

CAUSAL LINKS AMONG SAVING, INVESTMENT AND GROWTH AND DETERMINANTS OF SAVING IN SUB-SAHARAN AFRICA: EVIDENCE FROM ETHIOPIA¹

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Abstract

The relationship between saving, investment and GDP still remains an empirical issue. In their aspiration to catch up the rest of the world, developing countries provides a special place on this matter. This paper tried to investigate the main determinants of saving and the connection among saving, investment and GDP in the case of Ethiopia using a combination of time series models. The paper finds export, inflation and lag government expenditure to have a statistically significant short and long term impact on the saving rate. Growth of income has a positive effect on rate of saving and the impulse response function shows the relevance of the neoclassical growth model in explaining the relationship between the saving rate and growth of income albeit lack of statistically significant causality between saving and investment in either direction. Although they may not be conclusive, the results suggest a more conducive policy environment and measures to boost domestic saving so as to induce growth from inside.

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1. Introduction

The shortest path of development has still remained to be mysterious despite successes of some countries. Many countries in the developing world are still trying to search for the root that helps to traverse their population from living in abject state of life. Although it does not necessarily ensure all embracing improvements in the life of every person, economic growth is a necessary condition for eradication of poverty at a country level. In turn, since economics started emerging as an independent discipline during the era of mercantilists and Adam Smith, accumulation of wealth, (which is nothing but saving) has been identified as a key variable for growth. Saving, with the necessary enabling environment is easily converted into investment or capital and enables labour and other resources to be effectively mobilized for the growth of overall level of output in an economy.

The pioneer in terms of clearly establishing the link between saving and economic growth was Harrod (1939), who was later followed by Domar in (1946). The two pioneer development economists lent for the well-known Harrod and Domar Model. These two economists, Solow (1956) and Romer (1986) underscored the importance of saving as it translates itself into investment and stimulates economic growth. According to the neo-classical school led by Robert Solow, an increase in the saving rate brings about a shift in a steady state growth path although its effect is transitory because of diminishing marginal productivity of capital. The endogenous growth theorists argue that an increase in the rate of saving will have a sustained and permanent effect on economic growth because of increasing returns to scale. Regardless of differences in the weight attached to saving by different schools, the conventional view gives value for saving as a source of financing current investment or settling debts spent for past investments stemming either from foreign or domestic sources.

The policies and development activities of various countries have been influenced and guided by the approach advocated by the last generation development economists such as Harrod and Domar. The East Asian experience and the World Bank policy prescription has also been influenced by the same. However, the relationship between the saving rate and the level of income is somewhat complicated by the simultaneous operation of several factors. Thus, the relationship

between saving and investment, and thus, the relationship between saving and economic growth (through the medium of investment) has been an empirical issue.

In the traditional Keynesian theory, the relationship between the saving and the level of income indicates that saving rate increases with the level of economic development. The link between domestic saving rate and the investment is based on the hypothesis that capital does not freely move from one country to the other because of various imperfections. Economic agents and savers tend to invest their resources in domestic investment outlets and require premiums to cover the risk involved in making investment in other countries. This is generally the case provided that domestic investments opportunities are attractive, and resources are efficiently allocated for their most productive use.

Athukorala and Sen (2004) also argue against the perception of the globalization of capital that domestic investment is fundamentally determined by domestic saving and thus high rate of national saving is a crucial determinant of economic growth. There is cross-country evidence which supports the hypothesis that long-run growth rate of income is significantly determined by domestic investment rate and domestic saving rate (Levine and Renelt, 1992). Bacha (1990), DeGregorio (1992), Otani and Villanueva (1990) found a similar result. Loayza et. al. (2000) also find a strong and positive relationship between the national saving rate and the level of income of countries. If there is causality between the two, the policy implication is that domestic saving should be increased to finance domestic investment, finance imported capital goods and thereby achieve sustainable economic growth.

However, the relationship between income level and saving rate in poor countries might be influenced by considerations of subsistence consumption, which is more than inter-temporal consumption smoothing (Easterly, 1994 and Ogaki et.al., 1996). Saving rate and GDP may go in the same direction and this positive association may not necessarily indicate causality. There could be an omitted variable that commonly explains both saving and income. The empirical evidence suggests Granger-causality from economic growth rate to the saving rate instead of the vice versa (Attanasio, et.al, 2000; Rodrik, 2000). The same result has also been found by the studies of Jappelli and Pagano (1996), Gavin et al (1997), Sinha and Sinha (1998) and Saltz (1999).

Besides making an argument based on empirical evidence against the established view that saving is a necessary prerequisite for growth, Moore (2006) has come in open to provide a theoretical framework to show that saving cannot be a constraint for growth. As far as financial markets operate properly and there is a flow of capital across countries, it is not of a necessity to save for investment.

Even if the argument saving versus investment and economic growth has still been unsettled, the question of what determines saving is also a source of theoretical and empirical debate. The life cycle model (LCM), the permanent income hypotheses (PIH) and the relative income hypothesis (RIH) are widely used as a benchmark to organize the arguments about the consumption and saving behavior of households. The Life cycle model (LCM) assumes that economic agents make sequential decisions to achieve a coherent goal using the currently available information as best they can (Browning and Crossley, 2001). Utility maximizing agents postpone part of their current consumption and save it for consumption during retirement in a dynamic and uncertain environment. The PIH argues that consumption expenditure closely follows permanent income, instead of current income of economic agents as hypothesized by Keynesian economists. Modigliani (1986) in his RIH argues that the share of life time resources that households plan to devote to bequests is an increasing function of their life time resources relative to others in the same age cohort.

Basing their decisions on the underlying theory that suits the circumstances of their countries, governments strive to take policy measures that induce mobilization of saving. Propensity to save and thus the saving rate is relatively low in developing countries because of low level of income and the necessity to fulfill subsistence consumption before inter-temporal resource allocation, the relative dominance of necessities in the household budget and liquidity constraints. Interventions of governments in controlling interest rate and mobilization of loans and underdevelopment of financial institutions also contribute for low level of saving. Empirical evidence with regards to the role financial markets and interest rate in mobilizing savings has not been impressive in developing countries (Easterly, 1994; Ogaki et. al, 1996; Rebello, 1991) and this could partly be because of high distortions, which lead at times to negative real interest rate. One of the policy instruments to address this problem is financial liberalization. Financial liberalization

tends to improve and nurture the functioning of financial markets and facilitates the flow of capital across countries. It has become a common knowledge that owing to opening up of economies and increasing trend of globalization, the flow of capital across countries has increased over time. However, the mobility of capital is far from being perfect and supportive of sustainable development in all beneficiary countries.

For instance, Rodrik (2000) claims that countries that have successfully achieved fast and sustained economic growth are also those that increased and achieved high domestic saving rate and provided incentives for their citizens to engage in productive investment and growth promoting activities than otherwise. However, this has not been the case for countries such as Ethiopia, where a greater share of investment comes from foreign sources. The domestic saving rate in Ethiopia has been very low. During 1960-2004, the average domestic saving rate has been only 5.4 percent of GDP. The rate of saving as a share of GDP not only varied significantly among the three different policy regimes but also consistently declined: 14 percent during the period 1960/1- 1974/75, about 7% between 1975/76 and 1990/91 and about 4% between 1991/92 to 2004/5. The country has not been able to mobilize the required amount of saving, which causes for excessive dependence on foreign sources [Worku, 2004].

The main challenge is therefore to identify and explain the factors behind low level of saving for capital accumulation and establishing the link between saving and investment as well as the saving and growth in the context of Ethiopia. Having extensively discussing the theoretical and empirical literatures on saving, Abu (2004) estimated a saving function for Ethiopia and found that fiscal and monetary policy, the investment regime and external factors influence the behavior of economic agents and saving of the country. In addition to this effort, it is worthwhile to investigate the same with a different dimension with the use of different some sets of variables which have equality important influence on the saving rate of the country. This article tries to address these issues. The main objectives of the paper is therefore to (1) explore the main determinants of domestic saving, (2) assess the causality between saving and investment and (3) explore the response of economic growth to a change in saving rate with the intention of confirming or rejecting the validity of theory of the new classical growth by Robert Solow.

The remaining part of the paper is organized as follows. The next section discusses model specification, estimation procedures and the nature of the data set. The third section deals with the discussion of results and the final section provides a brief concluding remarks.

2. Model specification and description of the nature of data

2.1. Model specification

On the basis of the above theoretical and empirical literature, the saving function to be estimated can be specified in general functional form as:

$$LGDS_t = f(LGDP_t, LGC_t, LX_t, LIM_t, LRIM, POPGR, r, INF, LUSFC) \quad (1)$$

where $LGDS_t$ is log of gross domestic saving. This variable captures both private and government saving because of the fact that the private sector economy in Ethiopia is very fragile and at low stage of development as the country was under a socialist oriented government over seventeen years. Despite the pressure from World Bank and IMF, privatization has not gone far and most privatized establishments became more inefficient after post privatization, thus the public sector has still owned many large enterprises [Worku, 2005].

The explanatory variables with signs expected from the regression coefficients are given as follows.

Explanatory variable (Abbreviated)	Descriptions	Expected sign
$LGDP_t$	Log values of Gross Domestic Product	+ (saving is a the proportion of income which is not consumed)
LGC_t	Government Consumption	- (An increase in government consumption is expected to reduce the amount of saving directly though reduction in government saving and fueling inflation and reducing purchasing power of money kept for consumption).

Explanatory variables continued.

LX_t	Log of export proceeds	+ (Export positively contributes to GDP and thus expects to positively affect the level of saving).
IM_t	Log of cost of imports	- or + (Imports are expenditures, which suppresses the net worth of the country, thus could reduce saving or high import as sign of spending on capital goods triggering development, implying the need for more saving).
$LRIM$	Log of remittance flow into the country	+ (Remittance contributes fairly high share in the GNP of the country, and thus it is possible that it could positively contribute positively to saving).
$POPGR$	Population growth rate	+ Or – (As the size of population increases, the number of people with capacity to save will increase in absolute size and may positively influence the size of domestic saving. On the other hand, high rate of population growth in the context of a typical developing country such as Ethiopia tend to imply that the dependency ratio tends to increase and thus tends to restrain the amount of saving.
r	Nominal interest rate	+ (Following the classical school, nominal interest rate as opportunity cost of capital is expected to have a positive impact on the level of saving.
INF	Inflation rate	- (An increase in inflation rate reduces real interest rate and thus, reduces saving as people tend to diversify risks by spending on real assets than depositing money in the bank).
$LUSFC$	Log of Final Consumption values of the United States of America	- (In line with the relative income hypothesis, the consumption level may tend to follow a similar trend and thus influence the level of saving.

2.2. Estimation procedures

Determination of a saving function based on country level data on time series requires following strict estimation procedures including stationarity test so as to have robust coefficients of parameters.

2.2.1. Unit root test

Macroeconomic variables are normally non-stationary and estimating results of non-stationary series could not provide robust estimates. Thus, unit root tests are done based on the common ways including graphical analysis, Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) on both the dependent and explanatory variables³.

2.2.2. Engle Granger - Co-integration test

Once the test for unit root is performed and variables are found to be non-stationary, the next step is to make a bilateral co-integration test. A saving function

³ The common DF test is performed in accordance to the following steps. Assuming that $LGDS_t$ is generated as Autoregressive of Order 1 or AR (1) process of the form:

$$LGDS_t = \alpha_1 + \alpha_2 LGDS_{t-1} + u_t \quad (i)$$

Dickey Fuller (DF) test requires estimating

$$\Delta LGDS_t = \beta_1 + \beta_2 LGDS_{t-1} + u_t \quad (ii)$$

where $u_t \sim N(0, \sigma^2)$, $E(u_t u_{t-1}) = 0$ and $\beta_2 = (1 - \alpha_2)$.

The test is carried out under the condition that:

$$H_0 : \beta_2 = 0, \text{ implying unit root, or } \alpha_2 = 1,$$

$$H_A : \beta_2 < 0, \text{ implying stationary}$$

ADF Test: Provided that $E(u_t u_{t-1}) \neq 0$, the augmented test to correct for this problem is done by adding differences of lag variables up to the optimal lag length, k .

$$\Delta LGDS_t = \beta_1 + \beta_2 LGDS_{t-1} + \sum_{i=1}^k \Delta LGDS_{t-i} + u_t \quad (iii)$$

In this specification as well, the null and the alternative hypotheses are the same as the DF except in the case of ADF under $H_0 : \beta_2 = 0$, the coefficient follows a τ -statistic, which has its own critical values at different levels of degrees of freedom.

will be estimated based on single explanatory variable each. For instance, we have already estimated the co-integrating regression.

$$LGDS_t = \beta_1 + \beta_2 LGDP_t + u_t \quad (2)$$

The co-integration test is basically a test of the stationarity of the residuals that is derived from equation 4

$$u_t = LGDS_t - \beta_1 - \beta_2 LGDP_t \quad (3)$$

The error term captures the linear combination of the two variables and if it becomes stationary $I(0)$, we could say the two variables are integrated. Since, we do not have the values of the actual error terms; we use the residuals of the estimated results of equation 4.

$$\hat{\Delta}u_t = \alpha u_{t-1} + v_t \quad (4)$$

If all or some explanatory variables are co-integrated, the next step will be to estimate a multivariate saving function, $LGDS$ as a dependent variable and all bilaterally co-integrated variables with the saving function as explanatory variables. In our case, as will be discussed in the following section, $LGDS$, LGC , LX , $LUSFC$ and $LREM$ are co-integrated with $LGDS$. Thus, the following function will be estimated and following the above procedure a unit root test will be made to test overall co-integration of the variables.

$$LGDS_t = \alpha + \beta_1 LGDP_t + \beta_2 LGC_t + \beta_3 LX_t + \beta_4 LIM_t + \beta_5 LUSFC_t + \beta_6 LREM_t + u_t \quad (5)$$

2.2.2. Error correction model

Once variables are found to be jointly integrated, the next step is to estimate the following error correction model.

$$\Delta DGDS_t = \beta_0 + \sum_{i=1}^p \alpha_{1i} DGDS_{t-i} + \sum_{i=1}^p \beta_{1i} DLGDP_{t-i} + \sum_{i=1}^p \beta_{2i} DLGC_{t-i} + \sum_{i=1}^p \beta_{3i} DLX_{t-i} + \sum_{i=1}^p \beta_{4i} DLIM_{t-i} + \sum_{i=1}^p \beta_{5i} DLREM_{t-i} + \sum_{i=1}^p \beta_{6i} DLUSFC_{t-i} + POPGR + r + INF + \lambda_1 ECT_{t-1} + \varepsilon_t$$

$$\text{where } ERT_{t-1} = \lambda_1 (GDS_{t-1} - \hat{\alpha}_1 - \hat{\beta}_1 LGDP_{t-1} - \hat{\beta}_2 LGC_{t-1} - \hat{\beta}_3 LX_{t-1} - \hat{\beta}_4 LIM_{t-1} - \hat{\beta}_5 LUSFC_{t-1} - \hat{\beta}_6 LREM_{t-1}) \quad (6)$$

p , i , and t optimal lag length, lag length, and time respectively.

2.2.4. Granger causality test

The following VAR model will be employed to test the causality between saving and investment.

$$IGDS_t = \sum_{i=1}^p \alpha_i IINV_{t-i} + \sum_{i=1}^p IGDS_{t-i} + u_{1t} \quad (7)$$

$$IINV_t = \sum_{i=1}^p \alpha_i IGDS_{t-i} + \sum_{i=1}^p IINV_{t-i} + u_{2t} \quad (8)$$

After estimating restricted (leaving aside the lag variables of the independent variables in each equation) and unrestricted model (including all the dependent and explanatory variables), we construct the F-statistic of the following form:

$$F = \frac{(RSS_R - RSS_{UR}) / m}{RSS_{UR} / (T - k)} \quad (9)$$

where RSS_R and RSS_{UR} are sum of residuals of the restricted and unrestricted model, T is the number of observation (42 years), m is the number of lagged terms and k is the number of all estimated parameters.

2.2.5. Impulse response function

To test for the response of *LGDP* (or output growth, we will estimate a VAR model only considering *LGDS* and *LGDP* and their lags.

2.3. Nature and source of data

The source of data for this study is the World Bank (2007), World Development Indicators time series data, down loaded from the internet. The series has data for many socio economic variables. However, figures for most of these variables are missing for some of the years in the case of Ethiopia, thus limiting the number of key variables that are likely to have an impact on the dependent variables for this particular study. For instance, number of branches of commercial banks and bank density, wealth levels of households and similar other variables could directly or indirectly influence the level of saving and yet they are not considered in this particular study. This is one of the serious limitations of the study.

The rate of inflation (*INF*) is approximated by consumer price index as it directly influences the amount of expenditure of consumption expenditure of households. Banks facilitate mobilization of saving through the medium of interest rate and deposit rate is used to capture the opportunity cost of capital (*r*). Export proceeds of goods and services (*LX*) and cost of imported goods (consumption, intermediate inputs and capital goods) (*LIM*) is used to capture expenditure on imports. Government consumption or expenditure does not include capital goods and military hard wares. As explained above, an increase in government consumption is likely to have a negative effect on saving. All values are used in terms of US dollars for purposes of avoiding heterogeneity of currencies while considering final consumption expenditure of USA. Gross Domestic Product (*LGDP*) and remittance (*RIM*) are treated in their common usage in the literature. The series covers a period of 42 years (1962 to 2004).

3. Empirical results

3.1. Pre-estimation analysis of the nature of the series

3.1.1. Stationarity test

The first step is to examine the trend of variables over the study period to have a clue about the presence of a systematic trend. Because of the relative income hypothesis of Duesenberry (1949), consumption habits of developing countries could be influenced by the consumption pattern of industrialized countries. Globalization further facilitates the trend of cultural transfer. Unlike most other countries, Ethiopia has never been colonized and thus do not have a special attachment to any particular developed country. Nonetheless, in order to test for the relevance of demonstration effects in affecting consumption expenditure of countries transcending across countries, the consumption expenditure of the US is taken to represent the consumption pattern of the developed world as it is a giant economy in the globe. Figure 1 indicates that the trend of consumption of Ethiopia (LC) is slightly upward trending (with irregularities) while the consumption of USA (LUSFC) shows a smooth upward trend with a lower linear slop.

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The saving of Ethiopia (LGDS) and USA (LUSDS) as displayed in Figure 2 in the Appendix also reflects a similar trend as consumption of the two respective countries. Whereas the USA consumption and saving functions give a hint that the two variables could be non-stationary, the saving data for Ethiopia obscure the nature of the series. From the two figures, one may not be able to deduce that the USA consumption could influence consumption and thus saving rate of Ethiopia. This will be examined later in the empirical estimates.

Figures 3, 4 and 7 (in the Appendix), provide a hint that Investment (LINV), domestic saving (LGDS), import (LIM), export (LX) and remittance are likely to be non-stationary. On the other hand, Figure 5 and Figure 6 (in the Appendix) do not provide sufficient evidence on whether or not Gross Domestic Product (LGDP), Population Growth Rate (POPGR), Nominal Interest Rate (r) and Inflation (INF) are stationary. The summary of graphical representation of variables in levels (before differenced) is displayed in Figure 8 below.

A more concrete test of stationarity of variables is conducted using Dickey Fuller (DF) and Augmented Dickey-Fuller (ADF) and summary of the result is given Table 1 below.

Table 1: Dickey –Fuller and Augmented Dickey Fuller test results⁴

Variable	DF	ADF		Decision Rule
		Computed	Optimal Lag Length+	
LGDP	-1.8964	-1.802	4	Non-Stationary
LINV	-2.8737	-2.2225	4	Non-Stationary
LIM	-1.7762	-1.95	4	Non-Stationary
LX	-2.9623	-2.4458	4	Non-Stationary
LGC	-2.191	-2.1930	4	Non-Stationary
R	-0.91974	-1.4678	4	Non-Stationary
LREM	-3.2178	-2.1854	4	Non-Stationary
LUSFC	-0.49275	-0.43001	4	Non-Stationary
LGDS	-2.4423	-2.1820	4	Non-Stationary
POPGR	-6.4037**	-3.0628	4	Non-Stationary
INF	-3.100	-3.058	4	Non-Stationary

Source: Own calculations.

⁴ Critical Values: DF at 5% = -3.514, DF at 1% = -4.178. ADF at 5% = -3.525 and 1% = -4.202. + Based on the minimum values of AIC and SC.

The H_0 for Dickey Fuller is unit root and result indicated that except the population growth rate (POPGR), null hypothesis is not rejected for all other variables, implying that all variables are non-stationary. The ADF result also confirmed that all variables are non-stationary⁵.

Provided that the plots show most of these variables to move upward over time, differencing, including the trend variable and a constant term will likely to change the non-stationary series into a stationary one. The summary of results of the Dickey Fuller and Augmented Dickey Fuller test on first difference is displayed in Table 2 below.

Table 2: Results of Dickey–Fuller and Augmented Dickey Fuller test on first difference⁶

Variable	DF	ADF		Decision Rule
		Computed Values	Optimal Lag Length+	
DLGDP	-4.9850**	-3.7823*	2	Stationary
DLINV	-8.8722**	-4.1612*	4	Stationary
DLIM	-8.5529**	-8.5899**	1	Stationary
DLX	-9.3520**	-3.788*	4	Stationary
DLC	-5.2784**	-3.7845*	3	Stationary
Dr	-4.4491**	-3.750*	3	Stationary
DLREM	-6.6273**	-4.007	3	Stationary
DLUSFC	-17.850**	-4.3996**	3	Stationary
DLGDS	-9.6473**	-5.4808**	4	Stationary
DPOPGR	-10.728**	-4.5909**	4	Stationary
DINF	-9.0178**	-4.432**	4	Stationary

Source: Own calculations.

It could be learnt from Table 2, all variables became stationary after first difference, although at different lag length and level of significance. Figure 9 shows a summary of trends of first difference variables. These trends reflect the non-existence of a systematic moment away from the mean values, revealing the stationary of

⁵ The summary of graphical representation of variable in levels (before differenced) is displayed in Figure 8 in the Appendix

⁶ Critical Values: DF at 5% = -3.519, DF at 1% = -4.19. ADF four lag: at 5% = -3.532, at 1% = 4.2161 ADF three lag: at 5% = -3.528; at 1% = 4.209; ADF two lag: at 5% = -3.522; at 1% = 4.196 and ADF one lag: at 5% = -3.516; at 1% = 4.184. + Based on the minimum values of AIC and SC.

variables. The test for stationarity for investment variable (DLIV) is done together with the explanatory variables of the saving function to understand its behaviour as we will test for causality between saving and investment in the later stage.

3.1.2. Co-integration test

Provided that the variables are non-stationary at levels, the next step is to test for co-integration at two different levels. First, a bivariate regression of the saving variable (LGDS) on each of the explanatory variables is made for Engle – Granger and Augmented Engle Granger test for co-integration on the basis of the error term.

The Engle – Granger Causality test indicated that except interest rate (r), inflation rate (INF) and population growth parameter (POPGR), residuals of all bivariate estimates of saving (LGDS) on all other explanatory variables are co-integrated of order 1. The next step is to estimate a multivariate model on saving (LGDS) on all variables co-integrated with saving.

Table 3: Test Results of the Engle – Granger Co-integration Test⁷

Residuals Saved from $GDS = F(.)$	ADF			Decision Rule
	DF	Computed values	Optimal Lag Length+	
LGDP	-4.1871**	-3.6459*	2	Co-integrated
LIM	-8.5529**	-4.1404*	4	Co-integrated
LX	-4.936**	-3.6515*	4	Co-integrated
LGC	-4.1210*	-3.9770*	3	Co-integrated
R	-3.743*	-3.743*	0	Not-cointegrated
LREM	-4.3904**	-3.7975	3	Co-integrated
LUSFC	-4.3993**	-3.5654*	3	Co-integrated
POPGR	-4.9247**	-4.9247**	0	Not-cointegrated
INF	-4.5233**	-4.5233**	0	Not-cointegrated
Residual from multivariate regression	-4.9346**	-4.159**	4	Co-integrated

Source: Own calculations.

⁷ Critical Values for DF: at 5% = -3.514, at 1% = -4.178; ADF: Lag 4: 5% = -3.525; 1% = -4.202; ADF: Lag 3: 5% = -3.522; 1% = -4.196; ADF: Lag 2: 5% = -3.519; 1% = -4.19; + Based on the minimum values of AIC and SC.

The ADF test on the residual of multivariate co-integrating equation indicated that individually co-integrated variables with the saving function are jointly co-integrated⁸.

Before we estimate the final error correction model, the correlation matrix of independent or predetermined variables is estimated as shown below in Table 4.

Table 4: Correlation Matrix of Independent Variables

	REM	INF	LGC	LGDS	LUSFC	LIM	LX	POPGR
REM	1.0000	0.060936	0.18038	0.049008	0.0066465	0.030069	-0.0488	-0.0068
INF	0.060936	1.0000	0.53272	0.032368	0.14581	0.17669	0.055952	0.14572
LGC	0.18038	0.53272	1.0000	0.54048	0.59131	0.64347	0.44772	0.16066
LGDS	0.049008	0.032368	0.54048	1.0000	0.77618	0.80285	0.70278	0.29401
LUSFC	0.0066465	0.14581	0.59131	0.77618	1.0000	0.98059	0.88760	0.016970
LIM	0.030069	0.17669	0.64347	0.80285	0.98059	1.0000	0.89553	0.059704
LX	-0.0488	0.055952	0.44772	0.70278	0.88760	0.89553	1.0000	-0.10656
POPGR	-0.0068	0.14572	0.16066	0.29401	0.016970	0.059704	-0.10656	1.0000

Source: Own computations.

3.2. Error correction model

Most explanatory variables are found to be co-integrated of order 1. Estimating difference equation of the saving variable (DLGDS) on differences of other variables would give a robust estimate in econometric sense, but it could only show the short run or the transitory effect of these variables on saving. Economic policy decision requires marginal and total effects of predetermined and exogenous variables on the dependent or target variable. Thus, the error correction model (ECM) is estimated to capture both transitory and long run effects. The error correction term is captured from the first lag of the residuals of the multivariate equation. Apparently, we could observe from Figure 11 of the Appendix that the residual of the multivariate co-integrating equation is stationary oscillating its zero mean value. The over parameterization model for estimating the error correction model (8)

⁸ The trend of co-integrated variables is displayed in Figure 10 below.

captures first differences of co-integrated variables, the non-nonintegrated variables at levels and the error correction term.

After a series of iteration, the parsimonious estimated ECM with the major diagnostic test statistics result is summarized in Table 5 below.

Table 5: Error correction model results

Variable	Coefficient	Std. Error	T-value	Prob.
Constant	-0.0125	0.039625	3.17	0.0
DGDP	0.10581	0.0538	2.1	0.03
DLGC-1	-0.46688	0.2035	-2.29	0.029
DLX	0.0124	0.02048	2.02	0.024
DLIM	0.346976	0.2751	1.26	0.216
DLRM	0.0818217	0.0557	1.48	0.149
DLUSFC	-5.02955	3.303	-1.52	0.138
POPGR	0.15999	0.10628	1.505	0.154
R	0.0096	0.13728	1.43	0.155
INF	-0.0530674	0.007328	-3.15	0.001
INF-2	-0.0155380	0.008273	-1.88	0.07
ECT-1	-0.716116	0.2858	-2.51	0.019

Sigma = 0.40893 RSS = 3.01002492 $R^2 = 0.792061$, F (30, 12) = 298 [0.009]. Log likelihood = -4.24527 DW = 2.21 No of Observation = 42. ARCH - $\chi^2(1) = 0.05$. Reset - $\chi^2(1) = 0.061$.

Source: Own Calculations.

After a series of experimental estimation, the parsimonious equation estimates reveal six significant coefficients among eleven parameters (excluding the intercept term). On the basis of F – test, R^2 and the other tests, the model is statistically significant to describe the short and long run relationships. The stability of the model is also confirmed through the use of Chow Test. The power of the model to predict the actual values of the LGDS is also tested using graphical analysis. Both results are displayed in Figure 12 and 13 in the Appendix. The $ECT-1$ is the error correction term demonstrating the long run relationship of variables with the error

term and it appeared with statistically significant coefficient and expected usual sign. It shows the process of the long term adjustment towards equilibrium once saving diverges from equilibrium.

The result confirms the importance of *GDP* or economic growth in the saving processes. The level of current income positively and significantly influences the behavior of aggregate saving rate. This result supports the absolute income hypothesis in that the level of income is an important determinant of the capacity of a country to save. However, the aggregate nature of the data does not allow the effect of distribution of income on saving or the level of saving rates for different income categories. Lag government consumption (LGC-1) has significant and negative impact on the level of current saving.

The estimates on the population growth are not statistically significant. This is in line with our expectation that population growth has a mixed effect on saving. The higher the rate of growth of population, the larger the number of people joining the active age group with the capacity to save, which tends to boost the level of saving. However, because of lopsided population structure towards the dependent age group, the increasing rate of population may even lead to a more than proportionately increase in consumption and thus reduction in saving. The insignificant coefficient for the demographic variable (*POPGR*) is an indication of the inability of either of the two effects to outweigh the other. Neither the attempt to change the rate of population growth with proportion of the people in the active age of group (15 to 64 years) changes the result.

The coefficient for nominal interest rate (*r*) is positive as expected but found to be insignificant. This does not however lead to a conclusion that interest rate does not have a role to mobilize saving. The rate of interest has been set by the government and revisions have been made less frequently. Thus, the administratively set rate does not necessarily reflect the market clearing rate. Particularly before 1992, government was directly involved in credit rationing and this policy clearly used to distort the financial market in terms of mobilizing savings. Since 1991/92, the incumbent government has provided more opening to the financial market and yet the upper and lower bounds of interest rates are still set by the National Bank of Ethiopia. This has greatly limited the role of financial markets to link up the demand

for loanable funds with the supply (Authukorala and Worku, 2006). For this reason, interest rate in Ethiopia does not reflect the opportunity cost of current consumption relative to future consumption and thus does not provide adequate guide on the basis of which economic agents adjust their decisions.

Because of the need to capture the effect of the change in real interest rate, inflation rate (*INF*) was incorporated in the saving function with the nominal interest rate. As it is expected, current inflation rate (*INF*) has a significant negative impact on saving. This is contrary to the hypothesis and of the result of Athukorala and Sen (2004) that 'when faced with inflation, consumers attempt to maintain a target real wealth relative to income by reducing consumption'. The empirical result rather suggests that in a country where a largest segment of the population live in amidst of poverty, as risk averse economic agent, consumers tend to utilize their income in the current period before it loses its value in the coming future. Inflation in this context is a tax on saving.

Although migration into the developed world has a damaging economic effect as it is mainly in the form of a brain drain, remittance has now become a significant source of income into the developing world including Ethiopia. According to the World Bank (2006), remittance has exceeded US\$ 233 billion worldwide by 2005. [Brown, 1994] indicated that migrants' savings and investment abroad may represent a substantial or even the major part of their overall transfers. World Bank (2006) attributed this remittance to an increase in altruistic payments of migrants to their families abroad. Sinning (2007) indicated that savings in the home country is one of the motives for remittance. In this study, *LRM* has shown a positive and yet insignificant value. This might tend to shed light about the positive impact of remittance on saving. However, because of the macro nature of the data, it is difficult to capture the saving behavior of individuals, who benefit out of remittance.

Export proceeds (*LX*) have shown a positive and statistically significant impact on saving as it positively influences the trade balance and thus the capacity of the country to save. On the other side, coefficient for the imports (*LIM*) is not statistically significant although shows a theoretically unanticipated positive association with saving. It could be because of the fact that in the Ethiopian case, imports normally exceed over and above export revenues and they are largely

financed by foreign loan and aid. Thus, import revenue may not have a short or a transitory direct effect on savings.

The theory of the relative income hypothesis suggesting that demonstration effect has an impact on consumption pattern of households and this effect transcends across boundaries is not backed by empirical evidence in the case of Ethiopia. Despite the fact that the level of US consumption is found to be negatively associated with the Ethiopian domestic saving, it is not found to be statistically significant. This could be because of various reasons. There is a huge variation in the living standards of the people of two countries. Owing to Ethiopia's unique historical background of being out of cultural domination of any country, associating its consumption pattern and expenditure on a specific country on the basis of the relative income hypothesis may not give sound evidence.

3.3. Granger causality between saving and investment

Granger causality test has been undertaken to confirm whether the long-established view of development economists suggesting that saving is a necessary requisite for investment and of growth or the recent theoretical literature arguing that saving is never a constraint on investment. The result is indicated in Table 6 below.

Table 6: Pair-wise Granger causality test: Saving and investment (1962-2004)⁹

Null Hypothesis	Observation	Optimal lag length for the test*	Computed F-Statistic	Decision Rule
Investment does not Granger cause saving	42	6	1.4923**	Accepted
Saving does not Granger cause Investment	42	6	1.2300	Accepted

Source: Own calculations.

The econometric result in this particular study reveals that investment does not Granger cause saving and saving does not Granger cause investment. This might be because of the fact that in the Ethiopian case, the role of domestic saving in

⁹ Critical F (28,6): at 1% = 4.02; at 5% = 2.92.

financing investment is extremely limited. This is clearly observed from the external trade balance as well as the saving-investment gap of the country. This result seems to go in line with Moore (2006) hypothesis that 'Saving is never a constraint on investment'. Nonetheless, this conclusion does not necessarily imply that countries may not need to save in order to develop their economies.

Depending heavily on foreign sources for investment is likely to impose high debt burden and policy interference by lending or foreign capital source countries. In addition to foreign loan and aid, the other source of external finance is FDI. The economic impact FDI on sustainable development of countries has remained to be controversial because of the various motives [Athukorala and Worku, 2003] and asymmetric information and moral hazard issues. Thus, promoting domestic saving is not only a more reliable source of sustainable development as it reduces dependence on foreign sources but also boosts the level of investment of the country, which has still remained very low.

3.4. Impulse response function: Growth of GDP versus saving

The results of the vector autoregressive (VAR) model for saving and GDP in Table 7 indicates that past growth rate of real per capita income has a strong and robust prediction power on current saving rate performance.

Table 7: VAR Estimation Results on Saving and GDP Growth for 1962-2004

Variables	LGDS (Saving)	LGDP (GDP)
saving(-1)	0.5881*** (0.1703)	0.0551 (0.3766)
saving (-2)	0.3417** (0.16339)	0.0238 (0.3613)
Growth(-1)	0.1646** (0.07439)	0.1939 (0.1645)
Growth (-2)	0.0021 (0.0779)	-0.507*** (0.1722)

Note: The numbers in parenthesis are standard errors for the corresponding coefficients. *, **, *** refer to significance levels at 10, 5 and 1 percent, respectively.

However, GDP growth rate does not seem to be strongly predictable by past domestic saving performance. The weak, short-run dynamic relationship between past saving rate and current growth performance, albeit positive, might suggest weaknesses in allocation of saving to their most productive uses that can sustain and attract further saving efforts. The short term relation, however, should not be interpreted as if saving rate does not also have long term effect. A country still finances part of its investment from external borrowing and grants, this may not however continue in the long term since the economy would reach unsustainable level of external indebtedness. Rather failure to improve the saving rate might continue to negatively affect the domestic capacity of capital formation and thus sustainable development of the economy¹⁰.

The empirical result suggests that an increase in the saving rate is likely to boost the level of GDP and thus creates disequilibrium for a while. Adjustment for the shock could take up to a period of 20 years. The implication is that a one shot increase in the saving rate could positively contribute for the growth the economy and yet may not bring about a sustained increase in the pace of growth of the economy. A continuous improvement in the level of growth needs continuous rise in the saving rate, which may not be easy. Thus, in addition to improving the saving rate, it is also worthwhile to invest on human capital and technical progress to bring about a consistent rise in the rate of growth of the economy because of their effect in shifting the production frontier of the country and help to alleviate the problem of diminishing returns to capital possibly emanating from investing on the prevailing technology through increasing saving.

4. Conclusion

The article tried to identify the main determinants of domestic saving in Ethiopia. GDP growth, previous government consumption level, export and inflation have a statistically significant impact on saving. The error correction term is also found to be statistically significant indicating the existence of a long run relationship between these explanatory variables and the saving parameter. Remittance, interest rate and

¹⁰ The graphical representation of the impulse response function establishing the relationship between *LGDS* and *LGDP*¹⁰ is shown in Figure 14 of the Appendix.

the US consumption level are found to be statistically insignificant but with the expected sign of causality. The Granger causality test indicates that saving does not cause investment neither does investment cause saving. This is because of the heavy reliance of the country for investment. The vector auto-regressive model indicates that there is a positive short and long-run effect of saving on growth, which is not yet significant. Income growth has been seen to have statistically significant positive impact on saving. The impulse response function reveals the relevance of the Solow growth model to explain the relationship between saving rate and growth of GDP in the Ethiopian context.

The empirical result suggests the need for revisiting the policy environment to induce growth from inside. Barriers of financial markets including setting interest rate by government bodies might need to be looked into. The public should be encouraged to participate in the saving schemes of their choice and invest on various areas of the economy. Government should also need to look into the possible crowding out effect of excessive public expenditure and continue its move towards promoting exports. Although remittances are not found statistically significant impacts on saving, their importance on reducing foreign dependence should not be under looked. The country has many people in the Diaspora. Besides the remitting meager resources to the country, Ethiopians abroad need to be fully engaged into the country's development endeavors through mobilization of their savings. For this to come by, it requires investigating possible hurdles that might have constrained investment flows from this source in terms of policy, bureaucratic inefficiency, lack of investment promotion activities or other areas of concern and accordingly making the necessary measures to create a more accommodative and enabling environment.

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APPENDIX

Figure 1: Trend of Ethiopian and US consumption

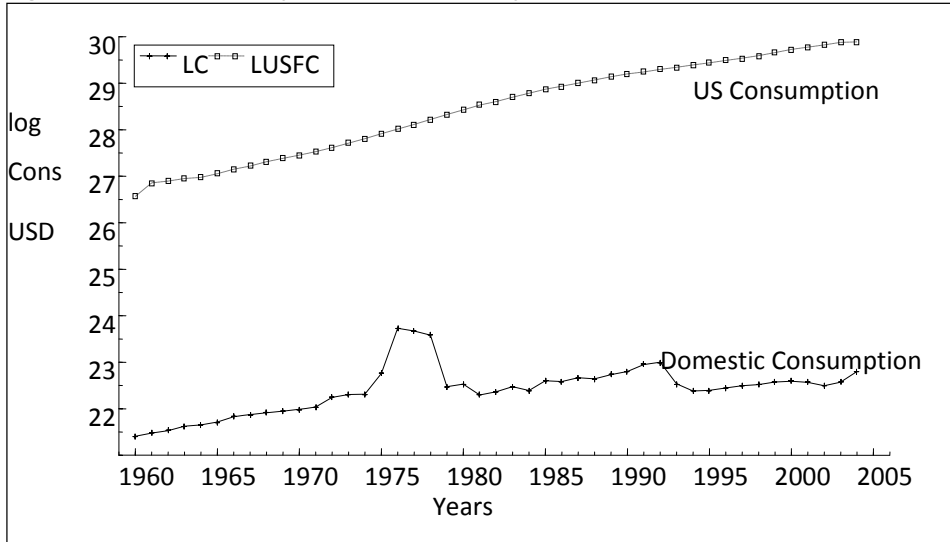


Figure 2: Trend of Ethiopian and US saving

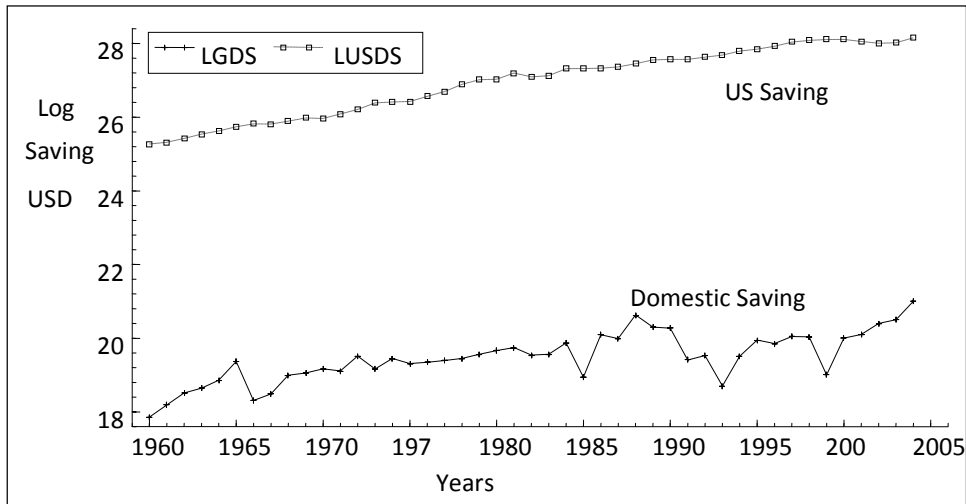


Figure 3: Trend of investment and saving

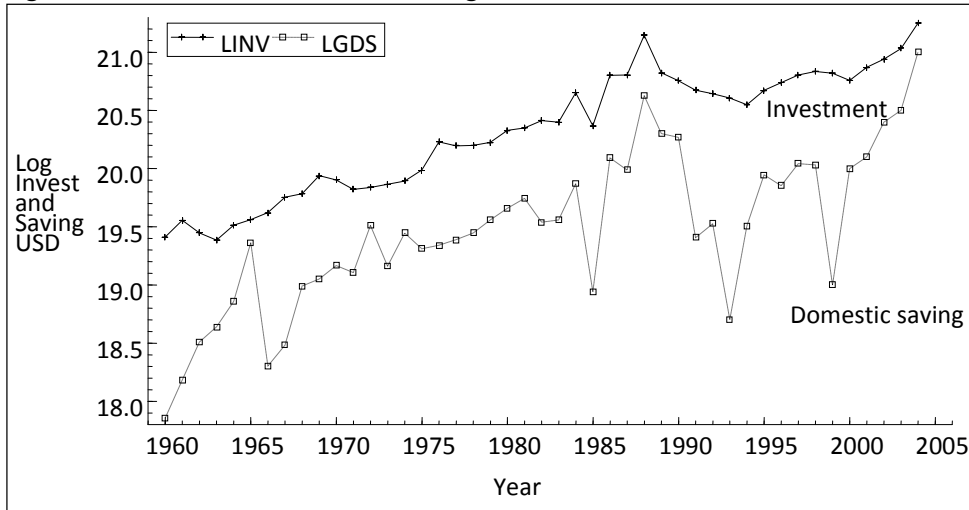


Figure 4: Trend of imports and exports

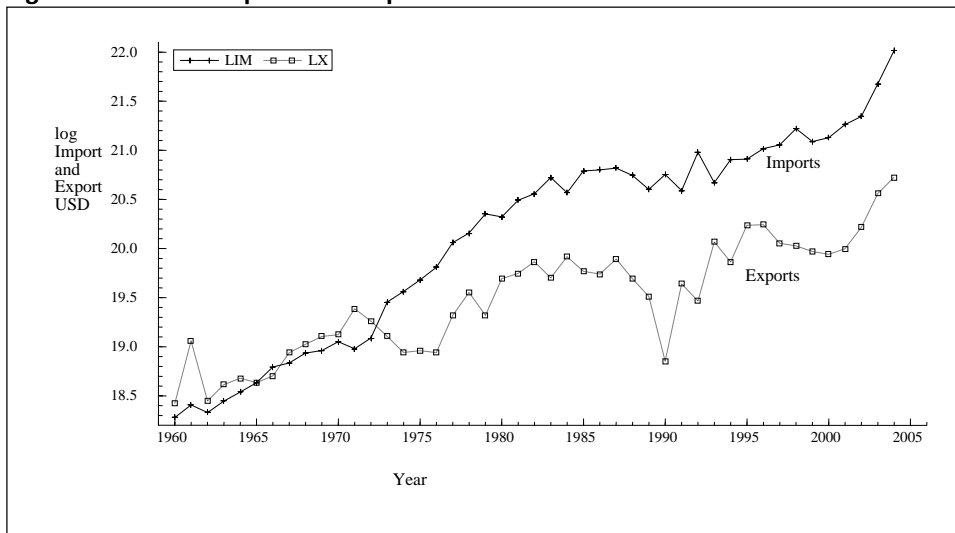


Figure 5: Trend of GDP and population growth rate

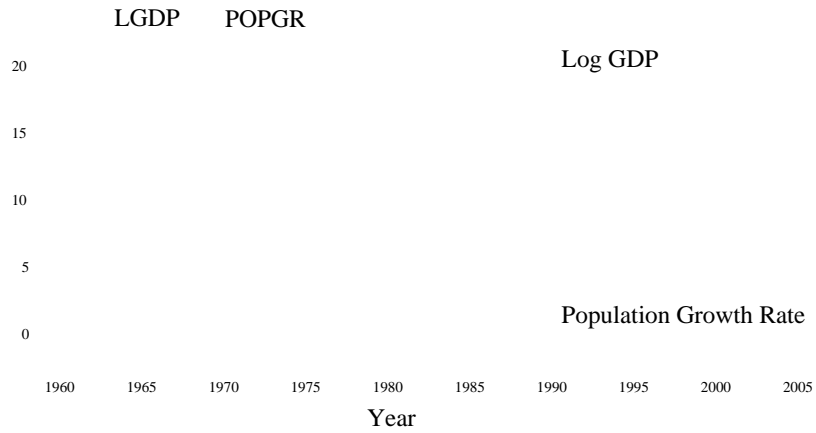


Figure 6: Trend of interest and inflation

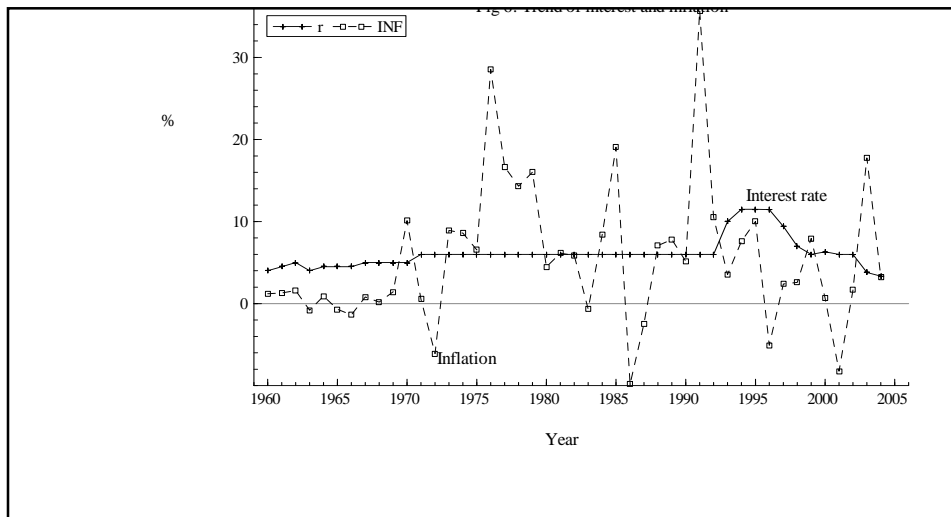


Figure 7: Trend of remittance



Figure 8: Trends of variable in levels (1960 – 2004)

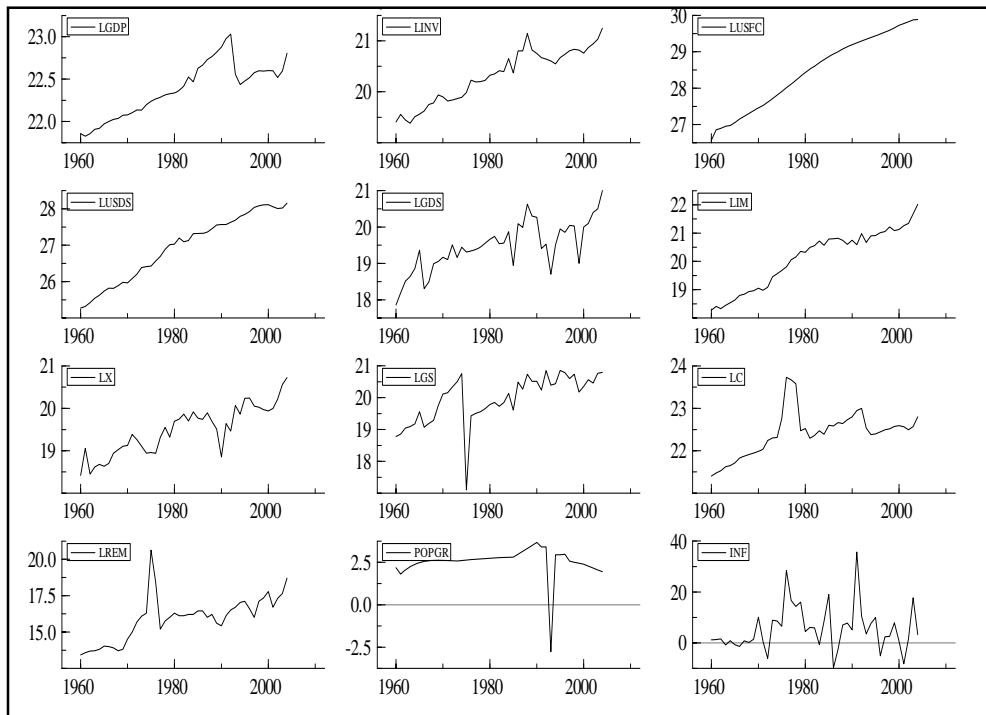


Figure 9: Trends of variables in their first difference

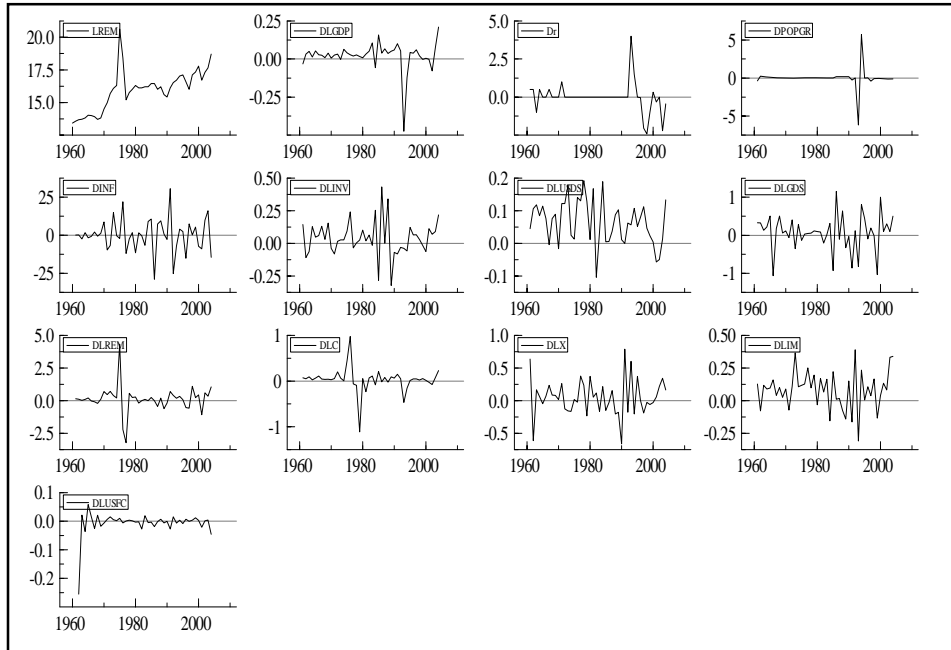


Figure 10: Trend of cointegrating variables

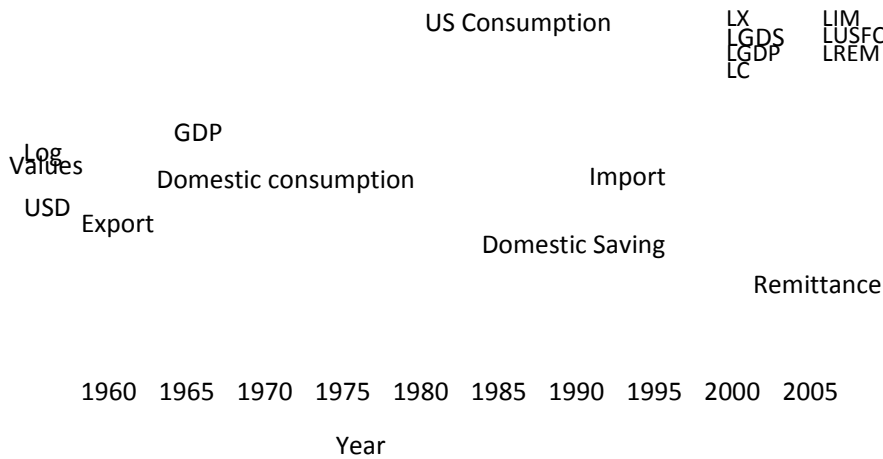


Figure 11: Error Correction Term from the Cointegrating Equation



Figure 12: Parameter Stability and Chow Test

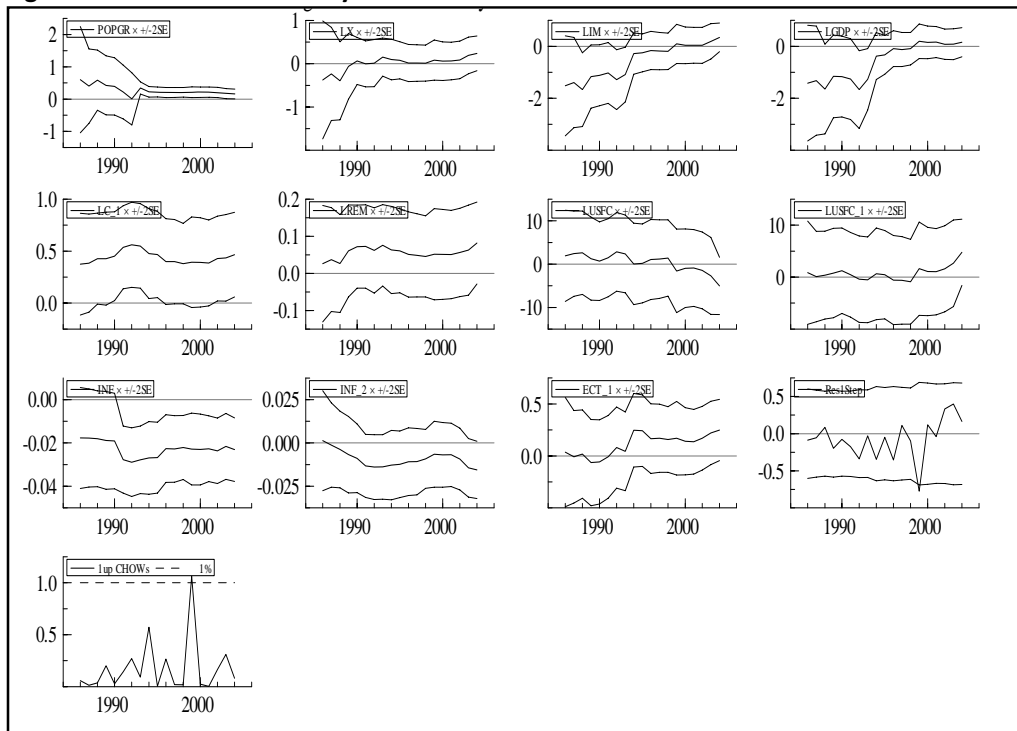


Figure 13: Actual versus fitted residuals

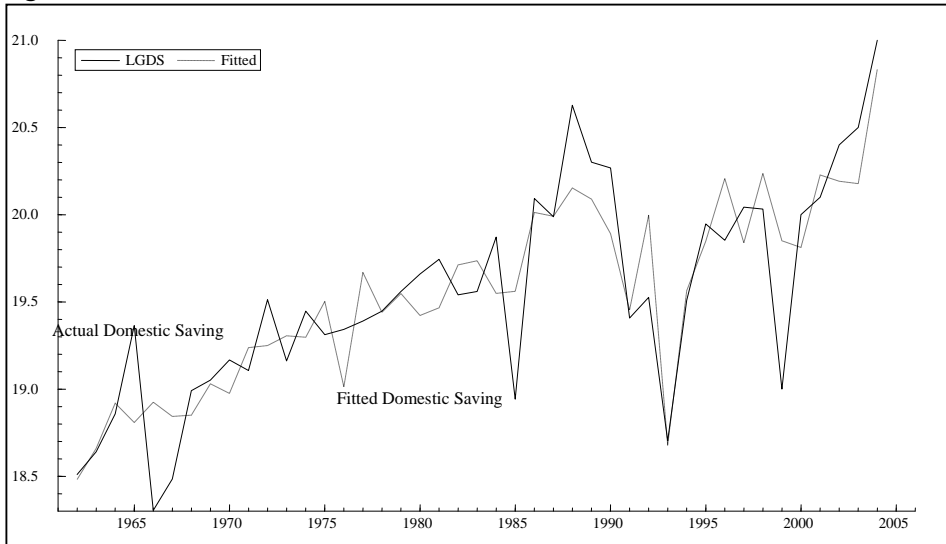


Figure 14: Impulse response function GDP (Growth) caused by change in saving rate

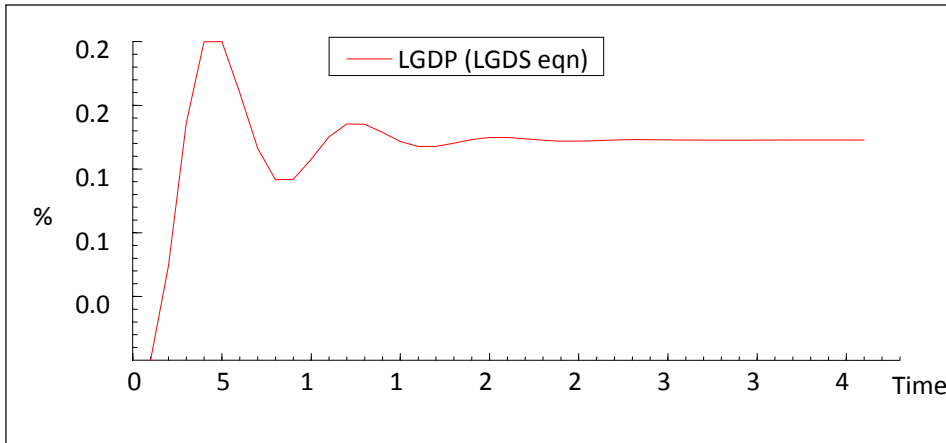


Figure 15: Actual GDP versus simulated GDP

