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"DOES DOMESTIC SAVING CAUSE ECONOMIC GROWTH? TIME-SERIES EVIDENCE FROM ETHIOPIA."

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ABSTRACT

Higher saving rates cause higher economic growth. Empirical works have shown that the direction of causality between gross domestic savings and economic growth may result in bidirectional causality between gross domestic savings and economic growth or no causal relationship between them. The objective of this study was to find the direction of causality between gross domestic savings and economic growth of Ethiopia using annual time series data from 1975-2016. Three analyses were undertaken. First, the time series properties of growth rate of gross domestic savings and the growth rate of real gross domestic product were ascertained using the ADF unit root test procedure. Second, the long-run relationship between the series was explored utilizing Johansen Co integration Test procedure. The result of Johansen Co integration Test indicated that the series were co integrated and there is a positive long run relationship between domestic savings and economic growth. Finally, the causal relationship between growth rate of gross domestic savings and the growth rate of real GDP was performed using the Vector Error correction (VECM) model and Pair wise Granger Causality Test. The results showed that there was bi-directional causal relationship between growth rate of gross domestic savings and growth rate of GDP both in the short run and long run in Ethiopia indicating that both the Keynes and the Solow model are relevant for Ethiopia. Thus, policy makers are required to implement policy mixes aiming at increasing savings and growth in Ethiopia.

Keywords: Bi-directional , Domestic Savings, Growth, Developing Nation.

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1. INTRODUCTION

Ethiopia is the second-most populated country in Africa with more than 91 million people. It is among the low-income sub-Sahara African countries and has been an exemplary of poverty for a number of decades. Economic growth is among the most important factors affecting the quality of life in a country. Higher saving means that nations have large funds available for investment opportunities which can enhance the economic growth. The theoretical framework for these policies is that high saving rate could increase the amount of credit/loan which will push up the investment, and then the economic development and economic growth rate (Stern, 1991). The theories of economic growth stipulate that the dynamics of the country's economic growth increases if the investment in human or material capital or in scientific research and development grows. Gross domestic saving which was 22.4 percent of GDP in 2015/16 On the other hand, the share of gross domestic investment to GDP was 38.5 percent in 2015/16 and resource gap (trade deficit) was -19.8 in Ethiopia at the same year (MoFEC,2016).

Policymakers, including the World Bank, have long advocated policies that lead to higher savings in order to boost economic growth for developing countries. That is why 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, 1993).

Some studies have found savings to cause growth in income, some have found income growth to cause savings, some has found bidirectional causality between gross domestic savings and economic growth and others found no causal relationship between them. It is obvious that the causal relationship between savings and economic growth has been examined by various researchers for various countries but the issue of the direction of causation between savings and economic growth remained unresolved.

If the results of causality test indicate that saving precedes and causes economic growth, then government and policy makers can design or employ policies that would promote the mobilization of saving in order to achieve higher economic growth. On the other hand, if econometric investigation reveals the reverse, then, efforts would be made to remove the obstacles to and accelerate economic growth in order to raise the level of saving.

Gross domestic savings rates and economic growth rates have been low in Ethiopia over the years, perhaps, due to the fact that government, policy-makers and other stakeholders in the Ethiopian economy are aware of the positive relationship between gross domestic saving rates and economic growth rates on the basis of economic theory but unaware of the angle of causality between them. Therefore the direction of policies and programmes over the years to improve the rate of growth of the two variables has been misplaced. It appears to exist a correlation between growth and domestic savings, the question is the way the direction of association runs for Ethiopia. Since the direction of causality is not known, it is difficult to decide the direction of policies and programmers to pursue to achieve increased growth and domestic savings. Major question of this study is "whether savings promote economic growth or growth promotes saving". Is the statement valid for Ethiopia.

2. Objectives of the Study

- To examine whether there is a long run relationship between gross domestic savings and economic growth in Ethiopia;
- To investigate the direction of causality relationship between gross domestic savings and economic growth in Ethiopia.

3. LITERATURE REVIEW

Some empirical studies (Adebiyi, 2000) have used cross-section data to study the direction of causality between the saving and growth whilst others [Carrol and Weil (1993), Mohan (2006), Lean and Song (2009)] have used time series data to study the causality between the gross domestic savings and economic growth.

Again, some studies have used both the growth rates of gross domestic savings and the growth rate of real GDP as dependent variables and have used the lags of growth rates of gross domestic savings and real GDP as explanatory variables. With regards to the gross domestic saving rate, some studies (Adebiyi, 2000) have used gross domestic savings as a ratio of real GDP (Saving-GDP ratio) whilst others [Mohan (2006), Lean and Song (2009)] have used the logarithm of gross domestic savings as both dependent and independent variables. Majority studies are using the growth rate of saving vis-à-vis economic growth rate because of the problem of unit roots in other specifications.

Saltz (1999) uses both the VECM and VAR model of the Granger causality method to examine the causal relationship between savings and economic growth of seventeen Third World countries. For nine countries whose variables were co-integrated, he used the VECM. For other eight countries whose variables are not co-integrated, he used the Vector Autoregressive (VAR) model to find the causality. The results are that in four countries (Colombia, Jamaica, Peru, and the Philippines) no causality is detected in either direction. For eight countries the empirical results indicated that the growth rate of real GDP positively granger causes the growth rate of gross domestic savings. For two countries (Argentina and Taiwan), it is the growth rate of gross domestic savings which granger causes the growth rate of real GDP. Finally, for two countries (Dominican Republic and Mexico), there is bi-directional causality.

Carrol and Weil (1993) examine the causal relationship between income growth rate and growth rate of savings using both cross-country and household data in OECD countries (Japan, Hong Kong, South Korea, Singapore etc.) using VAR model of Granger causality test. They find that income growth rate granger causes growth rate of gross domestic savings but gross domestic savings does not granger cause income growth. According to them the positive effect of growth on saving implies that previous estimates of saving on growth may be overstated.

Adebiyi (2000) examines the empirical evidence regarding gross domestic savings and economic growth relationship in Nigeria using a quarterly data spanning between 1971 and 1998. He investigates the causal links between saving and growth using Granger causality test via vector autoregressive model. In the final analysis the Granger causality tests showed that, in Nigeria, saving-GDP ratio granger causes per capita income.

Agarwal (2001) investigated the causality between gross domestic product (GDP) and saving for a sample consisting Asian economies. The author discovered that, in most economies causality runs from GDP to saving.

Anoruo and Ahmed (2002) have explored the causal relationship between economic growth rate and growth rate of gross domestic savings for Ghana and six other African countries (Kenya, South Africa, Congo, Côte d'Ivoire, Zambia etc.) using time series annual data and VAR model of Granger causality test. The results suggest that there is a long-run relationship between economic growth rate and growth rate of gross domestic savings and that contrary to the conventional wisdom; economic growth rate granger causes growth rate of gross domestic savings for Ghana and most of the other countries under study. Only in Côte d'Ivoire is bi-directional causality found.

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

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

Narayan (2006) conducted a study based on autoregressive distributed lag modeling approach for Japan over the period 1960–1999. Finally, the study confirmed that there is a co integrated result between investment and saving they used bootstrap approach to find out the direction causation that shows investment causes saving for the Japan.

Pahlavani et al, (2007) have explored the relationship between gross domestic savings and economic growth for Iran using Granger causality test. The result indicates that there is positive relationship between economic growth and gross domestic savings and that the direction of causality runs from gross domestic savings to economic growth.

Kumar et al. (2008) studies the relationship between economic growth and gross domestic savings in South East Asian countries in respect of the Granger causality test. The relationship between gross domestic savings and economic growth is found to be bi-directional.

Dawit (2005) has investigated the causal relationship between the real economic growth and the growth rate of real gross domestic savings in Ethiopia for the period 1960 - 2003 using annual time series data and Granger causality method. The findings lend support to the hypothesis that faster growth of real gross domestic savings granger causes higher growth rates of real gross domestic product in Ethiopia. Also to the lesser extent, a higher rate of growth of real GDP granger causes a faster growth of real GDS. Thus, he finds bi-directional (feedback) causality in Ethiopia.

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

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

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

Lean and Song (2009) examined the short-run and long-run relationship between savings and economic growth in China using Granger causality test via time series annual data. They find bi-directional causality between gross domestic savings and economic growth in the short-run. In the long-run, a unidirectional causality exists running from the gross domestic savings to economic growth.

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

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

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

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

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

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

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

Ciftcioglu and Begovic (2010) used Hausman and LM tests to study the relationship between savings and investment in the sample of advanced economies of the Europe and found statistically significant evidence of saving and GDP growth. Which, reveals that the optimal econometric model, the panel estimation of the relationship between domestic saving rate and the growth rate of GDP for their sample of Central and East European countries .The study recommended that the economic growth and domestic saving rate are positively correlated for the sample of Central and East European countries over the sample period. Based on their study domestic savings have continued to be an important source of domestic investment which is ultimately the parameter that links savings to output growth. Domestic saving rate is positive and statistically significant at 5% level.

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

In Summary, the evidence from the above theoretical and empirical literature review show that the link between saving and economic growth is mixed; the causality between the two variables is different for different studies. The different findings between of variables hold true for Ethiopia and other developing countries.

This study differs from the previous ones by the following points: First, it uses vector error-correction model (VECM) that incorporates the error-correction term for the co-integrating equation to capture the long-run deviation from the equilibrium relationship between economic and domestic saving growth rates; Second, it jointly tests the lagged values of the independent variables using the F-test to determine the direction of causality between the real GDP and GDS variables in the system; Third, it utilizes country specific time series from 1974/75- 2015/2016 since most studies are cross sectional and panel studies; Fourth, most studies in the extant literature make a prior assumption that growth in domestic savings causes economic growth and a result neglect the possibility of a feedback effect; and Fifth, it focuses solely on developing countries of like Ethiopia characterized by inadequate gross domestic savings (GDS).

4. METHODOLOGY

Annual time series data on gross domestic savings and real GDP used as a measure of economic growth in Ethiopia for the period 1975 to 2016 were used for this study. The data from 1975 to 2016 were from Ministry of Finance and Economic Cooperation (MoFEC) and National Bank of Ethiopia (NBE). All computations were performed using Eviews7 software.

The linear model for this study is specified in logarithmic form. The purpose is to eliminate or to reduce considerably any Heteroskedasticity in the residuals of the estimated model. In light of the existing literature, the theoretical model used to examine the relationship between gross domestic savings and economic growth is stated as follows:

$\Delta LRGDPt = f((\Delta LRGDPt - i), (\Delta LRGDSt - i))$.. (1)

$\Delta LGDSt = f((\Delta LRGDPt - i), (\Delta LGDSt - i))$... (2)

Where LRGDP is natural logarithm of real GDP and LGDS is natural logarithm of real gross domestic Savings. LRGDP is growth rate of RGDP, used as proxy for economic growth. LGDS is growth rate of real gross domestic savings throughout the study. Δ is difference operator, $\Delta LRGDPt - i$ is lagged values of real gross domestic product and $\Delta LGDSt - i$ is the lagged values of real gross domestic savings.

Several tests like Unit Root Test ; Johansen Co-integration Test ; Granger Causality Test ; Vector Error Correction Model (VECM): - A Test for Causality ; Pair Wise Granger Causality Test ; Residual Diagnostics Tests (including serial correlation Lagrange Multiplier (LM) test, normality test, Heteroskedasticity test and stability test) are usually employed to find the required results.

5. RESULT AND DISCUSSION

5.1. Augmented Dickey-Fuller Unit Root Tests

The test was done for three alternative test equations or models of ADF test. First it is tested with constant, and then it is tested with constant and trend and finally tested with no constant and no trend.

The results of ADF test of unit root with constant, with constant and trend and with no constant and no trend at level, first and second difference for each series are presented in table 5.1 and table 5.2 and table 5.3 respectively. The critical values used for the tests are the MacKinnon (1999) one-sided p-values. The results presented in table 5.1 indicates that the null hypothesis that the series in level contains unit root could not be rejected because ADF test statistic is positive and the probability is large The test results presented in table 5.2 indicates that the null hypothesis that the series in first difference contain unit root, could not be rejected for series data sets because, all the three critical value results are greater than their respective ADF test statistic and also their respective p-values are greater than the conventional significance level of α =0.05 in level. Since the null hypothesis cannot be rejected in order to determine the order of integration of time series, all the two series have non stationary or unit root al level and first difference.

The same tests were applied to their second differences as indicated in table 5.3. The order of integration is the number of unit roots that should be contained in the series so as to be stationary. So, table 5.3 suggests that all the series or variables display a stationary behavior at second difference and all model variables are integrated of order two I(2) with all models of ADF test which includes constant, constant and trend and no constant and no trend. (See Table 5.1, Table 5.2 and Table 5.3)

Table 5.1: The ADF Unit Root Test Result for original Series (level)

Variables	Intercept		Intercept and trend		no intercept and no trend		Order of integration
	Test Statistics	Prob.	Test Statistics	Prob.	Test Statistics	Prob.	
LRGDP	14.99802	1.0000	7.092941	1.0000	1.530196	0.9667	-
LGDS	4.232417	1.0000	2.046463	1.0000	5.130545	1.0000	-
Critical value (1%)	-3.600987		-4.198503		-2.627238		-
Critical value (5%)	-2.935001		-3.523623		-1.949856		-
Critical value (10%)	-2.605836		-3.192902		-1.611469		-

Source: E-Views7 Output

Notes: Null hypothesis: series has unit root. ADF test statistics is greater than critical values but positive implies non rejection of null hypothesis. Positive ADF statistic shows non stationarity.

As it can be seen from the above table (large p-values and Large and Positive ADF test statistics indicates non rejection of H_0) all variables do not satisfy the stationarity assumption.

Table 5.2: The ADF Unit Root Test Result for differenced Series (first difference)

Variables	Intercept		Intercept and trend		no intercept and no trend		Order of Integration
	Test Statistics	Prob.	Test Statistics	Prob.	Test Statistics	Prob.	
ΔLRGDP	1.193151	0.9976	-0.770717	0.9596	2.232668	0.9928	-
ΔLGDS	-1.989103	0.2902	-5.874015	0.0001	-1.567521	0.1088	-
Critical value (1%)	-3.600987		-4.198503		-2.627238		-
Critical value (5%)	-2.935001		-3.523623		-1.949856		-
Critical value (10%)	-2.605836		-3.192902		-1.611469		-

Source: E-Views7 Output

Notes: Null hypothesis: series has unit root. ADF test statistics less than critical values imply non rejection of null hypothesis Δ is the first difference operator.

As it can be seen from the above table (large p-values and small ADF test statistics indicates non rejection of H_0) all variables do not satisfy the stationarity assumption.

Table 5.3: The ADF Unit Root Test Result for differenced Series (second difference)

Variables	Intercept		Intercept and trend		no intercept and no trend		Order of integration
	Test Statistics	Prob.	Test Statistics	Prob.	Test Statistics	Prob.	
ΔLRGDP	-8.296686	0.0000*	-8.891968	0.0000*	-7.652782	0.0000*	I(2)
ΔLRGDS	-8.230960	0.0000*	-8.183172	0.0000*	-8.172461	0.0000*	I(2)
Critical value (1%)	-3.600987		-4.198503		-2.627238		-
Critical value (5%)	-2.935001		-3.523623		-1.949856		-
Critical value (10%)	-2.605836		-3.192902		-1.611469		-

Source: E-Views7 Output

Notes: Null hypothesis: series has unit root. * indicates the rejection of the null hypothesis at 5%. ADF test statistics greater than critical values imply rejection of null hypothesis. Δ is the first difference operator.

As it can be seen from the above table (small p-values and large ADF test statistics indicates rejection of H_0) all variables satisfy the stationarity assumption.

The results in table 5.3 indicate that the null hypothesis is rejected for the second differences of the three indices given that p-values less than 5 percent level of significance with three models in ADF test. Since p-value of all series in column two of table 2 is small (<0.05) we reject the null hypothesis and conclude that the series is stationary. This implies that the variables are integrated of degree two I (2). Therefore the ADF test shows that all series are non-stationary in the levels and first difference, and stationary in their second difference.

5.2. Estimating for Order of the VAR

In table 5.4, 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 minimize AIC or SC or HQ where the bolded row in table 5.4 indicates that the optimal lag length for the VAR model selected by the criterion is equal to one.

Table 5.4: VAR lag order selection results (Eviews7 output)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-945.6648	NA	4.38e+18	48.59820	48.68351	48.62880
1	**-801.7354**	**265.7157***	**3.35e+15***	**41.42233***	**41.67826***	**41.51416***
2	-797.8415	6.789399	3.37e+15	41.42777	41.85432	41.58081
3	-794.7039	5.148996	3.54e+15	41.47199	42.06917	41.68625

* indicates lag order selected by the criterion

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

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source: E-Views7 Output

5.3. VAR Lag Exclusion Wald Test

It should be checked whether the one lag (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. And the result was presented in table 5.5.

Table 5.5: VAR Lag Exclusion Wald Test results (Eviews7 output)

Chi-squared test statistics for lag exclusion: Numbers in [ ] are p-values			
	D(RGDP)	D(RGDS)	Joint
Lag 1	3.968337	3.530837	9.655647
	[0.137495]	**[0.171115]**	**[0.046645]**
Lag 2	4.921742	1.981363	6.142445
	[0.085361]	[0.371324]	[0.188760]
Df	2	2	4

*denotes rejection at 5% significant level and DF stands for degree of freedom: Source: E-Views7 Output

5. 4. Johansen Approach Co integration Test

Based on table 5.3 since the variables are integrated of order two, we proceed to test for co-integration. Johansen co-integration test which is applied at the predetermined lag one. In these tests, maximum Eigen values statistic or trace statistic is compared to special critical values and their probability values.

Table 5.6: Johansen Co-integration Test Result

Hypothesized No. of CE(s)	Eigen values	Trace Statistics			Maximum Eigen statistics		
		Trace Statistic	0.05 critical values	Prob.**	Max-Eigen statistic	0.05 critical values	Prob.**
None *	0.455756	24.84804	15.49471	0.0015	24.33429	14.26460	0.0009
At most 1	0.012762	0.513746	3.841466	0.4735	0.513746	3.841466	0.4735

Source: E-Views7 Output

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

The results of Co-integration tests for RGDP and GDS are reported in table 5.6. The trace statistic indicates one co-integrating equation exists in the system at the 95 percent confidence level (estimated trace statistic, 24.84804 > 15.49471, and 95 per cent critical value). The Trace statistics and the Max-Eigen statistics are greater than the critical value at 5% significance level, when the null hypothesis r=0 (None) against the alternative hypothesis r=1. This helps us to reject the null hypothesis and which in turn implies that there is at least one co-integration vector and the remaining rank tests continue in the same procedure.

Max-Eigen statistic also confirms the existence of one co-integrating relationship at the 95 per cent confidence level in this system (estimated Max-Eigen statistic, 24.33429 > 14.26460, and 95 per cent critical value).

The above result indicates that the variables are co-integrated and there is one co-integrating equation at 5 percent level of significance. So this infers from the fact that economic growth and growth rate of saving are co integrated for this country (l) that there is a long-run equilibrium relationship between the two time series and (2) the existence of causality in at least one direction.

The long run co integrating vector in the non-trended case is given in equation:

$GDPSt = 78607 + 0.487980{*}RGDP_t + U_t$

Therefore, this implies that there is a positive long run relationship between RGDP and GDS. However, although co integration indicates presence or absence of Granger-causality, it does not indicate the direction of causality between variables. This direction of the Granger causality can only be detected through the vector error-correction model (VECM) derived from the long-run co integrating vectors.

In addition to indicating the direction of causality amongst variables, the VECM also allows us to distinguish between short-run and long-run Granger-causality.

5. 5. Vector Error Correction: A Test of Causality

Vector error correction model (VECM) is estimated to examine the causal relationship between savings and level of output in Ethiopia. The ECM has been estimated using the OLS technique and the results are summarized in Table 5.7 and Table 5.8 below. Final Prediction error (FPE), Akaike information criterion (AlC) and Schwartz Bayesian information criterion (SBlC) were used to choose optimum lag length of the variables included in the VECM.

In order to check Vector error correction Model, the following target equation (Growth equation) is estimated:

Δ (RGDP) = C(1)*(RGDS(-1) - 0.487979514551*RGDP(-1) + 78607.7119392) + C(2)* Δ (RGDS(-1)) + C(3)* Δ (RGDP(-1)) + C(4)

Table 5.7: Result of Vector Error Correction Model (Growth Model)

Growth Equation				
Error Correction	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Constant	14803.77	2861.138	5.174086	0.0000*
ΔLRGDP(-1)	0.036705	0.194862	0.188367	0.8516
ΔLGDS(-1)	0.246481	0.176088	1.399762	0.1701
ECT(t-1)	-0.365795	0.071802	-5.094471	0.0000*

*indicates 1% level of significance. *Source: Authors own calculation using E-Views 7*

$R^2 = 0.8824$, Adjusted $R^2 = 0.8726$, DW = 1.9527 F- statistic = 90.103(0.000000) **

The regression results in table 5.7 are reproduced in the following equation:

$$\Delta LRGDPt = 14803 + 0.036705\Delta LRGDP_{t-1} + 0.246481\Delta LGDS_{t-1} - 0.365795ECT_{t-1} + \sum_t$$

(5.174086) (0.188367) (1.399762) (5.094471)

The values in parenthesis are t-values Δ is the first difference operator.

The error correction model for each of the saving and income variables are not spurious as the DW values are higher than the R^2 values and no autocorrelation problem in the model. The F-statistic 90.103 is statistically significant. The value of the F-statistic of 90.103 implies that the growth rate of gross domestic savings granger causes the growth rate of real GDP. The R-squared value of 0.884 implies that more than 88% of the value of the dependent variable explained by the independent variables.

The result of the ECT -0.3657 or 37%, which measures the adjustment to restore equilibrium in the model, appear with negative sign and is statistically significant at 1% level of significance level, ensuring the long run equilibrium can be attained. Therefore, the speed of adjustment is -0.3657 which implies that around 37% deviations from long-term equilibrium are adjusted every year. The significance of the error correction term shows Causality running from domestic Savings to Economic Growth in the long run.

This result of the probability of F-statistics clearly shows that causality runs from growth rate of GDS to growth rate of RGDP in the short run. The coefficient of error correction term is also significant and negative, which confirms the existence of co-integration or long-run equilibrium between the respective saving and real GDP.

In order to check Vector error correction Model, the following target equation (saving equation) is estimated:

$$\Delta(GDS) = C(1)*(GDS(-1) - 0.487979514551*RGDP(-1) + 78607.7119392) + C(2)*\Delta(GDS(-1)) + C(3)*\Delta(RGDP(-1)) + C(4)$$

Table 5.8: Result of Vector Error Correction Model (Saving Model)

Saving Equation				
Error Correction	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Constant	7648.719	2760.187	2.771088	0.0088*
ΔRGDS(-1)	-0.066633	0.169875	-0.392249	0.6972
ΔRGDP(-1)	-0.240910	0.187986	-1.281529	0.2082
ECT(t-1)	-0.248784	0.069269	-3.591572	0.0010*

*indicates 1% level of significance. *Source: Authors own calculation using E-Views7*

R^2 = 0.5239 Adjusted R^2= 0.4843 DW = 2.0164, F- statistic = 13.208(0.000006) **

The regression results in table 5.8 are reproduced in the following equation:

$$\Delta lnRGDSt = 7648.719 - 0.066633\Delta LGDS_{t-1} - 0.240910\Delta LRGDP_{t-1} - 0.248784ECTt_{-1} + \sum_t$$

$$(2.771088) \quad (-0.392249) \quad (-1.281529) \quad (-3.591572)$$

The values in parenthesis are t-values Δ is the first difference operator

The error correction model for each of the saving and income variables are not spurious as the DW values are higher than the R^2 values and no autocorrelation problem in the model.

The F-statistic 13.208 is statistically significant. The implication is that the growth rate of real GDP granger causes the growth rate of gross domestic savings. The R-squared value of 0.5239 implies that more than 52% of the value of the dependent variable explained by the independent variables.

The result of the ECT -0.248 or 25%, which measures the adjustment to restore equilibrium in the model, appear with negative sign and is statistically significant at 1% level of significance level, ensuring the long run equilibrium can be attained. Therefore, the speed of adjustment is -0.248, which implies that around 25% deviations from long-term equilibrium are adjusted every year.

This result of the probability of F-statistics clearly shows that causality runs from growth rate of real GDP to growth rate of gross Domestic savings in the short run. The coefficient of error correction term is also significant and negative, which confirms the existence of co-integration or long-run equilibrium between the respective saving and real GDP. The significance of the error correction term shows Causality running from economic growth to gross domestic savings in the long run.

Finally, overall result clearly shows that there is at two way causality from growth rate of RGDP to growth rate of GDS and from growth rate of GDS to Growth rate of RGDP.

5. 6. Result of Pair wise Granger Causality Test

The results of the ECM model suggest bidirectional causality between Real Gross domestic Product and Real Gross Domestic Savings. In other words, the growth rate of real GDP granger causes the growth rate of real gross domestic savings and vice- versa. The Pair wise Granger Causality Test is performed to affirm or refute the results of the ECM model. Table 5.9 illustrates the results of the Pair wise Granger causality test.

Table 5.9: Pair Wise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
ΔGDS does not Granger Cause ΔRGDP	41	7.37153	0.0099
ΔRGDP does not Granger Cause ΔGDS		12.7304	0.0010

Source: Author's Computation using Eviews7 Δ is the first difference operator

The results of the VAR model suggest bi-directional causality. In other words, the growth rate of gross domestic savings granger causes the growth rate of real GDP and vice-versa. From the results, the null hypothesis that gross domestic savings does not granger cause real GDP is rejected at 1% significance level.

Thus, the alternative hypothesis holds that gross domestic savings granger causes real GDP. Again, the null hypothesis that real GDP does not granger cause gross domestic savings is rejected at 1% level of significance. Hence, the alternative hypothesis holds that real GDP granger causes gross domestic savings. The results indicate bi-directional causality between real gross domestic savings and economic growth.

5.7. Results of Model Stability and Diagnostic Test

5.7.1. Result of Autocorrelation Test.

From the Table 5.10 it is found that the null hypothesis of no serial correlation (Brush God fray LM test) is failed to reject for the reason that that the p-values associated with test statistic is greater than the standard significant level [*I.e. 0.73> 0.05*]. Brush"s LM test used for testing serial correlation is applied since unlike the traditional Durbin Watson test statistic which is totally inapplicable when the lagged dependent variable appear as a regressors, LM test avoid such limitation of DW test.

Table 5.10: Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.101168	Prob. F(1,35)	0.7523
Obs*R-squared	0.115287	Prob. Chi-Square(1)	0.7342

Source: Author's Computation using Eviews7

5.7.2. Results of Heteroskedasticity Test

The diagnostic test for Heteroskedasticity from the result in the above table, we can reject at 5% significant level due to its p-value associated with the test statistics are greater than the standard significance level [I.e. 0.57 > 0.05].

Table 5.11: Heteroskedasticity Test: ARCH

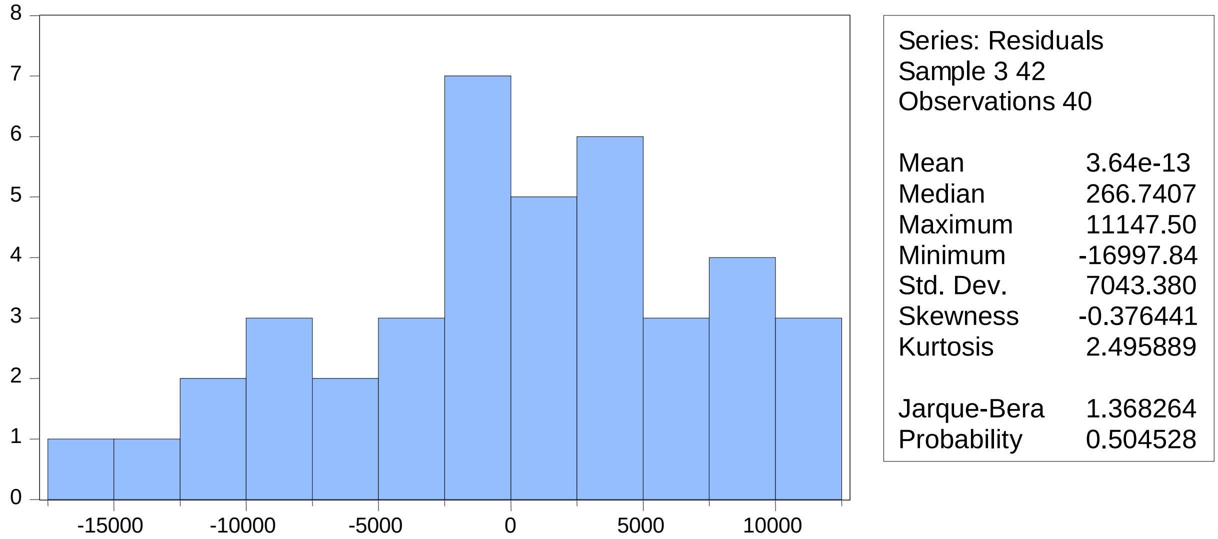
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.683084	Prob. F(4,35)	0.6084
Obs*R-squared	2.896547	Prob. Chi-Square(4)	0.5753
Scaled explained SS	1.754829	Prob. Chi-Square(4)	0.7807

Source: Author's Computation using Eviews7

5.7.3. Results of Normality test

One of the diagnostic tests is about the residual test. As the above result indicates that we could not reject the null hypothesis which says that the residuals are normally distributed, as a result, that the p -value associated with the Jarque-Bera normality test is larger than the standard significance level [i.e. 0.50 > 0.05]

Figure 5.1: Histogram Test of Normality

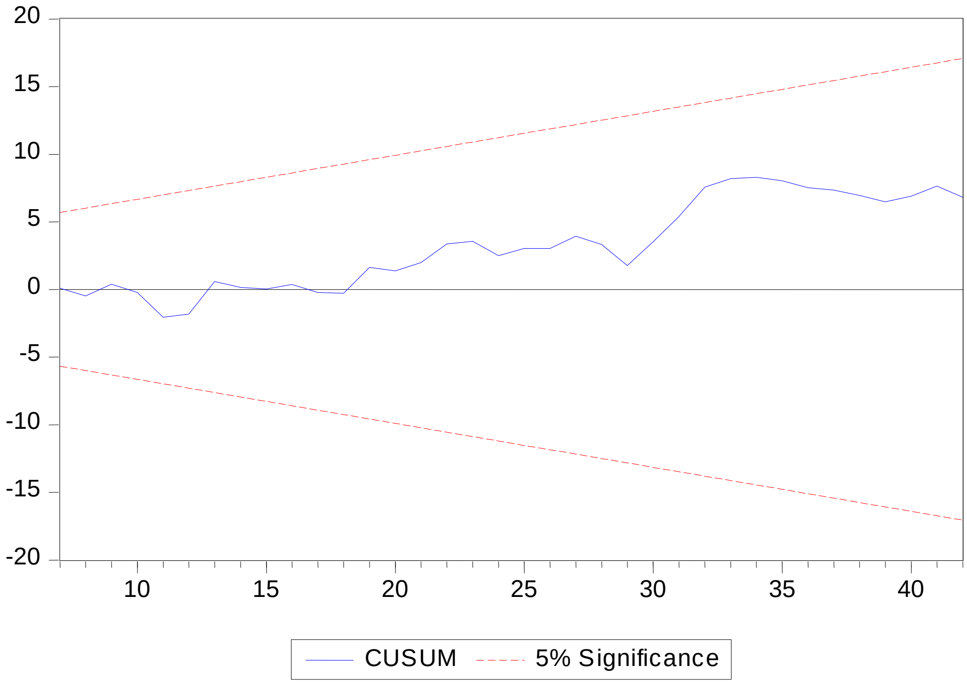


Source: Author's Computation using Eviews7

5.7.4. The VEC Model Stability Test

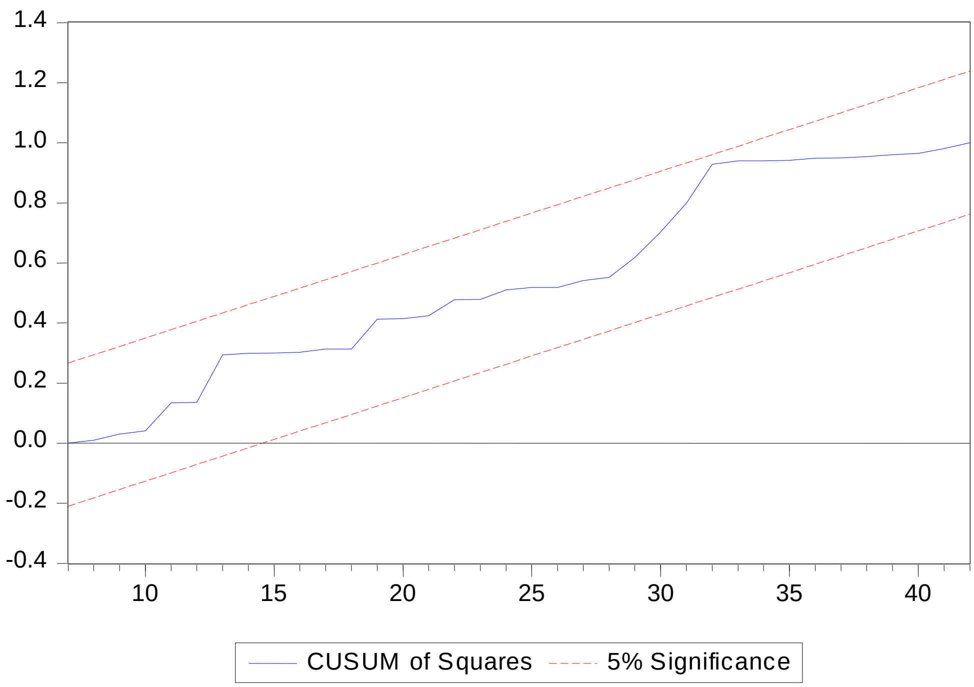
The results of both CUSUM and CUSUMSQ test are reported in Figures 5.2 and 5.3. As can be seen from the first figure, the plot of CUSUM test did not cross the critical limits. Similarly, the CUSUMSQ test shows that the graphs do not cross the lower and upper critical limits. So, we can conclude that long and short runs estimates are stable and there is no any structural break. Hence the results of the estimated model are reliable and efficient.

Figure 5.2: Plot of cumulative sum of recursive residuals



Source: Author Calculations. Note: The straight lines represent critical bounds at 5% significance level.

Figure 5.3: Plot of cumulative sum of squares of recursive residuals



Source: Author Calculations. Note: The straight lines represent critical bounds at 5% significance level.

6. CONCLUSION AND RECOMMENDATION

6.1. Conclusion

The main objective of this study was to examine the causal relationship between economic growth and gross domestic savings in Ethiopia over the period 1975-2016, i.e whether there is a causal relationship between them and if so, where the angle of causality runs between them for Ethiopian Economy. This study was done by the use of Vector Error Correction Model (VECM) and Pair wise granger causality test. The null hypothesis of no causality between gross domestic savings and economic growth was tested using modern time series analysis of unit root test, co-integration test, VEC model and the pair wise Granger causality test to a set of annual time series data covering the period.

In the short run, the traditional view of macroeconomic theory is that higher savings rates lead to higher investment and higher economic growth. The empirical results of this study, however, do not provide evidence supporting this conventional view. In other words, the findings of this study do not lend support to the hypothesis that only faster growth rate of gross domestic savings causes higher growth rate of real GDP. Neither do they support the Keynesian view that only income induces saving from one angle of causation nor do they support Solow only saving induces income causation. The study, however, finds bi-directional causality between economic growth and gross domestic savings.

6.2. Recommendations

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

The policy implication that emerges from this brief study is that the Ethiopian policymakers should be aware of causality running from gross domestic savings to real economic growth and from economic growth to gross domestic savings. Policy makers should put in place measures to boost domestic savings so that savings should be appropriately mobilized and directed towards productive investments and hence growth would be accelerated. And also policy makers should focus on promoting real economic growth by adopting income policies, since such strategies can definitely lead to higher growth of gross domestic savings as well as to a more rapid economic growth.

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