



ADDIS ABABA UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
DEPARTMENT OF STATISTICS

SOME ECONOMIC FACTORS ASSOCIATED WITH ECONOMIC GROWTH OF ETHIOPIA

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A thesis submitted to the Department of Statistics, College of Natural and Computational Sciences, Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Statistics (Applied Statistics)

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Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged

Declared by

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Signature

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Acronym

ADF	Augmented Dickey-Fuller (ADF)
MOFEC	Ministry of Finance and Economic Cooperation
ML	Maximum Likelihood
NBE	National Bank of Ethiopia
IMF	International Monetary Fund
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
DW	Durbin-Watson
GNP	Gross National Product
INF	Inflation Rate
OLS	Ordinary Least Squares
RGDP	Real Gross Domestic Product
EXP	Export
IMP	Import
MLRM	Multiple Linear Regression Model
INF	Inflation Rate
CSA	Central Statistics Agency
GDS	Gross Domestic Saving

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Abstract

This study aims to identify some economic factors associated with the economic growth of Ethiopia using annual data from 1975 to 2019. Although Gross Domestic Product (GDP) is one of the determinants of a country's economic growth, in this study the gross domestic product is considered as a measure of economic growth. This study investigates empirically the association of economic growth as measured by gross domestic product and variables such as gross domestic saving, imports, exports and the inflation rate. The study used the Johnson co-integration, Vector Error correction model (VECM), Granger causality tests to analyze long-run and short-run relationships between variables. The variables were non-stationary in the level but stationary after the first-difference. The results show that there is a significant association observed between import, inflation, export, gross domestic saving and real gross domestic product. Gross domestic saving granger causes imports. The real gross domestic product granger causes the inflation rate, exports, and domestic savings significantly. The results of ECM show that the model explains 61.2% of the variation in GDP. The policymakers should focus on promoting economic growth by revisiting policies to monitor inflation, export, and gross domestic saving since they are some of the strategies to boost the economic growth of Ethiopia.

1. Introduction

1.1 Background of the Study

The impact of saving on economic growth draws international attention among researchers and policymakers from both developed and developing countries. The neoclassical growth model led by Solow (1956) reveals a clear connection between saving and economic growth. The models show that higher saving leads to higher investment which intern leads to higher economic growth.

Economic growth is one of the indicators of economic progress. The world is working to achieve higher economic growth as economic growth is the common key target for the countries to raise their social welfare. Low saving rates have been identified as one of the big challenges for the growth process, especially in developing countries like Ethiopia (Schmid et al,1992).

Savings have long been considered as an engine for economic growth. A study conducted in China (Chow, 1993) evidenced that countries that had made the sustained accumulation of fixed capital have been able to achieve higher and sustained economic growth and development than other countries.

Savings caused by economic growth has been a serious theoretical as well as an empirical debate among researchers. In classical theory, an increase in savings will lead to an increase in the output (Krieckhaus, 2012)

Lin (1992) suggested that the economic development of a country depends largely on its ability to mobilize the necessary savings to finance capital formation to raise the nation's productive capacity.

Policymakers, including the World Bank, have long advocated policies that lead to higher savings to boost economic growth for developing countries. That is why the World Bank regularly recommends developing countries to adopt policies that increase the saving rate for those countries to achieve a higher rate of economic growth (World Bank, 1992).

Ethiopia is one of the low-income sub-Sahara, African countries that need fast and sustainable economic growth. However, a low domestic saving rate is consistently cited as one of the most serious constraints to sustainable economic growth. The rate of gross domestic saving was 22.4

percent of GDP in 2015/16; whereas the share of gross domestic investment to GDP was 38.5 percent in 2015/16 and the resource gap (trade deficit) was 19.8 at the same time (MoFEC, 2016)

1.2. Statement of the Problem

Savings play an important role in the economic growth and development process in Ethiopia. Savings determines the national capacity to invest and thus to produce, which in turn, affects the economic growth potential of the country. Low saving rates have been cited as the major problem hindering Ethiopia's attempt to accelerate growth and development for capital formation. Inadequate capital formation to undertake real investment has adversely affected the output level of the economy. Lack of adequate capital formation results from the non-availability of credit to add to existing ones. Therefore, savings in Ethiopia is a very critical and reliable factor in the capital formation process. Capital formation, whether financed from internal domestic saving or external sources, requires the mobilization of economic surpluses.

Sajid and Sarfraz (2008) examine the causal relationship between saving and economic growth showing that saving provides useful information which economic variable(s) that the government and relevant authorities need to control for achieving a desired level of variables. The relationship between savings and economic growth has significant implications for the state of the economy.

Determining the direction of the causal link between saving and growth is a crucial economic problem as it has important policy implications for developing countries.

1.3. The objective of the Study

The objective of this thesis is to identify some economic factors associated with the economic growth of Ethiopia

1.4. Significance of the study

Knowledge of the extent to which saving impacts on economic growth is a principal agenda to both the policymakers and the academicians. The findings of this study may provide useful information to the empirical basis needed for a proper understanding of the previous routes as well as emphasize future process on saving issues.

2. Literature Review

2.1. Theoretical Literature Review

Theoretical postulations on the relationship between saving and economic growth started during the time of Adam Smith (Tang & Tan, 2014). Adam Smith argues that the economy needs industrialization to achieve economic growth. According to him, capital accumulation is strongly and positively related to the rate of saving. This means society can only accumulate capital through increased savings. We, therefore, expect a higher saving rate that will lead to an increase in capital accumulation and, consequently, higher economic growth following the thought of Adam Smith.

Jagadeesh (2015) examined the impact of savings on economic growth in Botswana from 1980 to 2013 using the Auto-Regressive Distributed Lagged (ARDL) model and DOLS test to check the existence of a long-run relationship between GDP and GDS through identified dynamic long-run co-integration between GDP and its independent variables. She supported the Harrod-Domar growth model that saving positively or directly related to GDP.

Odionye and Ugwuegbe (2016) examined the causal relationship between domestic private savings and economic growth in Nigeria for the period of 1980 to 2013. The study employed the augmented Granger causality test approach. The result showed a strong unidirectional causality from domestic private savings to economic growth in Nigeria. The result supported the Solow's hypothesis. Also, the evidence from the Johansen co-integration result indicated that there is a positive long-run relationship between domestic savings and economic growth.

Hashmi and Sedai (2016) investigated the relationship between domestic saving and economic growth in India by employing the ARDL model and Granger causality test. They confirmed that the existence of bi-directional granger causality between domestic savings rate and GDP growth for India. It is in line with both the Keynesian hypothesis and Solow growth theory.

Pickson et al (2017) studied the relationship between gross domestic savings and economic growth in Ghana 1972 to 2013 using the Johansen co-integration test and VAR technique. They found that there was a unidirectional line of causation running from gross domestic savings to economic growth in the short run.

Patra et al (2017) examined the association and direction of causality between savings and real economic activity in the Indian context for the period 1950–51 to 2011–12 by employed Johansen and Juselius (1990) and Johansen (1991) and vector error correction mechanism (VECM). The study identifies the structural break in the year 1980 by employing the Bi-Perron test with unknown time. They revealed that saving and real economic activity has long-run relationships in both the pre and post-break period and the causality results obtained under the VECM framework reveals that in the long run, saving causes economic growth while in the short run economic growth causes saving.

Steven and Nelson (2011) mentioned that China's high saving rate is the engine for its economic growth. Markin (2006) also reported that a high level of saving and investment is good for a country because it will accumulate the capital stock and hence increase the economic growth

2.2 Empirical Literature in Ethiopia

Ibrahim (2014) found that there was unidirectional causality that runs from economic growth to savings both in the long run and short run using annual data from 1975 to 2013 by employing Johansen co-integration method and the Granger causality test to examine the causal relationship between savings and economic growth in Ethiopia.

Lambamo (2017) investigated the interplay between savings, inflation, and economic growth by applying the 2SLS technique within the framework of the simultaneous equation and OLS model using time series data from 1981 to 2015 to estimate the threshold level of inflation that is consistent for the economic growth of Ethiopia.

Getenet (2017) examined the trends and determinants of gross domestic savings (GDS) using economic growth rate as one of the explanatory variables of gross domestic savings. He employed the co-integration and error correction model via annual time series data for the period 1980-2014. The study revealed that the economic growth rate was insignificant to boost gross domestic saving but he did not conclude that saving was not contributed to economic growth in Ethiopia.

Zelalem (2017) The gross domestic savings and economic growth in Ethiopia using annual time series data (1976 to 2017) obtained from MoFEC and annual reports of NBE the study employed recently developed methods of autoregressive distributed lag (ARDL) approach to cointegration test and the augmented Granger causality test. The show significant evidence that gross domestic

savings and economic growth are cointegrated, and therefore hold a long-run relationship exists between them. The Error correction model also identified the presence of a short-run relationship. The Toda and Yamamoto version of the Granger causality test reveals that causality runs from economic growth to gross domestic savings, implying that economic growth.

Orji & Mba (2011) in their study looked at the relationship between FPI, capital formation, and growth, in Nigeria using the two-stage least squares (2SLS) method of estimation. The study found that the long-run impact of capital formation and foreign private investment on economic growth is larger than their short-run impact. There is thus, a long-run equilibrium relationship among the variables as the error correction term is significant, but the speed of adjustment is small in both models. The study showed no simultaneity between GDP growth and the capital formation model. These findings, therefore, have some policy implications as discussed in the work.

Adekunle & Aderemi (2012) examined the relationship between domestic investment, capital formation, and population growth in Nigeria. Their result showed that the rate of investment does not support the rate of growth of per capita GDP in Nigeria. The paper tests on the curve estimation regression models confirm that growth is in existence but is found to be insignificant. The linear result indicates the importance of government expenditure, capacity utilization, and bank credit in increasing the income of Nigerians. The results also show that there is a negative relationship between the growth rates of the population and capital formation.

3. Data and Methodology

3.1. Source of Data

Time series data on savings and economic growth covering the period time from 1975 to 2019 were used to analyze some economic factors associated with the economic growth of Ethiopia. The secondary data were collected from the National Bank of Ethiopia and Central statistics Agency. The variables included in this study are gross domestic product, gross domestic saving, export, import, inflation rate.

3.2. Description of the Research Variables

Gross Domestic Product (GDP): Gross domestic product is the general index of economic development. It shows how inefficiency of savings and investment affects economic growth and it was used based on the existing literature and as the main determinant of economic growth is measured by gross domestic product. This refers to the market or money value of all goods and services produced in a country at a particular period. GDP measures the economic size of a country.

Exports (EXT) are defined as the total exports of goods and services to the rest of the world. It is believed that the export of a country is one of the macroeconomic determinants of economic growth. For this reason and due to researcher interest this variable is entered as explanatory to analyze its effect on Ethiopian economic growth. The expected sign of this variable is expected to be positive (Brooks,2012).

Gross Domestic Saving (GDS): The Gross domestic savings increase the growth of domestic's production has increased. It measures the volume of savings that flows to the private sector of the economy for investment.

Import: -If the increase of import the economic growth of a country is increasing because there is a gain of the raw material for constriction from a foreign country then it increases economic growth in the country. It is expected to have a positive impact on economic growth (Brooks,2008)

The Inflation Rate is the annual percentage change in the consumer price index (CPI). CPI measures changes in the prices of goods and services that households consume. Such changes affect has real purchase Power of consumer's incomes and welfare. The inflation rate has a negative relationship with aggregate savings according to Hussain and Brookin (2001).

3.3 Methodology

Multivariate time series involves a vector of time series data that will be modeled simultaneously. Multivariate time series analysis is used to model and explain the interactions and co-movements among a group of time series variables. The methodology adopted in this study follows the vector error correction model (VECM).

3.3.1 Stationary test

To test for the stationarity of the data Augmented Dickey-Fuller (ADF) test will be adopted. The first step is to test for stationarity at the level. If the variable is not stationary, then the next step is to difference and test for the stationarity of the differenced variables. If the variables are stationary after the first differencing, then the variables are co-integrated. After that, the co-integration regression will be obtained from the normalized coefficients of the model generated from the co-integrating vector. Based on this the error correction mechanism which determines the speed of adjustment to the equilibrium will be estimated (Gujarati, 2003).

3.3.2 Unit Root Test

There are many tests to investigate whether time series data are stationary or not. These include the Dickey-Fuller (DF), the Augmented Dickey-Fuller (ADF) test, and the Phillips-Peron test. This study employed the Augmented Dickey-Fuller (ADF) test to determine the existence of a unit root (non-stationarity) of the variables. Before testing the stationarity of the variables, they are transformed into their log form because log transformation is best to show their growth rate over time. This test is preferred due to characters such as uniformity and precision. According to the test of stationarity of the variables deploying the Augmented Dickey-Fuller test reveals that the variables are non-stationary at levels. Meaning that; they have a unit root at their levels. Therefore, variables must be changed to the first difference because the variable will be the stationarity. Variables that have unit root must be changed to the first difference if not the regression becomes spurious. The Augmented Dickey-Fuller (ADF) test shows that the variable and the unit-roots in their level. So, variables are changed to their first difference. In the presence of unit-roots, the variables need to be differenced for the series to be stationary. Without differencing the time series data, a causality test would lead to misspecification (Gujarati,2003).

3.3.3 Co-integration Tests

This involves testing for the presence or otherwise of co-integration between the series of the same order of integration through forming a co-integration equation. The basic idea behind co-integration is that if in the long-run, two or more series moves closely together, even though the series themselves are trended, the difference between them is constant. It is possible to regard these series as defining a long-run equilibrium relationship, as the difference between them is stationary (Hall,1978). Dickey et.al, (1981), noted that a lack of co-integration suggests that such variables have no long-run relationship.

3.3.4 The Vector Error Correction Model (ECM)

If co-integration is proven to exist, then the third step requires the construction of an error correction mechanism to model dynamic relationships. The purpose of the error correction model is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. However, the greater the coefficient of the parameter the higher the speed of adjustment of the model from the short-run to the long-run equilibrium. The individual influence of the co-integrated variables can only be separated with an error correction mechanism through an error correction model.

The VECM specification (Brooks, 2002), which may be specified as:

$$\Delta Y_t = c + \sum_{i=1}^{k-1} \beta_i \Delta X_{t-1} + \Omega ECT_{t-k} + \epsilon_{ti}$$

Where Y_t is a vector of endogenous dependent variables,

$k-1$ is the lag length, c is constant,

ΔX_{t-1} is a deference of explanatory variables,

β_i =Coefficients of the model adjustment to long-run equilibrium,

Ω =speed of adjustment parameter, ECT =error correction term,

ϵ_{ti} =residual and often called white noise, stochastic error,

3.3.5 Model Stability and Residual Diagnostic tests

To check the variability of the estimated long-run model, a residual diagnostic test is undertaken. A diagnostic test is an important concept in model selection. The vector error corrected (VEC) model should pass diagnostics tests like the serial correlation test, heteroscedasticity test, and normality test to say the correct model is selected based on selection criteria.

Serial Correlation test: In time series analysis the selected model should satisfy the assumption of no serial correlation unless adding lags of variables to remove serial correlation. To test the existence of serial correlation in the VEC model LM test was considered. The null hypothesis stated here is that the residuals are not serially correlated against there is a serial correlation on the alternative hypothesis. To say the model well done the null hypothesis should not be rejected (Andrei and Andrei,2015).

Heteroskedasticity test: The other diagnostic test is the heteroskedasticity test which is used to test the homoscedasticity of residuals in the model. The null hypothesis states that the residuals are homoscedastic against the alternative the residuals are heteroskedastic.

A normality test: To test the normality Jarquebera test was considered. The null hypothesis stated that the residuals are normally distributed against the residuals are not normally distributed.

Stability test: To test the stability of the reduced VECM test of Roots of Characteristic Polynomial considered. If the moduli of the eigenvalues are less than one, then the VAR(p) process is stable.

3.3.6 Granger causality

Granger causality is a way to investigate causality between two variables in a time series. The method is a probabilistic account of causality; it uses empirical data sets to find patterns of correlation. Causality is closely related to the idea of cause-and-effect, although it is not the same. A variable X is causal to variable Y if X is the cause of Y or Y is the cause of X. However, with Granger causality, you are not testing a true cause-and-effect relationship; what you want to know is if a particular variable comes before another in the time series. In other words, if you find Granger causality in your data there is not a causal link in the true sense of the word (for example, sales of Easter baskets Granger-cause Easter!). Note: When econometricians say cause what they mean is Granger-cause although a more appropriate word might be precedence (Goldstein and Khan,1985).

3.3.7 Impulse Response Analysis

The responsiveness of the dependent variable in the VAR to shocks to each of the other variables trace value with impulse response analysis. For each variable from the equations separately, a unit or one-time shock is applied to the forecast error and the effects upon the VAR system over time are observed. The impulse response analysis is applied on the VECM and, provided that the system is stable, the shock should gradually die away (Brooks, 2002).

3.3.8 Variance Decomposition Analysis

Variance decomposition analysis measures the proportion of forecast error variance in a variable that is explained by impulses in itself and the other variables. It provides the proportion of the movements in the dependent variables that are due to their shocks versus shocks to the other variables (Brooks, 2002).

4. Results and Discussion

4.1 Descriptive Statistics of the Data.

The descriptive statistics for the dependent and independent variables are presented below. The dependent variable is economic growth measured by GDP while independent variables are gross domestic saving, inflation rate, export, and import.

Table 4.1 The descriptive statistics of the variables

statistics	LRGDP	LINF	LIM	LGDS	LEX
Mean	12.54730	2.759354	9.319034	10.19523	8.244122
Median	12.03123	2.696386	8.911511	9.903187	8.156403
Maximum	14.44395	4.971894	12.95651	13.19995	11.22419
Minimum	11.48916	0.965412	6.505481	8.388752	5.631305
Std. Dev.	1.007571	1.048785	2.087576	1.192763	1.736322
Skewness	0.534354	0.466849	0.417631	1.048642	0.490678
Kurtosis	1.733100	2.430968	1.829426	3.378205	1.887136
Jarque-Bera	5.150943	2.241731	3.877325	8.515575	4.127856
Probability	0.076118	0.325998	0.143896	0.014154	0.126954
Sum	564.6284	124.1709	419.3565	458.7855	370.9855
Sum Sq. Dev.	44.66881	48.39780	191.7509	62.59812	132.6518

4.2. Augmented Dickey-Fuller Unit Root Tests

The test was the ADF test. First, it is tested with constant, and then it is tested with constant and trend.

Table 4.2: The ADF Unit Root Test Result for original Series (level)

Variables	Intercept		Intercept and trend	
	t-statistics	Probability	t-statistics	Probability
LRGDP	1.365815	0.9986	-1.772115	0.7012
LINF	0.776365	0.9925	-0.680050	0.9684
LIM	0.837965	0.9936	-1.693553	0.7374
LGDS	1.004208	0.9959	-1.450915	0.8309
LEX	-0.142964	0.9380	-2.351307	0.3989
Critical value (1%)	-3.58851		-4.180911	
Critical value (5%)	-2.92973		-3.515523	
Critical value (10%)	-2.60306		-3.188259	

Null hypothesis (Ho) states that the series is not stationary tested against the alternative hypothesis (Ha) which states that the series is stationary. The results found in Table 4.2 are the values of the test statistic are less than the absolute value of the calculated test statistic at 5% level of significance, thus null hypothesis is not rejected and the time series has a unit root. In other words, the series is non-stationary. The stability of the series can be checked alternatively by p-value which is larger than the absolute value of at 5% level of significance.

Table 4.3: The ADF Unit Root Test Result for differenced Series (first difference)

Variables	Intercept		Intercept and trend	
	Test Statistics	One side p-value	Test Statistics	One side p-value
LRGDP	-5.841102	0.0000	-6.272670	0.0000
LINF	-5.776321	0.0000	-5.810152	0.0000
LIM	-6.683825	0.0000	-6.793777	0.0000
LGDS	-8.710789	0.0000	-9.292646	0.0000
LEX	-7.937553	0.0000	-7.939827	0.0000
Critical value (1%)	-3.58851		-4.180911	
Critical value (5%)	-2.92973		-3.515523	
Critical value (10%)	-2.60306		-3.188259	

The result in table 4.3 above show that the data are stationary after 1st difference, i.e. the absolute t-statistic is more than the critical value and the p-value is less than 5% thus hypothesis is rejected, hence the series is stationary.

4.3. Specification of Order the VAR

Table 4.4 provides the result of the lag length selection criterion was tabulated. The LR, FPE, and HQ test suggest that the appropriate lag length for the VAR model is one (1). That is, the best fitting model is the one that minimizes AIC or SC or HQ where the third row in Table 4.4 indicates that the optimal lag length for the VAR model selected by the criterion is equal to one because of the most minimum value in the third row.

Table 4.4: VAR lag order selection results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-102.2098	NA	0.000128	5.229746	5.229746	5.305842
1	75.17332	302.8492*	7.68e-08*	-2.203577	-0.949743*	-1.747000*
2	97.02040	31.97133	9.48e-08	-2.049776	0.248919	-1.212718
3	118.6659	26.39701	1.30e-07	-1.886144	1.457411	-0.668605
4	150.5565	31.11274	1.27e-07	-2.222269*	2.166148	-0.624250

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

4.4. VAR Lag Exclusion Wald Test

It should be checked whether the lag-1 (chosen as optimal) of all variables are jointly important and hence should be included in the estimation of the VECM /VAR model. This can be done by using the Wald lag exclusion test. The result is presented in Table 4.5.

Table 4.5: VAR Lag Exclusion Wald test result.

Chi-squared test statistics for lag exclusion:					
	D(LGDS)	D(LINF)	D(LIM)	D(LEX)	Joint
DLag1	3.689975	12.03539	5.426284	3.987987	39.05166
p-values	0.449586	0.017090	0.246286	0.407634	0.001069
Df	4	4	4	4	16

4.5. Johansen Approach Co-integration Test

The Johansen co-integration test which is applied to the predetermined lag one. In this test, the maximum eigenvalue statistic or trace statistic is compared to special critical values and their probability values.

Table 4.6 Johansen co-integration test

Hypothesized No. of CE(s)	eigenvalues	Trace statistics			Maximum Eigen statistics		
		Trace Statistics	0.05 critical value	Prob.**	Max-Eigen Statistic	0.05 Critical Value	Prob.
None *	0.597736	105.4569	88.80380	0.0019	39.15781	38.33101	0.0401
At most 1 *	0.547195	66.29908	63.87610	0.0308	34.06864	32.11832	0.0285
At most 2*	0.298699	32.23043	42.91525	0.3761	15.25719	25.82321	0.6113
At most 3 *	0.187107	16.97325	25.87211	0.4170	8.907684	19.38704	0.7339
At most 4 *	0.171030	8.065563	12.51798	0.2464	8.065563	12.51798	0.2464

Max-eigenvalue test indicates 2 co integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

The results of co-integration tests for RGDP and GDS are reported in Table 4.6. The trace statistics and the Max-Eigen statistics are greater than the critical value at a 5% significance level, the above results indicate that the variables are co-integrated and there is one cointegrating equation at a 5 percent level of significance. So, these indicators that there is a long-run equilibrium relationship between the two-time series and the existence of causality in at least one direction. Therefore, this implies that there is a positive long-run relationship between RGDP and GDS.

4.6: Correlation matrix

We use the correlation matrix table to test for multicollinearity among the variables. Gujarati, (2004) states that two explanatory variables are said to be multicollinear if the pairwise correlation coefficient of the variables is more than 0.9.

Table 4.7: Correlation matrix

Variable	LRGDP	LINF	LGDS	LIM	LEX
LRGDP	1.000000	0.080591	0.185062	-0.038954	0.244445
LINF	0.080591	1.000000	0.071282	-0.012234	-0.057058
LGDS	0.185062	0.071282	1.000000	0.395589	0.301145
LIM	-0.038954	-0.012234	0.395589	1.000000	0.368420
LEX	0.244445	-0.057058	0.301145	0.368420	1.000000

As a result, Table 4.6 shows, that there is no multicollinearity among the variables.

4.7 Diagnostic Tests

4.7.1 Serial Correlation LM Test

Table 4.8 Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test			p-value
F-statistic	65.38240	Prob. F (2,38)	0.0000
Obs*R-squared	34.86756	Prob. Chi-Square (2)	0.0000

The null hypothesis of no serial correlation (Brush Godfray LM test) is rejected for the reason that the P-values associated with test statistic is less than the standard significant level, therefore, the model has a serial correlation

4.7.2 Heteroskedasticity Test

Null hypothesis(H_0): Homoscedasticity is present

The alternative hypothesis(H_1): Heteroscedasticity (no homoscedasticity)

Table 4.9 Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	2.005498	Prob. F (4,40)	0.1122
Obs*R-squared	7.517174	Prob. Chi-Square (4)	0.1110
Scaled explained SS	4.354463	Prob. Chi-Square (4)	0.3602

Do not reject H_0 since the p-value is greater than the significance level of 0.05. There is insufficient evidence to conclude that the model has heteroscedasticity. Therefore, the model's assumption of homoscedasticity is met.

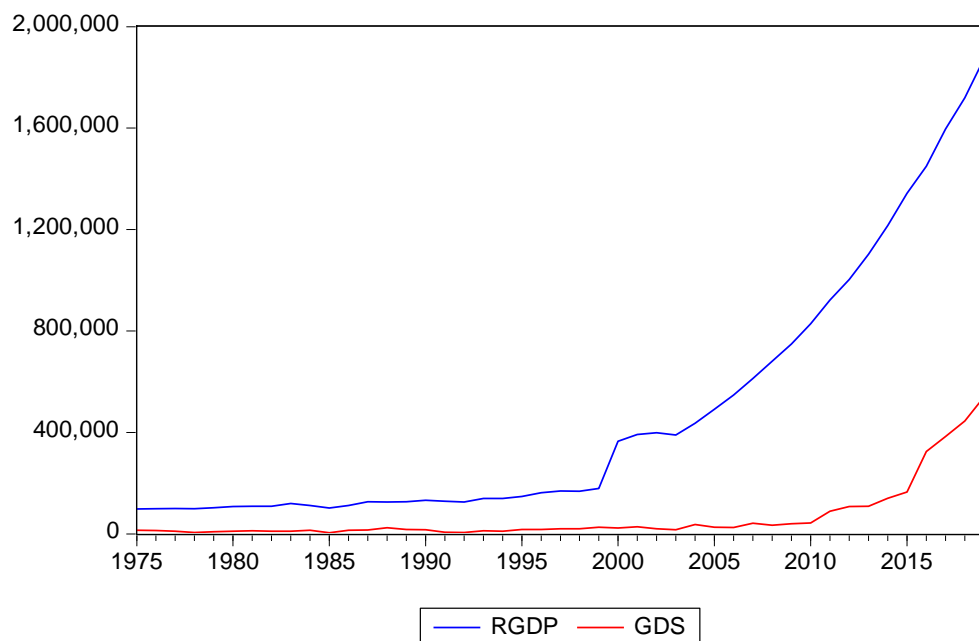


Figure 4.1. The trend of saving in economic growth (in millions of birr vs Years)

4.8. Test for Vector Error Correction Model

A vector error correction model is a restricted VAR model that has co-integration restrictions built into the specification. It is designed for use with non-stationary series that are known to be co-integrated. The vector error correction 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-integrating term (the error correction term) corrects the deviation from the long-run equilibrium gradually through a series of partial short-run adjustments. We use the VEC model because the unit root test results showed that the data series is not stationary in their levels, but are in their first differences, therefore we need to test if the variables are co-integrated and if there is a long-run relationship between them.

4.9 Estimation of long-run model

After confirming the existence of long-run co-integration relationship among the variables, the next step is running the appropriate VEC model to find out the long-run coefficients

Table 4.10 Results of the estimated long-run model

Variable	Coefficient	Std. Error	t-Statistic	p-value
LINF	-0.318519	0.129833	-2.453303	0.0186
LIM	0.596353	0.104101	5.728590	0.0000
LGDS	0.126083	0.061761	2.041452	0.0478
LEX	-0.039821	0.085659	-0.464877	0.6445
C	6.911616	0.451187	15.31874	0.0000
R-squared	0.970270	Mean dependent var		12.54730
Adj R-squared	0.967297	S.D. dependent var		1.007571
S.E. of regression	0.182209	Akaike info criterion		-0.462881
Sum squared resid	1.328011	Schwarz information criterion		-0.262141
Log-likelihood	15.41482	Hannan-Quinn criterion		-0.388047
F-statistic	326.3588	Durbin-Watson stat		0.992137
Prob(F-statistic)	0.000000			

$$RGDP_t = 6.911616 - 0.318519LINF + 0.596353LIM + 0.126083LGDS - 0.039821LEX$$

From the above result, we see that only export has no significant effects on GDP while import, gross domestic saving, the inflation rate has significant effects on economic growth. The overall measure of savings acts as a major booster of output growth in Ethiopia. A 1% percent increase in saving leads to GDP by 12.6 %. The result supports the Harrod-Domar model which asserts that the growth rate of income directly or positively is related to the saving. The result shows a positive relationship between economic growth and import. The positive relationship between import and economic growth. Export has an insignificant impact on Ethiopian economic growth.

4.10 Estimation of error correction model (ECM)

An error correction model belongs to a category of time series models most commonly used for data where the underlying variables have a long-run stochastic trend, also known as co-integration. ECMs are a theoretically-driven approach useful for estimating both short-term and long-term effects of one-time series on another. The term error-correction relates to the fact that last-periods deviation from a long-run equilibrium, the error, influences its short-run dynamics. The error

correction term (ECM), indicates the speed of adjustment to restore equilibrium in the dynamic model. It is a 1-lagged period residual obtained from the estimated dynamic long-run model.

Table: 4.11 Short-run coefficients

Variables	Coefficients	Standard Error	t-value
CointEq1	0.005551	0.00529	1.04896
D (RGDP (-1))	0.188872	0.17494	01.07961
D (INF (-1))	1934.724	1541.03	1.25547
D (IM (-1))	0.173109	0.74589	0.23208
D (GDS (-1))	0.295617	0.25285	1.16913
D (EX (-1))	1.802839	0.89044	0.89044
C	21022.27	10920.6	1.92501
R-squared	0.667633		
Adj. R-squared	0.612238		
F-statistic	12.05232		

The results of ECM estimation in Table 4.11 show that the model explains 61.2% of the changes in GDP and the remaining 38.8% is contributed by other variables outside the model or that are captured by the error term.

4.11 Granger causality

Granger causality test is considered a useful technique for determining whether a one-time series is good for forecasting the other. The concept of the Granger causality test is explored when the cosecants of the lagged of the other variables is not zero.

Table 4.12 Granger causality

Null Hypothesis	F-Statistic	Prob.
LINF does not Granger Cause LRGDP	1.47727	0.2312
LRGDP does not Granger Cause LINF	4.30090	0.0444
LIM does not Granger Cause LRGDP	9.65035	0.0034
LRGDP does not Granger Cause LIM	0.74861	0.3920
LGDS does not Granger Cause LRGDP	0.02603	0.8726
LRGDP does not Granger Cause LGDS	9.55053	0.0036
LEX does not Granger Cause LRGDP	1.13134	0.2937
LRGDP does not Granger Cause LEX	6.72641	0.0131
LIM does not Granger Cause LINF	4.62683	0.0374
LINF does not Granger Cause LIM	0.56578	0.4562
LGDS does not Granger Cause LINF	0.22729	0.6361
LINF does not Granger Cause LGDS	14.9745	0.0004
LEX does not Granger Cause LINF	2.46319	0.1242
LINF does not Granger Cause LEX	6.13424	0.0175
LGDS does not Granger Cause LIM	10.6013	0.0023
LIM does not Granger Cause LGDS	13.1383	0.0008
LEX does not Granger Cause LIM	0.47750	0.4935
LIM does not Granger Cause LEX	12.9605	0.0009
LEX does not Granger Cause LGDS	11.8555	0.0013
LGDS does not Granger Cause LEX	0.12667	0.7237

Ho: No Causality vs H₁: Causality; as shown from table 4.12 the Real Gross Domestic Product granger causes the inflation rate, exports granger causes gross domestic saving, imports granger causes exports, at a 5 percent level of significance.

5 Conclusion and Recommendation

5.1 Conclusion

The objective of this study was to analyze some economic factors associated with the economic growth of Ethiopia. To determine the long-run and short-run relationship among the variables. The gross domestic saving, gross domestic product, export, import, and inflation rate are stationary at the first difference with intercept and trend. The study carried-out the model stability tests and the result has shown that there is a serial correlation problem, the residual was normally distributed and there was no heteroscedasticity problem.

The study uncovered that there is a significant effect of saving on the economic growth of Ethiopia. For the case of Ethiopia, saving plays a major role in contributing to economic growth. This is in agreement with that the conventional wisdom that a higher level of saving leads to economic growth in Ethiopia. The empirical result showed that only export has no significant effects on economic growth, while import, gross domestic saving, and inflation rate have significant effects on economic growth. The Real Gross Domestic Product granger causes the inflation rate, exports, and domestic savings significantly. The overall measure of some of the above economic variables acts as a major booster of output growth in Ethiopian.

5.2 Recommendation

The government has to encourage exports and gross domestic savings which would support economic growth. The policymakers should focus on promoting economic growth by adopting policies to monitor inflation, export, and gross domestic saving since strategies can lead to a more rapid economic growth of Ethiopia.

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Appendix

Vector Error Correction Estimates

Date: 06/23/20 Time: 00:01

Sample (adjusted): 1977 2019

Included observations: 43 after adjustments

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

CointegratingEq:	CointEq1
RGDP(-1)	1.000000
INF(-1)	19264.18 (19221.4) [1.00223]
IM(-1)	79.93048 (8.26627) [9.66947]
GDS(-1)	-39.31922 (3.80503) [-10.3335]
EX(-1)	-169.2047 (25.7884) [-6.56127]
C	-1433458.

Error Correction:	D(RGDP)	D(INF)	D(IM)	D(GDS)	D(EX)
CointEq1	0.005551 (0.00529) [1.04896]	6.25E-07 (4.4E-07) [1.40883]	0.005818 (0.00143) [4.06230]	0.012268 (0.00266) [4.61543]	0.001893 (0.00040) [4.71614]
D(RGDP(-1))	0.188872 (0.17494)	-5.56E-07 (1.5E-05) [-]	0.016662 (0.04734)	-0.032778 (0.08787)	-0.013008 (0.01327)
D(INF(-1))	1934.724 (1541.03) [1.25547]	0.292374 (0.12927) [2.26170]	232.1474 (417.028) [0.55667]	-738.6833 (773.975) [-0.95440]	39.89165 (116.892) [0.34127]
D(IM(-1))	0.173109 (0.74589)	-4.72E-05 (6.3E-05) [-]	-0.499338 (0.20185)	-0.329167 (0.37462)	-0.293317 (0.05658)
D(GDS(-1))	0.295617 (0.25285) [1.16913]	5.54E-05 (2.1E-05) [2.61028]	-0.221941 (0.06843) [-3.24353]	-0.059425 (0.12699) [-0.46793]	-0.044288 (0.01918) [-2.30915]
D(EX(-1))	1.802839 (2.02465) [0.89044]	0.000608 (0.00017) [3.58106]	3.216728 (0.54790) [5.87096]	0.492249 (1.01687) [0.48408]	0.989355 (0.15358) [6.44209]
C	21022.27 (10920.6) [1.92501]	1.320461 (0.91609) [1.44141]	9872.006 (2955.30) [3.34044]	18376.50 (5484.82) [3.35043]	3563.204 (828.364) [4.30149]

R-squared	0.667633	0.784297	0.767482	0.758221	0.632863
Adj. R-squared	0.612238	0.748346	0.728729	0.717924	0.571673
Sum sq. resids	3.93E+10	276.4816	2.88E+09	9.91E+09	2.26E+08
S.E. equation	33036.12	2.771290	8940.126	16592.24	2505.900
F-statistic	12.05232	21.81600	19.80442	18.81600	10.34266
Log likelihood	-504.6245	-101.0247	-448.4213	-475.0119	-393.7295
Akaike AIC	23.79649	5.024403	21.18239	22.41916	18.63858
Schwarz SC	24.08320	5.311110	21.46909	22.70586	18.92529
Mean dependent	41298.94	3.291816	9835.028	12246.60	1729.901
S.D. dependent	53052.57	5.524338	17164.92	31240.78	3828.917
<hr/>					
Determinant resid covariance (of adj.)	3.93E+32				
Determinant resid covariance	1.62E+32				
Log-likelihood	-1899.591				
Akaike information criterion	90.21352				
Schwarz criterion	91.85185				