Causal Relationship between Economic Growth and Gross Domestic Savings: Case of Ethiopia.

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Abstract

This study used co-integration and vector error correction model (VECM) to examine the causal relationship between real economic growth and growth rate of real GDS for Ethiopia. In the due process, there are two analyses were undertaken. First, the time series properties of real GDP and real GDS were ascertained by using the ADF unit root test procedure. Finally, the long-run relationship between real GDP and real GDS was explored by utilizing the Johansen procedure. The estimated results indicate one order of integration or I(1) for the two series. Furthermore, the results of the co-integration tests indicate that there is a long-run relationship between real GDP and real GDS in Ethiopia. Finally, there is bi-directional causal relationship between real GDP and real GDS.

1. <u>Introduction</u>

The close relationship between the gross domestic saving rate of the economy and the economic growth rate is a stylized feature that has been well documented in a number of empirical investigations. In fact, it is one of the few, if not the only, relationship that cannot be erased when other possible growth influences are conditioned on. In this regards the close connection between saving and economic growth has also been a notable finding in the recent macroeconomic literature; the possibility that country differences in saving rates could be explained by differences in growth rates was recognized early. The relationship between economic growth and gross domestic savings has gained increased popularity in recent macroeconomic analysis (Pagano, 1996; Gavin et al, 1997; Sinha and Sinha, 1998; Saltz, 1999).

These studies have cast doubt on the conventional wisdom that savings engender economic growth shown by Harrod (1939), Domer (1946) and Solow (1956) indicate increase in savings translate into high investment, which in turn stimulates economic growth. The apparent effect of higher savings is to increase the availability of funds for investment. The more capital goods a nation has at its disposal, the more goods and services it can produce.

Recently, a couple of studies have dealt with the question of the temporal interdependence between the economic growth rate and the savings growth rate[1]. These research undertakings have looked more closely on what theory predicts regarding the timing of movements of savings and economic growth, and to what extent this is supported or rejected by empirical facts. That is, the results from these studies have urged some researchers to call for a reinterpretation of the traditional notion of a growth-capital accumulation relationship where capital accumulation supposedly leads growth. The present

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[1] See Carroll and Weil (1994), Kink and Levine (1994), Blomstom, Lipsey, and Zejan (1996), Paxson (1996), In and Doucouliagos (1997), Deato (1997), and Vanhoudt (1998).

paper is a contribution to this literature. Previous studies have mainly relied on cross-section or panel data to examine the causal relationship.

The point of departure here is to exploit time-series features and the information contained in the long-run relationship between the variables. Hence, savings economic growth rate modeled bivariately in either of vector autoregressive (VAR) or vector error-correction (VEC) models for Ethiopia and causality tests are then performed within these systems.

In this study we explore the causal relationship between real economic growth and growth rate of real GDS using theoretically consistent causal and co-integration test procedures. The specific purpose of this study is to determine whether increases in real GDP cause growth rate of real GDS or the vice-versa. The remaining part of the study proceeds as: section 2 deals with the macroeconomic performance of Ethiopia. Section 3 furnishes the literature review. In section 4, the data and methodology are thoroughly discussed. Section 5 presents the empirical results and section 6 provides the summary and conclusions of the study at large.

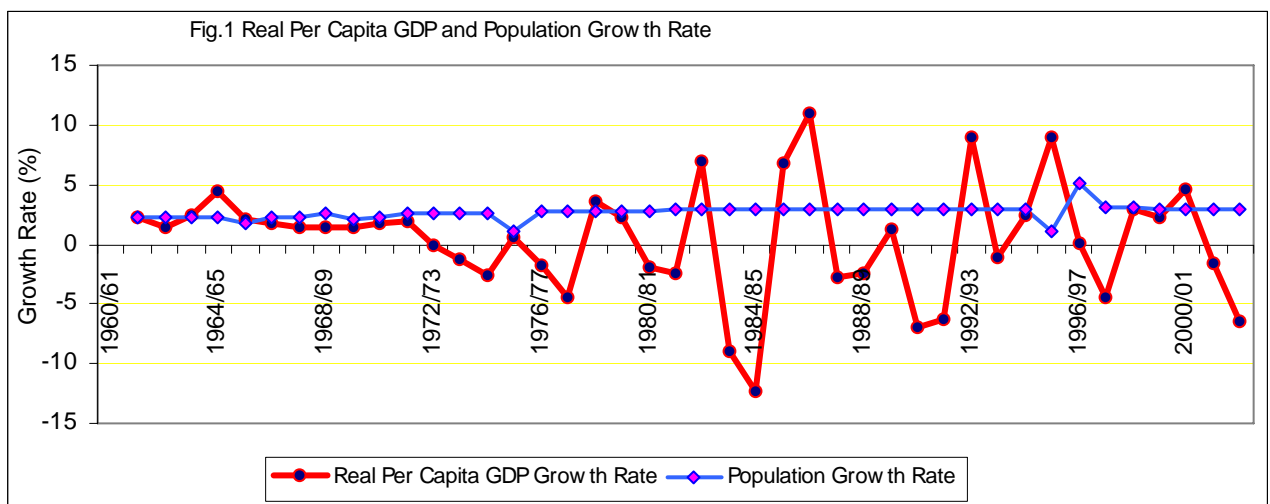## 2. Economic Growth and GDS Performance of the Ethiopian Economy

The Ethiopian economy has experienced three growth episodes during the sample period, 1960/61-2002/03. These three different growth episodes are characterized by the three regimes past and current in the country. The Ethiopian economy recorded a sustainable and promising growth performance from 1960/61-1974/75 (Bethelemy et al, 2001; Easterly, 2002). This was during the Imperial regime when the three-five-years development plans were designed and implemented. Many researchers invariably noted that the 1960s vibrant economic growth performance was somewhat short lived mainly because of the outbreak of the February, 1973/74 Ethiopian Revolution which is said to have seeded political unrest and economic stagnation in the country.

However, the above stated promising economic growth performance was aborted soon after the mid-1970s (see Table 2.1). Such unpleasant overall economic performance dwelled throughout the beginning of the 1990s. That means economic deceleration ended with the demise of the Dergue administration in May 1991. Thereafter, the poor economic performance has been reversed. If there has been any erratic macroeconomic growth path, it is attributed to both policy and non-policy related internal & external shocks in the pre-Dergue Ethiopia.
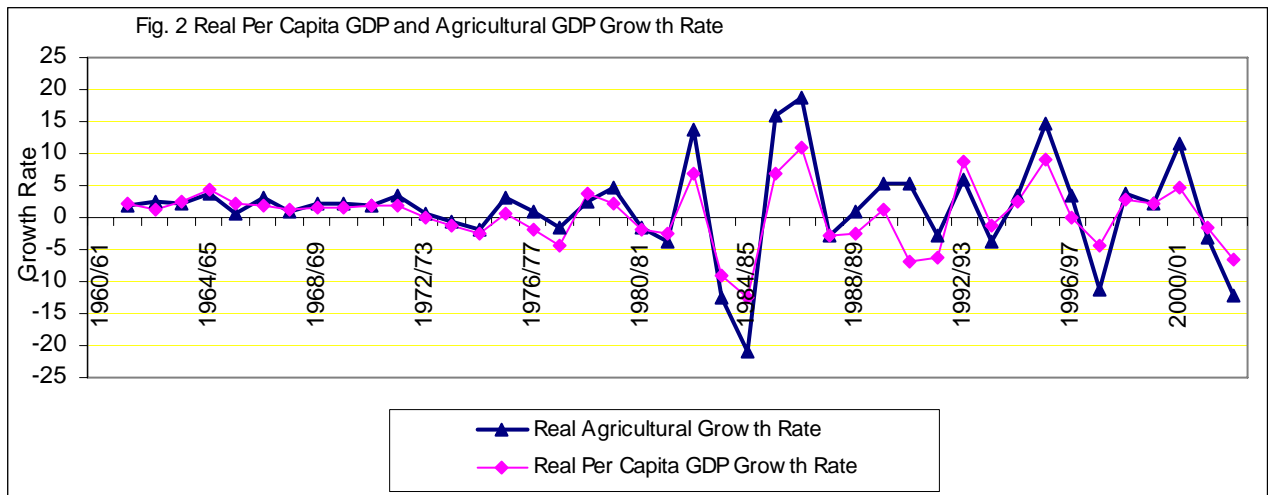
The evolution of the Ethiopian economy and its growth performance can be considered as taking place in three phases following the political swing of the country (see Alemayehu, 2000; Seid, 2000; Daniel, 2001; Easterly, 2002; Seid and Berehanu, 2003). Fig. 2.1 and 2.3 show that the growth rate of the nation's economy, which performed unsatisfactorily both in real GDP and real per capita GDP terms over the last forty-two years, 1960/61-2002/03, especially in the periods from 1974/75-1990/91. This was the period when the Dergue overthrew the monarchy government, promulgated and implemented centrally planned socialist economic management system. Thus, the

centralized economic administration of the then military government that lasted seventeen years experienced a desimal macroeconomic performance as depicted below. This had ended up in the increasing degree of macroeconomic distortion and misallocation of scarce resources.

After devastating the nation's private sector undertakings and steadily growing economy, the Ethiopian Peoples' Revolutionary Front (EPRDF) forces overthrew the military government in May 1991. The downfall of the Dergue government paved way for the EPRDF led Transitional Government of Ethiopia (TGE) to adopt a market oriented economic policy and to implement the World Bank and IMF backed structural adjustment programs (SAPs) that were expected to put the economy on its right track by eliminating distortions and resource misallocations at large. However, fig. 2.1 shows that picture of the country's economy had dramatically changed with the introduction of command economic system in 1975. For the period 1974/75-1990/91 even though the nation's economy was characterized by up and down swings in the growth process, the overall performance was extremely disappointing and poor as already mentioned above. This implies that per capita income was decelerating during the military administration (see fig. 2.2 below). Large decelerations were observed in the years 1984/85 and 1990/91. The former was due to drought and famine whereas the latter was due to the civil war and political instability.

Fig.1 Real Per Capita GDP and Population Grow th Rate

Source: Author's Calculation using the data from MOFED

Fig. 2 Real Per Capita GDP and Agricultural GDP Growth Rate

Source: Author's Calculation using the data from MOFED

2.2 Trends in Real GDP and Value Added in Sectors

As shown in fig. 2.3, the agricultural sector accounted for about 67%, 55%, 49%, and 57% of the Ethiopian real GDP in the period's 1960/61-1973/74, 1974/75-1990/91- 1991/92-2002/03 and 1960/61-2002/03, respectively. The declining trend over the last forty-three years shows as though structural transformation has taken place in the nation's economy in general and in the agricultural sector in particular.

Basically the growth of the Ethiopian economy depends on what happens to the agricultural sector, which has the largest share in every aspect of the entire economy. The industrial sector accounted for about 9,11.3, 11 and 10.3 percent, distributive services sector accounted for 11.2,14.2,14.3 and 13.2 percent as well as other services sector accounted for 13.4, 20, 27.1 and 20 percent in periods 1953-66, 1967-83, 1984-95 and 1953-95, respectively.

Fig.3 Sectors' Share in Real GDP
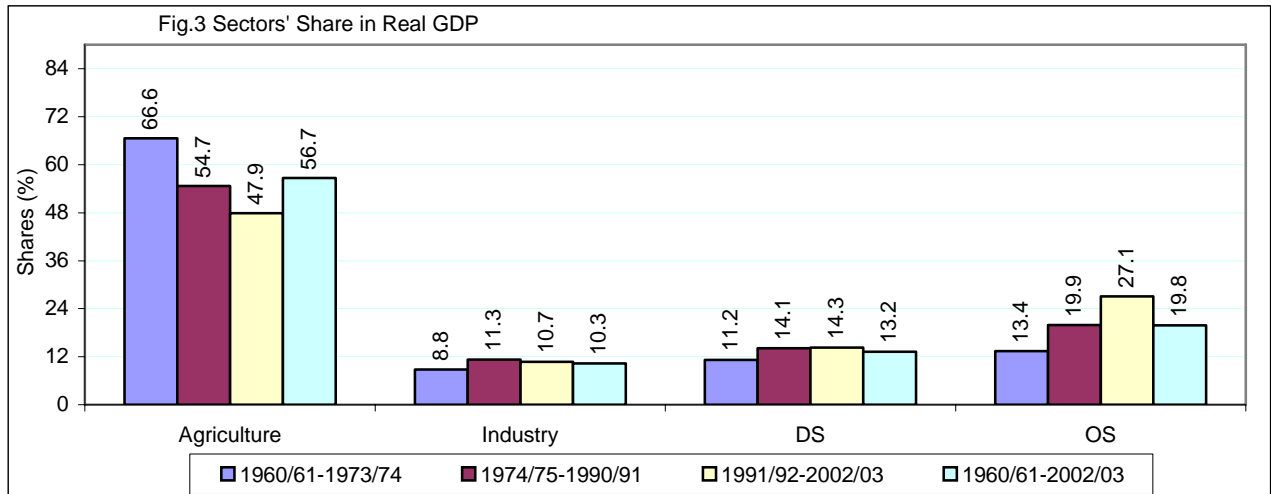
Source: Author's Calculation using the data from MOFED.

In the periods1960/61-1973/74, the country's real GDP had been growing at a linear growth rate of 3.83% per annum, whereas population and real per capita GDP were growing at rate of 2.4% and 1.9% per annum, respectively. In the next period 1974/75-1990/91, the real GDP growth rate of 1.8% per annum was not sufficient to maintain the already prevailing level of per capita income; population was growing at a rate of about 2.8% and real per capita GDP decelerating by about 0.84% per annum.

Compared to the period 1960/61-1973/74, the nation's real aggregates also recorded disappointing performance, i.e., government revenue to GDP ratio amounted 22%, and expenditure to GDP ratio was 30.2%, savings to GDP ratio 6.8% and investment to GDP ratio 13%. The country resorted heavily to both foreign and domestic borrowings so as to finance its ever-growing fiscal deficit because of accelerated growth in the government expenditure beyond the country's revenue generation capacity which, in turn, attributed to the expansion of the public sector following the socialist ideology (Daniel, 2000).

Therefore, there was huge resource gap generated then government revenue on average could not finance more than 73% of the central government expenditure which is a record level low in comparison to the 85.1% and 73.2% in periods 1960/61-1973/74 and 1991/92-2002/03, respectively. That

is, on average 27% of government expenditure was financed by domestic and foreign borrowings during the seventeen years of military regime per annum.

Since 1974/75 the Ethiopian real GDP and real per capita income had experienced conspicuous fluctuations until the downfall of the Dergue. Thereafter revival has been witnessed tremendously due to the multifaceted macroeconomic stabilization and structural adjustment programmes implemented by the TGE. Furthermore, the EPRDF led government created an economic environment that promoted private investment and also increased public enterprises profitability by strengthening their efficiency in every aspect. However, during the whole sample period in general and the Dergue regime in particular, the agricultural sector has performed unsatisfactorily.

This is substantiated by the sector's less than a unit factor contribution for real GDP growth (see Table 2.2), while the rest non-agricultural sectors have been contributing more than a unit factor to the real economic growth throughout the sample period. In the periods 1960/61-1973/74, 1974/75-1990/91, 1991/92-2002/03 and 1960/61-2002/03 growth in agriculture on average accounted for 36%, 19%, 18.5% and 29.2% of the GDP growth; while industry in the same period contributed 16.4%, 23.2%, 13.4% and 13.8 %; distributive services contributed 23.2%, 20%, 20.6% and 18.5 %; and other services accounted for 24.3%, 38.1%, 47.6% and 38.6% per annum, respectively.

Table1 Growth Rates of Real GDP and Value Added in the Sectors[2]

Periods	Growth Rate				Growth Rate of Value Added in Real Sectors			
	RY	RS	Population	PCY	Agriculture	Industry	DS	OS
1960/61-1973/74	3.87	1.63	2.4	1.9	2.12	7.3	8.11	7.1
1974/75-1990/91	1.80	0.96	2.8	-0.84	0.62	3.7	2.53	3.44
1991/92-2002/03	4.60	-2.4	3.0	0.84	1.8	5.83	6.72	8.2
1960/61-2002/03	2.53	0.46	2.7	0.41	1.32	3.43	3.6	5.0

Source: Author's Calculation using the data from MOFED.

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[2] Where 'DS' denotes distributive services & 'OS' denotes other services of GDP components.

During the Dergue period, on average, the agricultural sector grew by only 0.62%; distributive services by 2.51%; other services by 3.43%; and industrial sector by 3.7% per annum in the increasing order. The industrial sector performed well in growth terms due to the Dergue's in-ward-oriented trade and aggressive public investment led industrialization policies implemented using ten-years-perspective plan (MEDaC, 2000) even though most of the public industrial enterprises were inefficient because of the prolonged protection that shielded them from international competition.

In this period, its share in GDP growth declined by 22.1% in comparison to the Imperial period. Despite its largest share in GDP, especially between 1974/75-1990/91, agricultural sector of the nation not only contributed less than 15% to GDP growth but also performed the least in comparison to the remaining three sectors of the economy. This was due to the then military government's misguided economic policies in general and agricultural sector policies in particular as well as natural calamities; external aggression which the then Somali's government in the late 1970s and civil war that overstretched the country's entire resources to the war effort in addition to the socialist policies that contributed to country's poor growth performance. War claimed productive labor force from the sector, and diverted necessary financial resources which otherwise could have been used for the sector's enrichment and productivity rise at large.

On the other hand, the remaining three sectors, which were having small shares in GDP, continued to contribute by far greater share than the agricultural sector to growth, (other services 34.8%, industry 26.1% and distributive services 24.6%, respectively in their order of contribution share over the seventeen years of the Dergue rule). Therefore, the surprising development here is that the other services sector that was having a meager share in GDP increased from 21.4% during the Imperial administration to about 35% during the EPRDF rule. With the exception of agricultural sector,

the rest three had exhibited an increasing contribution to growth in comparison to the Monarch rule.

In the period 1991/92-2002/03, the value added of other services, distributive services, industry and agriculture grew by 8.2%, 6.72%, 5.83% and 1.8%, respectively. However, the industrial sector grew by 2.13% faster than what was achieved during the Dergue period. This was due to management autonomy and other liberalization measures that resulted increase in the public enterprises efficiency.

Despite its small share in GDP, the industrial sector is still contributing to economic growth significantly. The contribution of agriculture to growth has increased significantly over that of the Dergue regime, but did not catch up with what had been achieved during the imperial period (Seid and Berehanu, 2002). About 36% of growth in GDP came from the agricultural sector during the imperial period while this share in the EPRDF administration has become about 19% (see table 2).

This was due to frequent prevalence of natural calamities like drought in the period under consideration. During the later administration period, a great deal of contribution share to GDP growth is coming from the sectors that do not have a larger share in GDP if we compare non-agricultural sectors' with the agricultural share. Furthermore, the agricultural sector's contribution performance was by 5.1% greater than the industrial sector that has 13.4% share in GDP in the period under review. Besides, all other sectors contributed to GDP growth by a greater amount than the agricultural sector during the EPRDF administration.

Table 2 Sectoral Contributions to Economic Growth[3]

Periods	Items	Agriculture	Industry	DS	OS	SUM
1960/61-1973/74	Value	1.41	0.64	0.91	0.95	3.91
	CF	0.55	1.91	2.12	1.85	
	Percent	36.0	16.4	23.2	24.3	100.0
1974/75-1990/91	Value	0.34	0.42	0.36	0.68	1.80
	CF	0.34	2.06	1.41	1.91	
	Percent	19.0	23.2	20.0	38.1	100.0
1991/92-2002/03	Value	0.86	0.62	0.96	2.22	4.67
	CF	0.39	1.27	1.46	1.78	
	Percent	18.5	13.4	20.6	47.6	100.0
1960/61-2002/03	Value	0.75	0.35	0.48	0.99	2.57
	CF	0.52	1.36	1.42	1.98	
	Percent	29.2	13.8	18.5	38.6	100.0

Source: Author's calculation Using the MOFED's National Accounts Data.

Fig.4 Growth Rate Trend of Real GDP and Real Domestic Savings
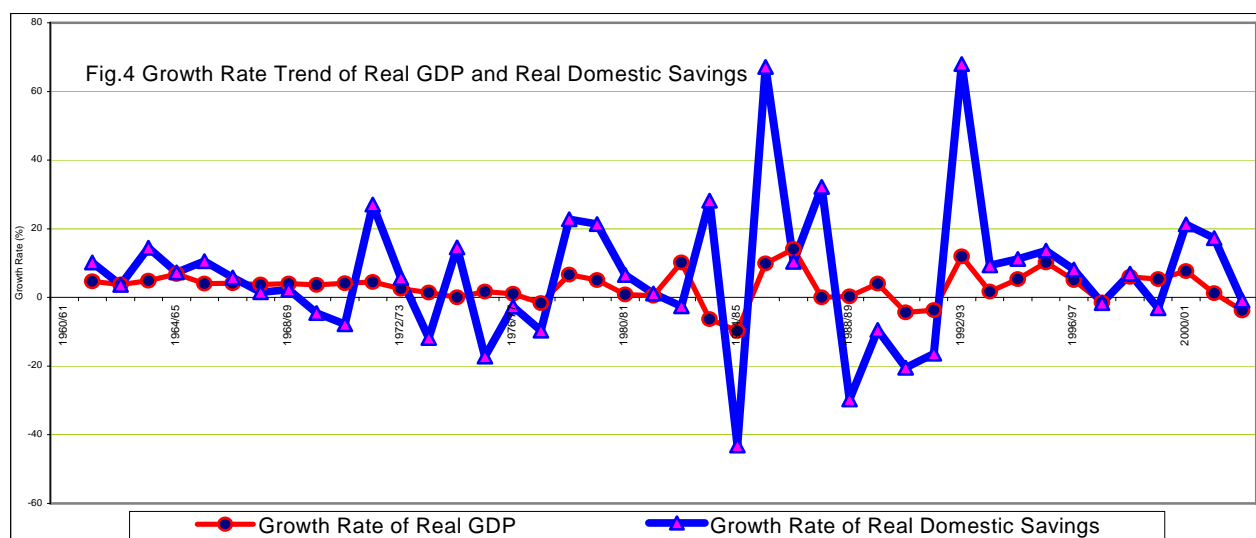
Source: Author's calculation Using the MOFED's National Accounts Data.

2.3 Trends in Gross Domestic Savings (GDS)

Macroeconomic theory reveals that economic growth is substantially affected by the rate of investment, which in turn is highly influenced by the rate of gross domestic savings (GDS). However, the Ethiopian average gross domestic savings to GDP ratio has been lower than that of the SSA average in

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[3] CF, DS and OS denote contribution factor, distributive services and other services, respectively.

real terms. The average GDS to GDP ratio in real terms for the SSA had been 16% in the 1970s and 14% in 1990s (World Bank, 1993).

The average linear growth rate of GDS to GDP in Ethiopia had been decelerated by 0.6% in the 1960s, 0.82% growth in 1970s, and 2.2% in the 1980s and plummeted into 3.2% deceleration in the 1990s. Hence, in addition to the then government's uncondusive economic policies, natural calamities, external aggression by the then Somalia expansionist regime from the late 1970s up to the early 1980s had badly affected the country's over all economic activities in general and agricultural sector in particular, which is the nation's mainstay. Continued civil war was also a main cause for this unsatisfactory performance of Ethiopia's GDS in the 1990s.

In the mean time, the poorest performance of 0.8% was recorded in 1999/00, which was one of the worst drought periods in nation's history. The highest rate of 12.3% was achieved in1987/88 after three years of recovery from the horrible drought in 1984/85, which had caused downturns during the military regime. Despite encouraging economic reform measures, disappointing performance of the country's GDS has continued, under EPRDF led government since its assumption of power at the beginning of 1990s.

This could be due to unfavorable economic basis inherited from the previous regime. Furthermore, because of unexpected Eritrea's aggression in May 1998, the country's GDS had reached a rock bottom, i.e., a record level low of less than one percent of GDP as shown above. Due to the war Ethiopian government and the entire public opted to redirect their material and human resources to defend their country that negatively affected the entire economy.

However, the country's GDS to GDP ratio has been showing a recovering trend in the post-Ethio-Eritrea border war periods despite prevalence of drought in some parts of the country. Furthermore, on average the Ethiopian real GDS

had been growing at a linear growth rate of about 2% during the Imperial period, per annum. While national consumption had been growing at a linear rate of 6.5% per annum that is by about one percent greater than that of GDS rate of growth in the same period.

However, it experienced one percent growth rate during the Dergue period, when command economic policy or central planning had been implemented for about two decades. Here it should be noted that about one percent GDS growth improvement was shown merely because the entire private sector was banned by the law of socialization of formal economic sectors as conspicuously outlined in the ten year perspective plan of the Dergue regime which persuaded the private sector to consume more and hoard the remaining portion of their income as they did not have investment opportunities otherwise. Similarly, total national consumption had grown at a linear rate of 7.43% showing nearly one percent above the Imperial period's performance due to the over expansion of the socialized public sectors and central government structures all over the country.

Despite the bold economic liberalization measures taken, the Ethiopia's GDS yet remained to be ever decelerating. These all show that saving performance of the nation has experienced no improvements even over the whole sample period (Table 4 below). Last 43 years, in all the three regimes consumption grew faster than the private one while savings growth performances were insignificant during the last two regimes. That is, growth in private, government and total consumption outweighed that of private, government and total savings growth throughout the sample period.

Table3 Growth Rates of Real GDP and Real GDS of Ethiopia

Periods	Growth Rate				
	RY	RS	R (S/Y)	PCY	Population
1960/61-1973/74	3.87	1.63	-0.02	1.9	2.4
1974/75-1990/91	1.80	0.96	0.2	-0.84	2.8
1991/92-2002/03	4.60	-2.4	-4.3	0.84	3.0
1960/61-2002/03	2.53	0.46	-1.0	0.41	2.7

Source: Author's Calculation Using the MOFED's National Accounts Data.

Fig.5 Real GDP-GDS Performance Trend
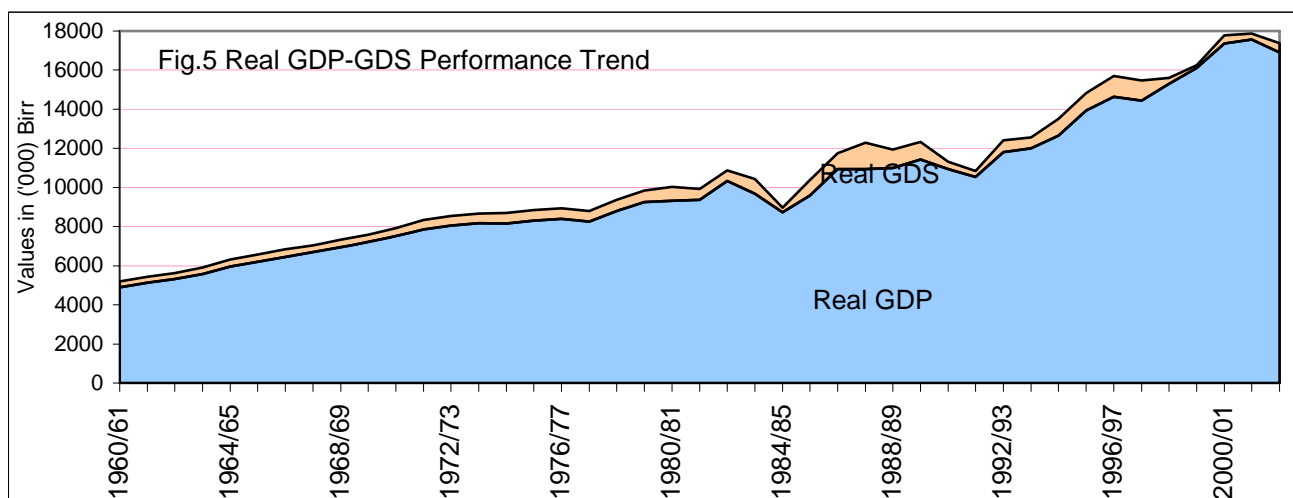
Source: Author's Calculation Using the MOFED's National Accounts Data.

3. Literature Review

Several researchers have examined the dynamic relationship between economic growth and domestic savings for developed countries. Despite its obvious importance, there has been at best very little empirical attention devoted to developing countries of Africa (Emmanuel and Ahmad, 2000). In the literature, there has been considerable debate among development economists relative to the relationship between economic growth savings. Bacha (1990), DeGregorio (1992), Otani and Villanueva (1990), and Stern (1991) using ordinary least squares (OLS) procedure found that a higher growth rate of savings is associated with higher growth.

This finding was consistent with the conventional wisdom that stipulates that domestic savings stipulate economic growth through investment. The implication is that since most developing countries are capital importers, domestic savings are therefore needed to acquire more foreign capital for investment purposes. Modigliani (1970, 1990) and Maddison (1992) also found that there is a positive correlation between savings and gross domestic product. However, recent studies by Jappelli and Pagano (1996), Gavin et al (1997), Sinha and Sinha (1998), Bosworth (1993), Carrol and Weil (1994), Saltz (1999), and Anoruo and Ahmad (2000) found evidence that economic growth granger-causes savings. The consensus that emerges from these recent studies is that economic growth granger-causes growth rate of domestic savings. This finding contradicts the traditional view with regard to the relationship between economic growth and rate of savings.

This study differs from the previous Ones by the following five 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 real GDS variables in the system;

Third, it utilizes longer country specific time series from 1960/61- 2002/03; 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. <u>Data Source and Methodology</u>

Getting an appropriate, an accurate and consistent data set for macroeconomic time-series can be one the burning issues that highly limit an economic research in developing countries like Ethiopia at large. Furthermore, most of in such cases the available data sets are not long enough to allow a reliable a long-run time-series analysis. When we come to the Ethiopian particular case, the dependable statistical data gathering and disseminating institutions are very much limited both in number and capacity. Even the organizations like former Ministry of Economic Development and Co-operation (MEDaC) data gathering history may not be longer than forty-three years. Consequently, it is hardly possible to obtain domestically prepared data, for instance for periods of five or six decades in Ethiopia.

That is, it is only from 1960/61-2002/03 that the ideal national accounts data/information is available for undertaking reliable time-series based studies like this one. This much length of time span is fairly long enough to analyze and use a co-integration of five to seven variables with the reasonable lags. Such a dependable macroeconomic/national accounts data is available in the Ministry of finance and Economic Development (MOFED), Department of National Accounts, in both old and new series. But, in the whole sample periods, the new series of national accounts goes back to only from 1979/80-2002/03 while the old series is available only for periods from 1960/61-1979/80. Therefore, national accounts data used in this study, old series is adjusted by using its growth rate. The main sources of data sources for this study are the national income accounts of Ethiopia as prepared and compiled by the Ministry of Finance and Economic Development (MOFED), Department of National Accounts.

This study uses annual data to examine the causal relationship between real economic growth rate[4] and real gross domestic saving for Ethiopia. The co-integration procedure requires time series in the system to be non-stationary in their levels. Moreover, it is imperative that all time series in the co-integrating equation have the same order of integration. Thus, the study first ascertains the time series properties of real GDP and real gross domestic saving growth rates by using the augmented Dickey-Fuller (ADF) test for stationarity (Dickey and Fuller, 1979 and 1981). The equation estimated for the ADF test is stated as follows:

$$\Delta X_t = \phi_0 + \beta_1 X_{t-1} + \delta t + \sum_{i=1}^{n} \theta_i \Delta X_{t-1} + \varepsilon_t \ldots \ldots (1)$$

Where, RY is the real GDP, Δ is the first difference operator, t is the time trend, ε is the stationary random error and n is the maximum lag length. The null hypothesis is that the series contains a unit root which implies that $\beta_1 = 0.$ the null hypothesis is rejected if β_1 is negative and statistically significant. To determine the long run relationship between economic growth rate and growth rate of gross domestic savings, the Johansen co-integration procedure is used (Johansen, and Juselius, 1990 and Johansen, 1991). The procedure involves the estimation of a VECM in order to obtain the likelihood-ratios (LR). The VECM used in the study is as follows:

$$\Delta LRY_t = \theta_0 + \sum_{i=1}^{k-1} \theta_i \Delta LRY_{t-1} + \alpha \beta' LRY_{t-k} + \varepsilon_{t.} \ldots \ldots (2)$$

$$\Delta LRS_t = \theta_0 + \sum_{i=1}^{k-1} \theta_i \Delta LRS_{t-1} + \alpha \beta' LRS_{t-k} + \varepsilon_t \ldots \ldots (3)$$

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[4] Real economic growth rate is defined as the changes in the log of real GDP and growth rate of gross domestic saving is defined as the changes in the log of real gross domestic saving.

Where, Δ is represents the difference operator. Furthermore, θ_0 represents the intercept and ε the represents the vector of white noise process. The matrix β consists of r (r≤n-1) co-integrating vectors. Similarly, the matrix α consists the error correction parameters. In reduced rank of r ≤ n-1. The alternative hypothesis, on the other hand, is that the matrix $(\pi = \alpha\beta')$ has full rank.

The Johansen co-integration technique produces two likelihood ratio test statistics namely the trace test and the maximum eigenvalues (λ-max) test. The number of significant non-zero eigenvalues determines the number of co-integrating vectors in the system. The existence of co-integration between the two variables suggests the presence of causality between GDP and growth rate of domestic savings in at least one direction.

The causal relationship between economic growth and growth rate of domestic savings is examined with the help of a granger-causality procedure based on VECM in the cases where the two series are co-integrated. This procedure is particularly attractive over the standard VAR because it permits temporary causality to emerge from:

(1)   The sum of the lagged coefficients of the explanatory differenced variable, and
(2)   The coefficient of the error-correction term.

In addition, the VECM allows causality to emerge even if the coefficients of the lagged differences of the explanatory variable are not jointly significant (granger, 1983; Engle and granger, 1987;Miller and Russek, 1990;Miller, 1991;Deble Gemechu, 2002; Dawit Sheggu, 2003). It must be pointed out that the standard granger-causality test omits the additional channel of influence (Z_{yt-1} and Z_{st-1}). In this study, the error-correction models are based on the following regression equations:

$$\Delta LRY_t = \alpha_y Z_{yt-1} + \sum_{i-1}^{a} \beta_i \Delta LRY_{t-i} + \sum_{j=1}^{b} \phi_j \Delta LRS_{t-1} + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

$$\Delta LRS_t = \alpha_s Z_{st-1} + \sum_{i=1}^{c} \theta_i \Delta LRS_{t-i} + \sum_{j=1}^{d} \lambda_j \Delta LRY_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(5)$$

Where Z_{yt-1} and Z_{st-1} represent the error-correction terms lagged by one period for the RGDP and RGDS equations, respectively. LRY_t is the growth rate of real income (defined as the changes in the logarithm of RGDP in period t). LRS_t is logarithm of RGDS (defined as the changes in the logarithm of RGDS in period t), and a, b, c, and d represent the optimal lag lengths obtained from the Akaike Information and Schwarz- Bayesian Criterion.

 In equation (4), the null hypothesis that growth rate of real GDS does not real economic growth is rejected on the condition that either the sum of $\phi_j's$ or α_y is statistically significant. Similarly, in equation (5) the null hypothesis that real economic growth does not Granger-Cause growth rate of real GDS is rejected provided that either the sum of $\lambda_j's$ or α_s is statistically significant.

5. <u>Emprical Results</u>

One of the most important attributes of a time series variable is its order of integration. The results of the augmented Dickey-Fuller (ADF) unit root tests are presented in Table 4 shows that our variables under review are non-stationary at level and stationary at the first difference. Thus the null hypothesis of non-stationarity of real economic growth and growth rate of real gross domestic savings (RGDS) of Ethiopia is tested against the alternative hypothesis of stationarity. The results indicate that both time series are not stationary in their levels. After first differencing, however, the null hypothesis of no unit root is rejected in all of the cases. In all, the results indicate one order of integration I (1) for real economic growth and growth rate of real gross domestic savings.

Table 4 The Augmented Dickey-Fuller (ADF) Unit Root Test[5]

Variables	With Constant			With Trend (and Constant)			With Seasonals (and Constant)		
	Lags			Lags			Lags		
	0	1	2	0	1	2	0	1	2
LRY_t	−0.78	−0.79	−0.59	−2.74	−3.11	−2.01	−0.78	−0.79	−0.58
LRS_t	−1.21	−1.11	−0.19	−0.86	−0.58	+0.74	−1.21	−1.11	−0.18
$DLRY_t$	−5.80**	−6.91**	−6.87**	−5.72**	−6.81**	−6.76**	−5.80**	−6.91**	−6.87**
$DLRS_t$	−4.59**	−4.81**	−4.75**	−5.21**	−5.27**	−4.86**	−4.59**	−4.81**	−4.75**

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[5] * and ** indicate that statistical significance at 1% and 5% level, respectively. The critical values for With Constant at the 1% and 5% significance levels are −3.60 and −2.94; for With Trend (& Constant) −4.20 and −3.53; and for With Seasonals (and Constant) −3.60 and −2.94, respectively.

Table 5: Johansen Co-integration Test Results[6]

Ho: rank=r	-T Ln (1-\mu)	Using T-nm	λ_{max} (95%)	-T\Sum Ln (.)	Using T-nm	λ_{max} (95%)
r==0	73.61**	34.64**	19.0	86.1**	40.52**	25.3
r<=1	12.48*	5.875	12.0	12.48*	5.875	12.3

The next step of our study involves the application of the Johansen procedure to ascertain whether real economic growth and growth rate of RGDS of Ethiopia are co-integrated. The results of the tests are shown in Table 5. The null hypothesis of no co-integration between real economic growth and real GDS growth rate (at r=0) is rejected at the 1 percent significance level. However, the null hypothesis that (r=<1) could be rejected at 5 percent but not at 1 percent level of significance. One can infer from the fact that economic growth and growth rate of real GDS are co-integrated for the Ethiopia economy (1) that there is a long-run equilibrium relationship between the two series (variables) and (2) the existence of causality in at least one direction.

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[6] ** Indicates the rejection of the null hypothesis at the 1% level of significance. The critical values are obtained from the Pc Fiml 9.10 program. The number of lags used in the analysis is 9. A variable entered unrestricted is constant but a variable entered restricted is time trend.

Table 6: Causality Test Based on VECM: F-statistic[7]

Panel A: LRY Growth Equation		
Z_{y-1}	LRY	LRS
t=-2.805 [0.0149]*	F(9,13) = 2.998 [0.03357]*	F(9,13) = 3.292[0.0256]*
Panel B: LRS Growth Equation		
Z_{s-1}	LRY	LRS
t=-3.172 [0.0074]**	F(9,13) = 16.208 [0.0000]**	F(9,13)= 14.673[0.0000]**

Given the results of the co-integration tests, one has to estimate the VECM of equations (2) and (3) in chapter 3 above to determine the direction of causality between real economic growth and growth rate of real GDS since the series are co-integrated. If they were not co-integrated, the standard Granger-Causality test based on a vector autoregressive (VAR) was used to ascertain the direction of causality as done by Anorou and Ahmad, 2000 for Nigeria. The results of the bivariate causality tests from the VECM are shown in panels A and B of Table 6. The results indicate that there is a bi-directional causality or feedback between real economic growth and growth rate of real GDS. The previous studies show that in most Sub-Saharan African countries, the empirical investigation results revealed that causality ran from real economic growth to the growth rate of real GDS.

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[7] Lag length is 9 and trend is included in the regression. * & ** Associated with the F-statistic represent statistical significance at all 5% and 1% level of significance, respectively.

6. <u>Summary and Conclusions</u>

This study used a co-integration procedure to investigate the causal relationship between the real economic growth and the growth rate of real gross domestic savings in Ethiopia for the period 1960/61-2002/03. When we come to the specific methodology, the study adopted the Johansen's co-integration approach to determine the rank(s) of the co-integration vectors spanned by the stochastic process of real economic growth and growth rate of real gross domestic savings. The vector error-correction model is estimated to ascertain the direction of causality between the nation's RGDP and RGDS. That means, this study finds that real economic growth and growth rate of real GDS are co-integrated in our case.

Overall, this study findings lend support to the hypothesis that faster growth rate RGDS cause higher growth rates of RGDP in Ethiopia. Also to the lesser extent, a higher rate of growth of real GDP causes a faster growth of real GDS. Finally, for Ethiopia bi-directional (feedback) causality was found. In summary, this study finds that real economic growth engenders real GDS for Ethiopia more than the vice-versa. This is consistent with Sinha and Sinha (1998), Saltz (1999) and Anoruo and Ahmad, 2000.

The policy implication that emerges from this brief study is that the Ethiopian policymakers should be aware of the possibility of causality strongly running from real GDS to real economic growth than otherwise. To effect, they should be cognizant of these results and should concentrate on promoting real economic growth via adopting income policies, since such strategies can definitely lead to higher growth of real GDS as well as to a more rapid economic growth.

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