKinnon (1996) with constant Test critical values 1% -3.621 5% -2.943 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 GDP are stationary at level I [0], [with intercept] yet, Gross national saving, inflation, Average lending rate and Real effective exchange rate are stationary at integrated of order 0ne I [1] at first difference.

Diagnostic Tests

Diagnostics test are usually undertaken to detect model misspecification and as a guide for model improvement. These tests include multicollinearity, serial correlation, normality and heteroscedasticity tests.

Multicollinearity 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 multicollinearity has to be conducted to determine which variable to retain and which one to exclude from the final analysis.

The formal test of multicollinearity 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 multicollinarity 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 multicolinarity 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	LCPI	LALR	LREER
	1	0.80360	0.80360	0.80360	0.80360	0.80360
	2	0.40562	0.40562	0.40562	0.40562	0.40562
Normality Test (Jarque-Bera)		0.00363	0.85524	0.05421	0.02042	0.95721
Heteroscedasticity test (White'sTest)		0.2596	0.156	0.0575	0.423	0.231

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, inflation rate 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 levelof 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 four 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	-20.1148	NA	3.0e-06	1.47734	1.55389	1.70181
1	111.977	264.18	5.6e-09	-4.82217	-4.36287	-3.47538*
2	140.749	57.545	5.0e-09	-5.04407	-4.20203	-2.57495
3	158.522	35.546	1.0e-08	-4.61894	-3.39415	-1.0275
4	215.576	114.11*	2.9e-09*	-6.50447*	.4.89694*	-1.79071

Note: * indicates lag order selected by the criterion

4.3.2The 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 inestimating 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		100.5471	68.52
1	0.79159	44.0894*	47.21
2	0.55581	14.8754	29.68
3	0.26117	3.9786	15.41
4	0.09849	0.2461	3.76
5	0.00681		

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 100.5471 is greater than the 5% critical value of 68.52. From this, one can infer the existence ofco-integrating relationship between GDP at current price, gross national saving, inflation, average lending rate and real exchange ratefor 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
LnRGDP	LnGNS	0.89951	0.4922
LnRGDP	LnCPI	5.7654	0.0068
LnRGDP	LnALR	2.0079	0.1527
LnRGDP	LnREER	4.933	0.0122
LnRGDP	ALL	2.2904	0.0691
LnGNS	LnRGDP	5.7911	0.0067
LnGNS	LnCPI	4.8551	0.0129
LnGNS	LnALR	2.4864	0.0950
LnGNS	LnREER	3.7106	0.0316
LnGNS	ALL	4.7112	0.0037
LnCPI	LnRGDP	1.0156	0.4349
LnCPI	LnGNS	1.486	0.2629
LnCPI	LnALR	3.964	0.0257
LnCPI	LnREER	1.2346	0.3440
LnCPI`	ALL	2.7427	0.0365
LnALR	LnRGDP	8.5152	0.0013
LnALR	LnGNS	7.4237	0.0024
LnALR	LnCPI	17.783	0.0000
LnALR	LnREER	6.4419	0.0044
LnALR	ALL	7.1453	0.0005
LnREER	LnRGDP	4.6306	0.0152
LnREER	LnGNS	1.6075	0.2312
LnREER	LnCPI	18.911	0.0000
LnREER	LnALR	3.9653	0.256
LnREER	ALL	0.868	0.0002

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 exchange rate; it does not granger causes inflation rate. Gross national saving rate (GNS) granger-causes average lending rate; it does not Granger cause economic growth, Inflation rate and real exchange rate. Inflation rate (INF) granger causes economic growth rate, National Saving rate,Average lending rate and Real exchange rate. Average Lending Rate (ALR) granger causes inflation rate. Real exchange rate (REER) granger causes economic growth rate, gross national saving rate and average lending rate. It also indicates the existence of bi directional causality between inflation and average lending rate.

4.4.4 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 inflation rate and gross national savings rate on economic growth rate; the impact of inflation rate and economic growth rate on gross national savings rate and the impact of economic growth and gross national saving rate on inflation 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	LCPI	LALR	LREER	C
Coefficients	0.495426	0.325789	-0.291602	0.043019	9.862726
t-statistics	6.9	4.10	-2.07	0.44	7.35

R-squared=0.97, Adj-R-squared=0.95

$$\mathbf{LRGDP_t = 9.86276 + 0.495426LGNSt + 0.325789LCPIt - 0.291602LALRt + 0.043019LREERt + \varepsilon_t}$$

The adjusted R^2 has approximately a value of 0.95 which implies that the variations in real gross domestic product are well explained by changes in gross national saving (GNS), inflation which is proxied by consumer price index (CPI), real effective exchange rate (REER) and average lending rate (ALR). From the estimation result shown in the above table, LRGDPcan be explained by gross nationalsaving, inflation, average lending rate and real exchange rate. The result shows that gross national saving rate and inflation rateexert significant positive effect on

economic growth rate in the long run. The effect of average lending rate on economic growth rate isnegative and significant, whereas the long run effect of real exchange rate on economic growth rate is positive and insignificant.

The result showed that 1percentincrease in growth of gross national saving increases economic growth rate by 0.495% 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.

As can be seen from the above result inflation has a positive impact on economic growth rate of the country over the period of 1980 – 2017. The result showed that 1 percent increase in inflation rate increases economic growth rate by 0.325percentassuming other variables constant. This result is in line with Philip's curve that exist a positive relationship between inflation and economic growth. The result is the consistent with the empirical findings of Mallik and Chowdhury (2001) showing a positive long-run relationship betweeninflation and economic growth but inconsistent with Michael (2008) in Ethiopia.

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

Variables	LRGDP	LCPI	LALR	LREER	C
Coefficients	1.201404	0.0253203	0.319479	-0.1785972	-5.364897
t-statistics	6.97	0.17	1.41	-1.18	-1.64

R-squared=0.96, Adj-R-squared=0.95

$LGNS_t$=-5.36489 +1.20140LRGDPt +0.02532LCPIt + 0.31947LALRt -0.178597LREERt+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 1.20 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 inflation rate and average lending rate on gross national saving rate is positive but insignificant in the long run. The impact of real exchange rate is negative but insignificant effect on national saving rate. The result shows that 1 percent increase in inflation rate increases gross national saving rate by 0.025percent in the long run by holding other things fixed. The result supports the neoclassical economists such as Tobin's (1965) and Mundell (1963) that is according to them the increased inflation leads to increased nominal interest, which then will make people option to save and investment instead of consumption. This result is consistent with the empiricalfindingsof Haile (2013), Mallik and Chowdhury (2001) and inconsistent with the findings of Michael (2008),(Yohannes, 2014) that statistically significant long-run negative relationship exists between inflation and growth in Ethiopia.

Table 4.8: The Estimated Long- Run Model for LCPI (Consumer Price Index)

Variables	LRGDP	LGNS	LALR	LREER	C
Coefficients	1.037044	0.033236	0.587668	0.185772	-19.52352
t-statistics	4.10	0.17	2.38	1.07	-10.35

R-squared=0.93, Adj-R-squared=0.92

$LCPI_t$=-19.5235 +1.03704LRGDPt + 0.033236LGNSt + 0.587668LALRt +0.185722LREERtε_t

The above equation shows that, in the long run, LCPI can be explained by real gross domestic product, gross national saving, average lending rate and real exchange rate. The positive sign of the coefficient of RGDP implies that the existence of a positive long-runrelationship between inflation and economic growth. The estimated coefficient of RGDP suggests that, an increase in growth of RGDP by one percentage point is estimated to boost the growth rate of inflation at 1.037 percentage point. For a rapidly growing economy such as Ethiopia, the strong positive

relationship between the two variables is acceptable. This finding is similar to the Keynesian theoretical finding that the two macro-economic variables have positive relationships

According to the estimation result given of the above table, the variations in inflation which is proxied by CPI are explained by changes in gross national saving rate. The effect of gross national saving rate on inflation rate is positive but insignificant in the long run. An increase in one percentage point in gross national saving rateraises the rate of inflation by 0.033 percentage point. As national saving rate increases in the economy money circulated in the economy may be increased and this induces inflation rate in the long run period.

According to the estimation result, 18% of the variations of inflation are explained by the real exchange rate.One percent increase inreal effective exchange rate increases gross national saving rate by 0.185 percent in the long run. The explanatory power of real exchange rate islow. Likewise, the impact of average lending rate on inflation is positive and significant. 1 percent increases of average lending rate increases the rate of inflation at 0.59 percentage point.

Table 4.9: The Estimated Long- Run Model for ALR (Average Lending Rate)

Variables	LRGDP	LGNS	LCPI	LREER	C
Coefficient	-0.3941974	0.1780962	0.2495714	-0.3761279	7.827683
t-statistics	-2.07	1.41	2.38	-3.97	3.67

R-squared=0.64, Adj-R-squared=0.59

LALRt=7.827683 -0.3941974LRGDPt +0.1780962LGNSt +0.2495714LCPIt-0.3761279LREERt+ε_t

The result indicates that both economic growth rate and real effective exchange rate exert negative and significant effect on average lending rate in the long run whereas the long run effect of inflation rate on average lending rate is positive and significant but the effect of gross national saving rateon average lending rate is positive and insignificant. A 1 percent increase in real gross domestic product decreases average lending rate by 0.394 percent in the long run. Likewise, a 1 percent increase real effective exchange rate reduces average lending rate by 0.376 percent

points. A 1 percent increase in inflation rate causes average lending rate to increase by 0.249 percent in the long run. A 1 percent increase in gross national saving increases average lending rate by 0.178 percent.

Table 4.10: The Estimated Long- Run Model for REER (Real Exchange Rate)

Variables	LRGDP	LGNS	LCPI	LALR	C
Coefficient	0.1326531	-0.2271003	0.1799592	-0.8579588	7.876564
t-statistics	0.44	-1.18	1.07	-3.97	2.21

R-squared=0.46, Adj-R-squared=0.41

$LREER_t$=7.87656+0.132653LRGDPt -0.227100LGNSt +0.179959LCPIt -0.857958LALRt+ε_t

The above equation shows that, in the long run, LREER can be explained by real gross domestic product, gross national saving rate, inflation rate and average lending rate. The positive sign of the coefficient of RGDP implies that the existence of a positive long-run relationship between real exchange rate and real GDP. The estimated coefficient of RGDP suggests that, an increase in growth of RGDP by one percentage point is estimated to boost the growth rate of real exchange rate at 0.132 percentage point.

According to the estimation result given of the above table, the variations in the real exchange rate (REER) are explained by changes in gross national saving rate. The effect of gross national saving rate on real exchange rate is negative and insignificant in the long run. An increase in one percentage point in gross national saving raises the rate of real exchange rate by 0.227 percentage point. Likewise, the impact of average lending rate on real exchange rate is negative but its impact issignificant. The impact of inflation rateon real exchange rate is positive but insignificant in the long run. The result shows that 1 percent increase in inflation rate increases real exchange rate by 0.18 percent in the long run.

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

Dependent Variable is D(LRGDP)		
Error Correction	Coefficient	T-Ratio
Co-integration	-1.33364	-4.522918
ECM(-1)	0.5669	2.42042
DGNS(-1)	0.7432	2.2697
DCPI(-1)	0.0112	1.32897
DALR(-1)	0.51328	0.32954
DREER(-1)	0.45672	1.2498
Constant	-4.6279	-1.6456
R-squared = 0.84897;		R-bar- squared = 0.75704
F-stat. F (10, 27) 12.9290;		DW-statistic = 2.2518

Source: Authors own calculation using STATA 13

The co- integrationcoefficient, estimated at -1.33364 isnegative and highly significant. These shows that the existence of long run causality from independent variables to dependent variable. According to Bannerjee*et 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 56.6% in the next period to bring back equilibrium. The result shows thatgross national saving, inflation, 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 0.7432 percent increase in real GDP in the short run. Similarly, a one percentage increase in inflation rate will result in 0.011 percent increase in real GDP in short run. This shows inflation is not significantly affect Ethiopian economic growth in short run, despite their relationship is positive. This is consistent withthe empirical findings of Fekadu(2012) and inconsistent with the empirical findings of Faria and Carneiro (2001).

Table 4.12: Results of short run model when dependent variable is D (LGNS)

Dependent Variable is D(LGNS)		
Error Correction	Coefficient	T-Ratio
Co-integration	-1.25364	-1.522918
ECM (-1)	0.77458	-2.80587
DRGDP(-1)	0.04525	0.4535
DCPI(-1)	-0.04752	-0.84543
DALR(-1)	-0.065478	0.27848
DREER(-1)	0.02345	0.45213
Constant	1.728345	1.684354
R-squared = 0.5878		R-bar- squared = 0.5345
F-stat. =1.0345, Probability(0.3034)		DW-statistic = 2.145

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 insignificant in the short run. The result is consistent to Shimelis (2014) whereas the impact of inflation rate which is proxied by CPI on gross national saving rate is negative and insignificant. The empirical finding is consistent with Feyera (2015).According to the estimation result;an increase in one percentage point in economic growth rate raises the rate of gross national saving rate by 0.0475 percent. Similarly,onepercentage increase in inflation rate decreases gross national saving rate by 0.0475 percent in the short run.

Table 4.13: Estimation results of short run model when dependent variable is D (LCPI)

Dependent Variable is D(LCPI)		
Error Correction	Coefficient	T-Ratio
Co- integration	-1.0345	-2.921
ECM(-1)	0.1215	2.5535
DRGDP(-1)	0.3954	1.7485
DGNS(-1)	0.5324	1.2543
DALR(-1)	2.0345	1.5132
DREER(-1)	1.0325	1.1453
Constant	-6.65745	-3.0521
R-squared = 0. 7242		R-bar- squared = 0. 6845
F-stat=7.0245; Probability (0.000235)		DW-statistic =1.9527

Source: Authors own calculation using STATA 13

If the coefficient of co-integration is negative and significant there is long run causality from the independent variables to dependent variable. As we observedfromthe above table, coefficient of co-integration is negative and significant this reveal that there is long run causality from independent variables to dependent variableduring the study period .Therefore the speed of adjustment toward long run equilibrium is -1.0345. It takes less than a year to be corrected toward long run equilibrium.Thesecond error correction coefficients (ECM-1) are short run coefficients. The result of short run coefficients indicates the existence of short run causality from independentvariablesto dependent variable.

The impact of economic growth rate on inflation rate is positive but insignificant in the short run. The result shows that, 1 percent increase in economic growth rate increases inflation rate by 0.3954 percent. Similarly, the impact of gross national saving rate on inflation rate is positive and insignificant .Theresult shows that a one percent increases in gross national saving rate increases inflation rate by 0.5324percent; other things remain constant.

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Conclusions

The main objective of this study is to examine the nexus of saving, inflation and economic growth in a given time frame. In doing so, VAR model was applied to analyze the long run relationship between variables and Error Correction model used for short run relationship analysis.

Before applying the model the necessary tests like unit root test were applied using ADF test. As a result, real GDP is stationary (no unit root problem) at level, while gross national saving,inflation,average lending rate and real effective exchange rate 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 statinarity test, model stability test was carried out in the study and the result shows the absence of multicolinarity, serial correlation, hetroscedasticity problem and abnormal distribution of the residuals.

The findings of this study reveal that gross national savingrate,inflation rate and real effective exchange rate exert positive and significant impact on economic growth while average lending rate exert negative and significant impact on economic growth in the long run.

Economic growth rate, inflation rate and average lending rate has positive impact on gross national saving rate in the long run. The impact of economic growth rate on gross national saving rate is positive and significant but the impact of bothinflation rate and average lending rate on gross national saving rate are positive and insignificant in the long run. Moreover, real effective exchange rate has negative and insignificant impact on gross national saving rate in the long run.

Gross national saving rate,Economic growth rate, average lending rate and real effective exchange ratehave long run impact on inflation rate of the country. Economic growth rate and average lending rate exert positive and significant impact on inflation rate in the long run but the impact of gross national saving rate and real effective exchange rate on inflation rate is positive and insignificant in the long run.

The other objectives of this paper is to test the short run relationship between the variables using Error Correction model on time series data of Ethiopia from 1980-2017. The result shows thatinflationrate, average lending rate and real effective exchange rate exert positive andinsignificantimpacton Economic growth rate of the country while Gross national saving rate exert positive and significant impact on economic growth rate in the short run time period in the country.

The impact of economic growth, average lending rate and real effective exchange rate on gross national saving rate is positive and insignificant while inflation rate exert negative and insignificant impact on gross national saving rate in the short run time period in the country. Economic growth rate, gross national saving rate, average lending rate and real effective exchange rate exert positive and insignificant impact on inflation rate in the short run.

The granger causality test shows that economic growth granger causes gross national saving rate; it does not granger causes inflation rate. Gross national saving rate does not Granger cause economic growth and Inflation rate. Inflation rate granger causes economic growth rate and National Saving rate.

5.2 Policy Recommendations

Based on the findings of the study the following policy recommendations are suggested:

- Ethiopia is challenged with a persistent and wide saving gap in recent years which have been financed by external sources. And the risk associated with external sources of financing offers the motivation of relying on national saving to finance the investment. The positive impact of gross national saving rate on economic growth rate in short and long run shows that government should intervene to increase national saving rate to promote long run economic growth rate. So the government of Ethiopia can do this by domestic saving mobilization, increase tax base and encouraging private businesses.
- The long run and short run positive relationship between inflation rate and economic growth rate indicates that the sustained economic growth increases long run inflation rate. The suitable measure to solve this problem is using inflation rate targeting at correct inflation rate threshold level. At present MoFEC uses 6%inflation rate target annually and

this should be practically implemented. Therefore policy makers of the country should use inflation rate targeting system which will be more optimal for economic growth

- The result shows positive relationship between inflation and gross national savings in the long run and insignificant negative effect in the short run for Ethiopian economy.This means that inevitable inflationary problem during economic growth increases national saving rate in the country in the long run and reduces it in the short run. So the government of Ethiopia should target appropriate optimal level of inflation rate to encourage national saving.

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APPENDICES

APPENDIX:A ADF Unit Root Test Result

Dependent Variable (LRGDP)

Intercept only at level

Dickey-Fuller test for unit root — Number of obs = 37

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	3.363	-3.668	-2.966	-2.616

MacKinnon approximate p-value for Z(t) = 1.0000

D.lnRGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnRGDP L1.	.0929587	.0276457	3.36	0.002	.036835	.1490823
_cons	-1.713935	.5317561	-3.22	0.003	-2.793457	-.6344128

Intercept only at first difference

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

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.057	-3.675	-2.969	-2.617

MacKinnon approximate p-value for Z(t) = 0.0000

D. diff_lnRGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
diff_lnRGDP L1.	-.8557137	.1692112	-5.06	0.000	-1.199592	-.5118351
_cons	.0643126	.0243059	2.65	0.012	.014917	.1137082

Trend and intercept at level

Dickey-Fuller test for unit root — Number of obs = 37

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	0.687	-4.270	-3.552	-3.211

MacKinnon approximate p-value for Z(t) = 0.9970

D.lnRGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnRGDP						
L1.	.052666	.0767011	0.69	0.497	-.1032094	.2085414
_trend	.0026372	.0046759	0.56	0.576	-.0068653	.0121397
_cons	-.9894689	1.392226	-0.71	0.482	-3.818812	1.839874

Trend and intercept at first difference

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

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-6.536	-4.279	-3.556	-3.214

MacKinnon approximate p-value for Z(t) = 0.0000

D.diff_lnR~P	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
diff_lnRGDP						
L1.	-1.134014	.1734998	-6.54	0.000	-1.487002	-.7810262
_trend	.0066245	.0020721	3.20	0.003	.0024087	.0108403
_cons	-.0380952	.0386117	-0.99	0.331	-.1166512	.0404608

Dependent Variable: D (LGNS)

Intercept only at level

Dickey-Fuller test for unit root — Number of obs = 37

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	0.227	-3.668	-2.966	-2.616

MacKinnon approximate p-value for Z(t) = 0.9737

D.lnGNS	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnGNS L1.	.0133526	.0588256	0.23	0.822	-.1060697	.1327749
_cons	-.1393005	1.040977	-0.13	0.894	-2.252597	1.973996

Intercept only at first difference

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

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-7.967	-3.675	-2.969	-2.617

MacKinnon approximate p-value for Z(t) = 0.0000

D.diff_lnGNS	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
diff_lnGNS L1.	-1.302186	.1634456	-7.97	0.000	-1.634348	-.9700249
_cons	.1248964	.0537307	2.32	0.026	.0157025	.2340902

Trend and intercept at level

Dickey-Fuller test for unit root — Number of obs = 37

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.250	-4.270	-3.552	-3.211

MacKinnon approximate p-value for Z(t) = 0.4620

D.lnGNS	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnGNS						
L1.	-.3312468	.1472413	-2.25	0.031	-.6304772	-.0320164
_trend	.0309407	.0122713	2.52	0.017	.0060024	.0558791
_cons	5.363141	2.387942	2.25	0.031	.5102579	10.21602

Trend and intercept at first difference

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

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-8.316	-4.279	-3.556	-3.214

MacKinnon approximate p-value for Z(t) = 0.0000

D.diff_lnGNS	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
diff_lnGNS						
L1.	-1.352631	.1626494	-8.32	0.000	-1.683543	-1.021718
_trend	.0079846	.0049192	1.62	0.114	-.0020235	.0179927
_cons	-.0179396	.1024612	-0.18	0.862	-.2263984	.1905193

Dependent Variable: D (LCPI)

Intercept only at level

Dickey-Fuller test for unit root — Number of obs = 37

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	0.994	-3.668	-2.966	-2.616

MacKinnon approximate p-value for Z(t) = 0.9942

D.lnCPI	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnCPI L1.	.02318	.0233275	0.99	0.327	-.0241774	.0705375
_cons	.0015231	.0798098	0.02	0.985	-.1604993	.1635455

Intercept only at first difference

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

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.349	-3.675	-2.969	-2.617

MacKinnon approximate p-value for Z(t) = 0.0000

D.diff_lnCPI	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
diff_lnCPI L1.	-.9135463	.1707941	-5.35	0.000	-1.260642	-.566451
_cons	.0723075	.0242353	2.98	0.005	.0230555	.1215595

Trend and intercept at level

Dickey-Fuller test for unit root — Number of obs = 37

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
		Interpolated Dickey-Fuller		
Z(t)	-1.148	-4.270	-3.552	-3.211

MacKinnon approximate p-value for Z(t) = 0.9206

D.lnCPI	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnCPI						
L1.	-.086327	.0752004	-1.15	0.259	-.2391525	.0664985
_trend	.0089543	.0058571	1.53	0.136	-.0029489	.0208574
_cons	.1948088	.1487287	1.31	0.199	-.1074442	.4970619

Trend and intercept at first difference

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

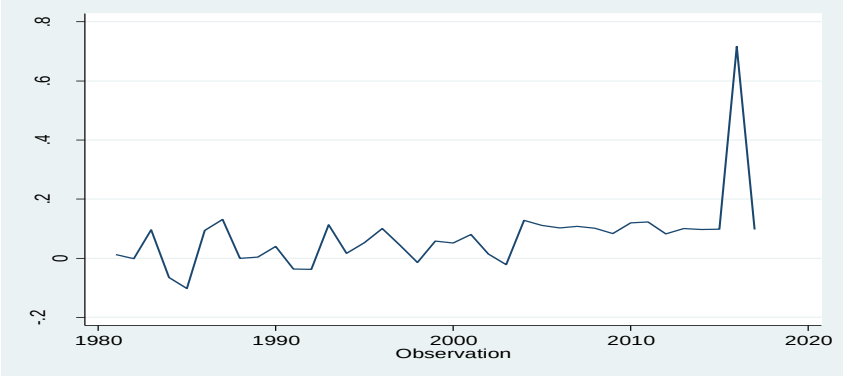
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
		Interpolated Dickey-Fuller		
Z(t)	-5.554	-4.279	-3.556	-3.214

MacKinnon approximate p-value for Z(t) = 0.0000

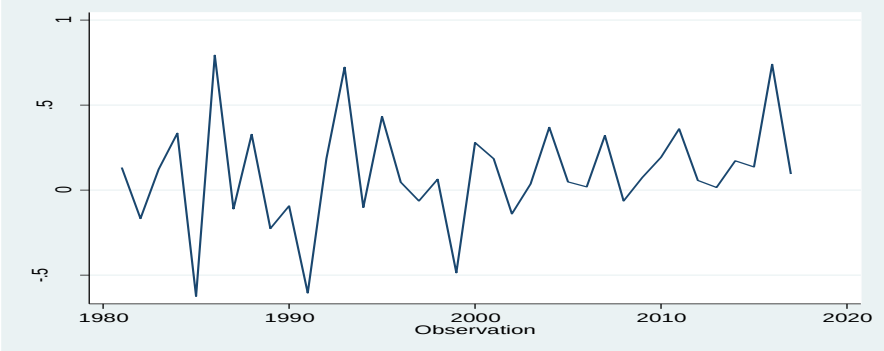
D.diff_lnCPI	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
diff_lnCPI						
L1.	-.9701439	.174684	-5.55	0.000	-1.325541	-.6147467
_trend	.0025672	.0019834	1.29	0.205	-.001468	.0066025
_cons	.029278	.0410009	0.71	0.480	-.0541388	.1126949

APPENDIX B: The Graph for Time Series Variables When Differenced

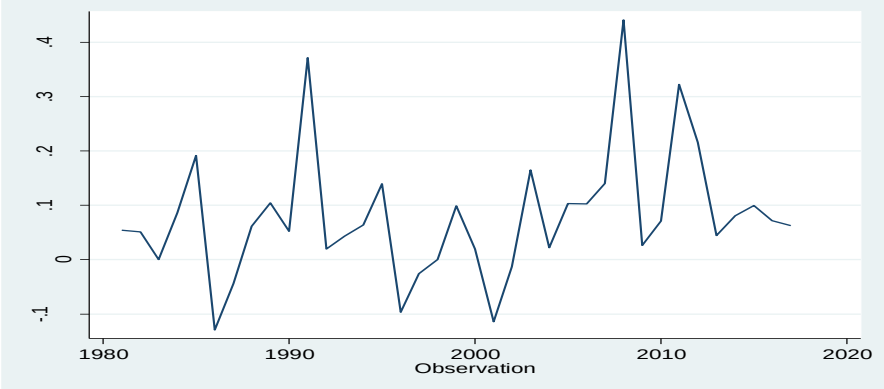
LRGDP



LGNS



LCPI



APPENDIX C: Lag Order Selection Criteria

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-20.1148				3.0e-06	1.47734	1.55389	1.70181
1	111.977	264.18	25	0.000	5.6e-09	-4.82217	-4.36287	-3.47538*
2	140.749	57.545	25	0.000	5.0e-09	-5.04407	-4.20203	-2.57495
3	158.522	35.546	25	0.079	1.0e-08	-4.61894	-3.39415	-1.0275
4	215.576	114.11*	25	0.000	2.9e-09*	-6.50447*	-4.89694*	-1.79071

Endogenous: lnRGDP lnGNS lnCPI lnALR lnREER
Exogenous: _cons

APPENDIX D: Unrestricted Co-Integration

```
. tsset OBS, yearly
        time variable:  OBS, 1980 to 2017
                delta:  1 year

. vecrank RGDP GNS CPI ALR REER, trend(constant)

                     Johansen tests for cointegration
Trend: constant                                      Number of obs =      36
Sample:  1982 - 2017                                       Lags =       2
```

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	30	-1684.2881	.	100.5471	68.52
1	39	-1656.0592	0.79159	44.0894*	47.21
2	46	-1641.4522	0.55581	14.8754	29.68
3	51	-1636.0038	0.26117	3.9786	15.41
4	54	-1634.1376	0.09849	0.2461	3.76
5	55	-1634.0145	0.00681		

APPENDIX E: GrangerCausality Wald test

Granger causality Wald tests

Equation	Excluded	F	df	df_r	Prob > F
lnRGDP	lnGNS	.89951	4	13	0.4922
lnRGDP	lnCPI	5.7654	4	13	0.0068
lnRGDP	lnALR	2.0078	4	13	0.1527
lnRGDP	lnREER	4.933	4	13	0.0122
lnRGDP	ALL	2.2904	16	13	0.0691
lnGNS	lnRGDP	5.7911	4	13	0.0067
lnGNS	lnCPI	4.8551	4	13	0.0129
lnGNS	lnALR	2.4864	4	13	0.0950
lnGNS	lnREER	3.7106	4	13	0.0316
lnGNS	ALL	4.7112	16	13	0.0037
lnCPI	lnRGDP	1.0158	4	13	0.4349
lnCPI	lnGNS	1.486	4	13	0.2629
lnCPI	lnALR	3.964	4	13	0.0257
lnCPI	lnREER	1.2346	4	13	0.3440
lnCPI	ALL	2.7427	16	13	0.0365
lnALR	lnRGDP	8.5152	4	13	0.0013
lnALR	lnGNS	7.4237	4	13	0.0024
lnALR	lnCPI	17.783	4	13	0.0000
lnALR	lnREER	6.4419	4	13	0.0044
lnALR	ALL	7.1453	16	13	0.0005
lnREER	lnRGDP	4.6306	4	13	0.0152
lnREER	lnGNS	1.6075	4	13	0.2312
lnREER	lnCPI	18.911	4	13	0.0000
lnREER	lnALR	3.9653	4	13	0.0256
lnREER	ALL	8.0868	16	13	0.0002

APPENDIX F: Vector Error Correction Estimates

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnRGDP						
_ce1						
L1.	-.067852	.0331336	-2.05	0.041	-.1327927	-.0029114
lnRGDP						
LD.	.0929197	.2595355	0.36	0.720	-.4157605	.6015999
L2D.	-.0639485	.5359136	-0.12	0.905	-1.11432	.9864228
L3D.	.3390786	.5390271	0.63	0.529	-.717395	1.395552
lnGNS						
LD.	-.3962652	.1916044	-2.07	0.039	-.771803	-.0207274
L2D.	-.1994051	.1522846	-1.31	0.190	-.4978775	.0990673
L3D.	-.1443969	.1149712	-1.26	0.209	-.3697363	.0809426
lnCPI						
LD.	-.0608126	.2217667	-0.27	0.784	-.4954673	.3738421
L2D.	.6968378	.2367841	2.94	0.003	.2327495	1.160926
L3D.	-.8128981	.3462198	-2.35	0.019	-1.491476	-.1343198
lnALR						
LD.	.084993	.2365781	0.36	0.719	-.3786916	.5486776
L2D.	.2676025	.2168048	1.23	0.217	-.1573272	.6925321
L3D.	.4570783	.2158582	2.12	0.034	.034004	.8801526
lnREER						
LD.	-.6641454	.1971431	-3.37	0.001	-1.050539	-.2777519
L2D.	.4000882	.2509461	1.59	0.111	-.0917571	.8919336
L3D.	.1479137	.1631371	0.91	0.365	-.1718293	.4676566
_cons	.0100051	.0370295	0.27	0.787	-.0625714	.0825815

--more--

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnGNS						
_ce1						
L1.	-1.168684	.4986851	-2.34	0.019	-2.146089	-.1912795
lnGNS						
LD.	.1837525	.4827068	0.38	0.703	-.7623355	1.12984
L2D.	.5075958	.3836489	1.32	0.186	-.2443422	1.259534
L3D.	.3402798	.2896456	1.17	0.240	-.2274152	.9079748
lnRGDP						
LD.	1.767559	.6538447	2.70	0.007	.4860473	3.049072
L2D.	-.6343245	1.350121	-0.47	0.638	-3.280512	2.011863
L3D.	3.419644	1.357965	2.52	0.012	.7580824	6.081206
lnCPI						
LD.	-.5126348	.5586942	-0.92	0.359	-1.607655	.5823857
L2D.	1.369573	.5965274	2.30	0.022	.2004011	2.538746
L3D.	.1372083	.8722274	0.16	0.875	-1.572326	1.846743
lnALR						
LD.	-1.120076	.5960085	-1.88	0.060	-2.288232	.0480789
L2D.	-.5245882	.5461938	-0.96	0.337	-1.595108	.545932
L3D.	.0077407	.5438091	0.01	0.989	-1.058105	1.073587
lnREER						
LD.	-1.157406	.4966604	-2.33	0.020	-2.130842	-.1839694
L2D.	.2874401	.6322056	0.45	0.649	-.9516601	1.52654
L3D.	.9391249	.4109895	2.29	0.022	.1336004	1.744649
_cons	.0148439	.0932879	0.16	0.874	-.167997	.1976848

--more--

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnCPI						
_ce1						
L1.	-.1436108	.1374742	-1.04	0.296	-.4130554	.1258338
lnCPI						
LD.	.2236437	.2680148	0.83	0.404	-.3016556	.748943
L2D.	-.225237	.286164	-0.79	0.431	-.7861081	.3356341
L3D.	-.1751639	.4184218	-0.42	0.675	-.9952556	.6449278
lnRGDP						
LD.	-.1662235	.3136601	-0.53	0.596	-.7809859	.4485389
L2D.	.5173596	.6476751	0.80	0.424	-.7520601	1.786779
L3D.	-.1222791	.6514379	-0.19	0.851	-1.399074	1.154516
lnGNS						
LD.	-.0812766	.2315624	-0.35	0.726	-.5351305	.3725773
L2D.	-.1464843	.1840427	-0.80	0.426	-.5072013	.2142327
L3D.	-.0658112	.1389478	-0.47	0.636	-.3381438	.2065214
lnALR						
LD.	.0470278	.2859151	0.16	0.869	-.5133554	.607411
L2D.	.4307835	.2620181	1.64	0.100	-.0827626	.9443297
L3D.	.0754204	.2608741	0.29	0.773	-.4358835	.5867243
lnREER						
LD.	-.0238977	.2382562	-0.10	0.920	-.4908711	.4430758
L2D.	.3753763	.3032794	1.24	0.216	-.2190404	.9697929
L3D.	-.0631493	.1971584	-0.32	0.749	-.4495726	.3232741
_cons	.0354019	.0447517	0.79	0.429	-.0523099	.1231137

--more--

APPENDIX G: TheRegressed Variables

```
. reg lnRGDP lnGNS lnCPI lnALR lnREER
```

Source	SS	df	MS		
Model	19.0890229	4	4.77225572	Number of obs	= 38
Residual	.598932258	33	.018149462	F(4, 33)	= 262.94
				Prob > F	= 0.0000
Total	19.6879551	37	.532106895	R-squared	= 0.9696
				Adj R-squared	= 0.9659
				Root MSE	= .13472

lnRGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnGNS	.4954262	.0711221	6.97	0.000	.3507272	.6401251
lnCPI	.3257895	.0793941	4.10	0.000	.1642609	.4873181
lnALR	-.2916026	.140853	-2.07	0.046	-.5781701	-.0050351
lnREER	.0430194	.0988493	0.44	0.666	-.1580911	.2441298
_cons	9.862726	1.341007	7.35	0.000	7.134426	12.59103

```
. reg lnGNS lnRGDP lnCPI lnALR lnREER
```

Source	SS	df	MS	Number of obs =	38
				F(4, 33) =	191.18
Model	33.6567346	4	8.41418365	Prob > F =	0.0000
Residual	1.45240536	33	.044012284	R-squared =	0.9586
				Adj R-squared =	0.9536
Total	35.10914	37	.948895675	Root MSE =	.20979

lnGNS	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnRGDP	1.201404	.1724704	6.97	0.000	.8505103	1.552298
lnCPI	.0253203	.1518746	0.17	0.869	-.2836709	.3343115
lnALR	.3194792	.2264208	1.41	0.168	-.1411773	.7801357
lnREER	-.1785972	.15121	-1.18	0.246	-.4862362	.1290419
_cons	-5.364897	3.261406	-1.64	0.109	-12.00028	1.270484

```
. reg lnCPI lnRGDP lnGNS lnALR lnREER
```

Source	SS	df	MS	Number of obs =	38
				F(4, 33) =	115.85
Model	26.7708474	4	6.69271184	Prob > F =	0.0000
Residual	1.9065047	33	.05777287	R-squared =	0.9335
				Adj R-squared =	0.9255
Total	28.6773521	37	.775063569	Root MSE =	.24036

lnCPI	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnRGDP	1.037044	.2527253	4.10	0.000	.5228707	1.551218
lnGNS	.0332368	.1993587	0.17	0.869	-.3723616	.4388351
lnALR	.5876688	.2467582	2.38	0.023	.0856355	1.089702
lnREER	.1857723	.1738853	1.07	0.293	-.168	.5395445
_cons	-19.52352	1.88593	-10.35	0.000	-23.36047	-15.68657

APPENDIX H: Diagnostic Test

Multicollinarity Test

```
estat vif
```

Variable	VIF	1/VIF
lnCPI	9.96	0.100403
lnGNS	9.79	0.102196
lnALR	2.44	0.409590
lnREER	1.90	0.527122
Mean VIF	6.02	

Breusch- Godfrey Serial Correlation LM Test

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
lnGNS	1	.	.	.	.	.
lnRGDP	-.1673864	.1808155	-0.93	0.355	-.5217782	.1870054
lnCPI	-.5746592	.1317273	-4.36	0.000	-.83284	-.3164785
lnALR	-.1502657	.1192207	-1.26	0.208	-.383934	.0834026
lnREER	.165477	.0696799	2.37	0.018	.0289069	.302047
_cons	-12.7603	.	.	.	.	.

. veclmar

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	18.8639	25	0.80360
2	26.0372	25	0.40562

H0: no autocorrelation at lag order

Jarque-Bera Normality Test

Jarque-Bera test

Equation	chi2	df	Prob > chi2
D_lnRGDP	11.234	2	0.00363
D_lnGNS	1.288	2	0.52531
D_lnCPI	2.963	2	0.22725
D_lnALR	2.157	2	0.34010
D_lnREER	0.888	2	0.64138
ALL	18.531	10	0.04665

Jarque-Bera test

Equation	chi2	df	Prob > chi2
D_lnGNS	0.313	2	0.85524
D_lnRGDP	0.627	2	0.73084
D_lnCPI	2.963	2	0.22725
D_lnALR	2.157	2	0.34010
D_lnREER	0.888	2	0.64138
ALL	6.949	10	0.73029

Jarque-Bera test

Equation	chi2	df	Prob > chi2
D_lnCPI	5.830	2	0.05421
D_lnRGDP	4.072	2	0.13052
D_lnGNS	1.554	2	0.45968
D_lnALR	2.157	2	0.34010
D_lnREER	0.888	2	0.64138
ALL	14.502	10	0.15130

APPENDIX I: TheTime Series Data Used for the Study

Year	GNS (In millions)	RGDP (in millions)	CPI	ALR	REER
1980	15,237	113,795	9	8.8	177.3
1981	17,413	115,224	9.5	8.8	162.6
1982	14,738	115,111	10	8.8	179.2
1983	16,647	126,707	10	8.8	194.3
1984	23,275	118,729	10.9	8.8	196.4
1985	12,461	107,221	13.2	8.8	239.3
1986	27,554	117,837	11.6	8.8	246.6
1987	24,681	134,380	11.1	6.8	204.8
1988	34,258	134,309	11.8	6.8	186.8
1989	27,308	134,767	13.1	6.8	188
1990	24,858	140,248	13.8	6.8	201
1991	13,565	135,165	20	6.8	231.4
1992	16,350	130,177	20.4	6.8	284.8
1993	33,679	145,799	21.3	14.9	170.5
1994	30,407	148,276	22.7	14	123.4
1995	46,878	156,247	26.1	14.58	112.5
1996	49,085	172,839	23.7	15.08	104.5
1997	46,035	180,911	23.1	15.5	102.7
1998	49,049	178,301	23.1	11.6	119.5
1999	30,167	188,990	25.5	11.75	113
2000	39,856	198,963	26	12	99.5
2001	47,960	215,629	23.2	12.75	99.98
2002	41,706	218,873	22.9	10.75	93.3
2003	43,220	214,132	27	10.75	98.9
2004	62,543	243,526	27.6	10.75	99.2
2005	65,640	272,142	30.6	10.5	94.1
2006	66,922	301,468	33.9	10.5	107.4
2007	92,239	335,919	39	10.5	121.3
2008	86.462	372,014	60.6	11.5	136
2009	93,152	404,338	62.2	12.25	185.5
2010	112,982	455,539	66.8	12.25	141.75
2011	161,984	515,079	92.2	11.88	121
2012	171,434	559,622	114.4	11.88	150
2013	174,031	618,842	119.6	11.88	161.5
2014	206,587	682,358	129.7	11.88	173.4
2015	236,702	753,230	143.3	11.88	135.9
2016	495,718	983,274	154	12.75	159.7
2017	545,219.5	991,782	164	12.75	169.7
Source	NBE	NBE	CSA	NBE	NBE