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Domestic Investment, Savings and Economic Growth in Tanzania: A Dynamic Multivariate Analysis

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Abstract
The study examined interdependence between domestic investment, savings and economic growth using cointegration and VECM. The study used time series data of 42 years from 1972 to 2012. The result indicates no evidence of the existence of short run or long run correlation between savings and investment. The weak short run positive correlation is observed between savings and per capita GDP. Moreover, there is long run positive correlation between investment and per capita GDP. Interestingly EDS found to have a long run significant positive correlation to both investment and savings but on the other hand significant negative correlation between EDS and per capita GDP in short run. EDL found negatively correlated with investment over the long run. Granger causality result provides strong evidence of joint influence of variables than individual causality. The shock imposed on investment found to have positive long lasting effect on itself, savings and per capita GDP unlike savings shocks which dies away after short period on investment and long lasting negative impact on per capita GDP. Moreover, shock on per GDP is having long lasting effect on itself, investment and savings. We therefore suggest proactive policy which would encourage investment and promote growth. As a result, over the long run domestic saving will automatically increase and lead to sustainable economic growth.
Keywords: Investment, Savings, Economic growth, Cointegration, VECM, Impulse Response, Variance Decomposition

1. Introduction

This study aimed at examining the interdependence between investment, savings and economic growth. Economic growth has been a concern of every country in the world. However the road towards growth has been a debatable topic for a long time. Savings and investments are among the immensely discussed factors determining economic growth; however, it is noted that theories discussing connection between investment, savings and economic growth have no consensus. Neo-classical and Marxist theories of economic growth gave emphasis on savings as a determining factor for growth, also supported by McKinnon (1973) and Shaw (1973) that high level domestic savings accelerate investment, enhance productive and economic growth (Obi et al. 2012). On the other hand Neo-Keynesian and classical models emphasis on investment (Chaudhri & Wilson 2000). Keynes states that savings is an excess income over consumption or a by-product of growth whereas growth is a result of investment through a multiplier effects (Seka 2011).

The equality between investment and domestic savings is core to insure macroeconomic balance in a given country(Obi et al. 2012). However countries which are open to foreign capital then domestic savings is neither necessary nor sufficient for investment and economic growth (Chaudhri & Wilson, 2000; Youri & Reding, 2000). Besides, depending on foreign savings may be costly because it is volatile and the sudden stop may lead to costly macroeconomic adjustment and crisis on growth (Obi et al. 2012). Similarly, foreign saving led growth might not be translated to the welfare of people within the country thus national strategy should not only focus on promoting foreign investors but encourage domestic savings to transcend the impact of growth to majority.

1.1 Experience in Tanzania

This section discusses the trend of investment, savings and growth in Tanzania. Background indicates that there has always been saving gap in Tanzania. Data extracted from World Bank database and national bureau of statistics indicates the gross domestic investment exceeds national savings since 1972 to 2012 except 1977 where both are expressed as a percent of Gross domestic product (GDP). As depicted in figure 1 there has been stationary structure of saving gap from 1972 to 2003 though from 2004 started to increase till 2012. The gap was around TZS 267 million excess of investment over savings in 1972 and it has reached TZS 13,392,098 million in 2012. Interestingly, economic growth has been moving with the gap (see figure 1). The higher the gap the higher the growth, this create a view that the more the investment the more the growth. However this study needs to establish the role of savings on growth and its nexus with investment in Tanzania.

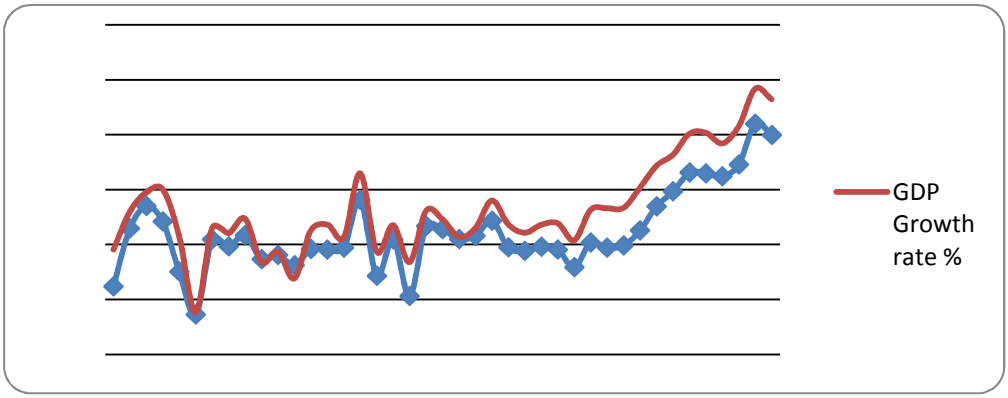

Figure 3: Saving Gap and Growth Of GDP Trend

The presence of more investment than domestic savings creates a need of foreign financing. Studies shows external debt in developing countries plays an important role in filling a gap between savings and investment by (Chenery, 1996) as cited from (Kasidi & Said 2013). Tanzania stated to be one of the top recipients of external debt in Sub-Saharan Africa (SSA) (Edwards 2012). The data indicates debt to GDP ratio in Tanzania before 1994 had no pattern, however from 1994 debt to GDP ratio started to show the decreasing trend (see figure 2). Perhaps this is a good sign because debt servicing may be a burden to threaten economic growth. Table 1 reveals external debt has always been on the higher side relative to domestic savings. The highest five years average to be attained on the domestic savings (SV) to GDP ratio is 15.36 percent while total external debts (EDT) to GDP highest attained is 143 percent and the lowest is 35 percent. This is the evidence of the crucial role external debt is playing in Tanzanian economy. Thus, our study incorporates external debt in the analysis of relationship between investment, savings and economic growth.

Table 1: Savings and External Debt (EDT) in Tanzania (Five years average)

YEAR	% of SAVING to GDP	% of INV to GDP	% of EDT to GDP	GDP Growth rate %
1972-1976	10.72	21.02	90.82	4.92
1977-1981	13.24	20.61	98.21	1.48
1982-1986	9.08	17.48	115.68	1.62
1987-1991	15.36	24.81	128.14	4.18
1992-1996	10.86	22.69	143.35	2.3
1997-2001	6.50	15.25	77.25	4.6
2002-2006	8.65	22.32	56.82	7.2
2007-2011	6.46	31.46	35.17	6.78

Despite the decreasing trend of external debt the inflows, we noted the inflow of foreign direct investment (FDI) has been increasing in Tanzania (see figure 2). It shows that ratio of foreign direct investment (FDI) to GDP has increased from 0.26 percent in 1991 to 6.04 percent in 2012. Though FDI is increasing yet still is in the very lower side relative to total external debt (see table 1). Thus our study has considered only external debt than FDI. This trend of external debt and FDI trend in Tanzania might support the view that countries which are open to foreign capital then domestic savings is neither necessary nor sufficient for investment and economic growth (Chaudhri & Wilson, 2000; Youri & Reding, 2000). This is because we see GDP growing in Tanzania despite decreasing saving rate in Tanzania as depicted in figure 1. However this raises a sustainability concern, as stated by Obi et al., (2012) for sustainable growth in developing countries significant increase in domestic savings is required because dependence on foreign savings may be costly for macroeconomic adjustment and crisis on growth due to its volatile and sudden stop may occur.

Therefore this paper examines interdependence between domestic investment, savings and economic growth, also the role played by external debt in Tanzanian economy. The finding of this study is fundamentally relevant to the policy makers in analyzing the policy relevance boosting domestic investments, savings and economic growth.

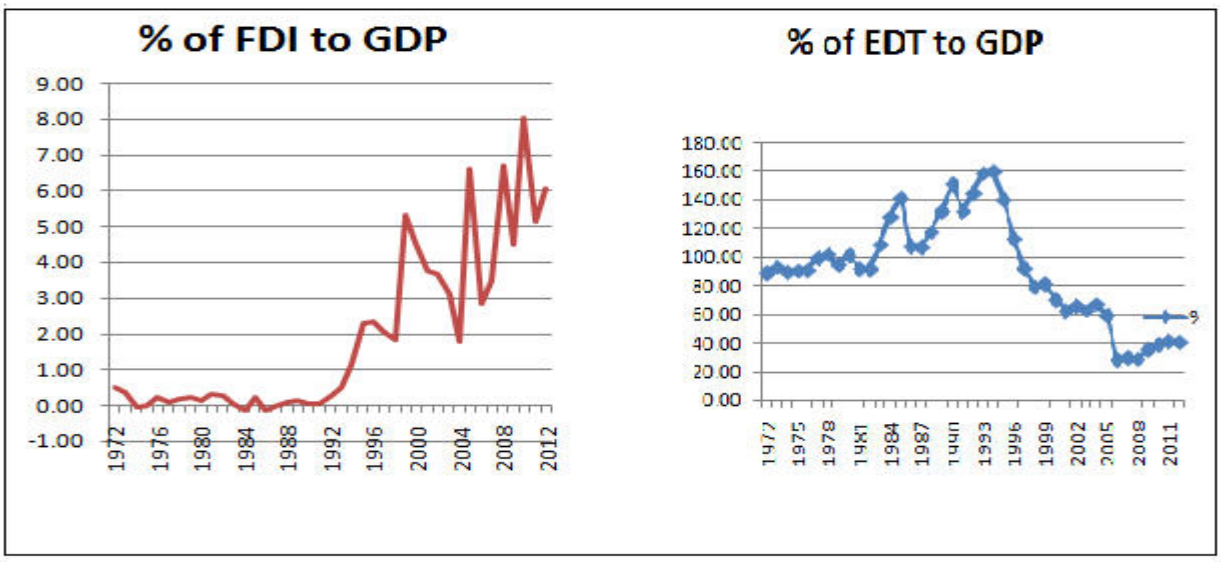

Figure 4: FDI and Total External Debt (EDT) Trend

The paper is organized in five sections whereas section one is the introduction part covered above, section two review of literature, section three data description, section four model specification and analysis and last is conclusion policy implication

2. Review of Literature

Investment is considered to be an engine of economic growth (Tehranchian & Behravesh 2011). It argued that increased investment not only increases production but also it creates more job opportunities in the economy. The investment may be in both business assets and public infrastructure. However, financing is an important component in investment. Thus, savings play a key role in proving support to investment (Sentance, 2007; Tehranchian & Behravesh, 2011). Sentance added that savings occurs when income is not immediately consumed rather it is set aside for future use. The national savings is generated by savings of private, corporate and government entities.

The equality between savings and investment is necessary for macroeconomic balance(Obi et al. 2012). However in most of developing countries saving rate is lower hence creating a gap between savings and investment. The saving gap considered to be an obstacle in economic growth (Tehranchian & Behravesh 2011). However in an open economies, foreign savings in terms of foreign direct investment or external debt especially in developing countries plays an important role in filling a gap between savings and investment by (Chenery, 1996) as cited from (Kasidi & Said 2013). Though dependence on foreign savings may be costly in terms of macroeconomic adjustment and crisis on growth because it is volatile and sudden stop may occur (Obi et al. 2012). This is evidenced by the fact that foreign aid has been a tool for inducing the adoption of policy changes in recipient countries, whereas failure to adhere to donors wishes result cutting down of aids e.g. There has been a deadlock between Tanzania and donors in 1980s before embarking to economic reform and in mid of 1990s (Edwards 2012).

Despite clear role stated for savings and investment yet still causality between the two and economic growth is far from consensus. Neo-classical and Marxist theories of economic growth gave emphasis on savings as a determining factor for growth supported by McKinnon (1973) and Shaw (1973) stating that high level domestic savings accelerate investment, enhance productive and economic growth (Obi et al. 2012). On the other hand Neo-Keynesian and classical models emphasis on investment (Chaudhri & Wilson 2000)

The empirical evidence shows mixed results on the relationship between saving and economic growth. In one hand the relationship between savings and economic growth found to be bidirectional in the study conducted in Bangladesh, China, Iran and Malaysia by Pradeep Agrawal & Pravakar Sahoo, (2008) Lean & Song, (2009), Verma, Wilson, & Pahlavani, (2007) and Tang & Chua, (2009) respectively. Whereas unidirectional causality from saving to economic growth is reported in study conducted in Botswana, China and emerging countries by Amusa & Busani, (2013), Lean & Song, (2009) and Misztal, (2004) respectively. The study of Lean & Song states that bi-direction exist short run but unidirectional exist in long run. On the other hand study by Obi et al., (2012) found unidirectional causality from economic growth to saving, this is in line with Keynesian theory which states that saving is a byproduct of growth, the growth which is result of investment through a multiplier effects (Seka 2011). Thanoon & Baharumshah, (2012) reported impacts of particular factors depends on the regions, they found economic growth to have positive effect on national saving for Asia but negative for Latin America. Contrary, countries which are open to foreign capital then domestic

savings is neither necessary nor sufficient for investment and economic growth (Chaudhri & Wilson, 2000; Youri & Reding, 2000). For example foreign savings has been a source of investment in Australia (Chaudhri & Wilson 2000).

Moreover, existing empirical studies reported mixed results on the relationship between investment and economic growth. Bidirectional causal relationship between investment and economic growth is reported for Pakistan using granger causality test(Ahmad, Najid; Luqman' Muhammad and Hayat 2012). However another study in Pakistan found unilateral causal relation from investment to economic growth by using VAR approach (Hashmi & Hashmi 2012). On the other hand (Obi et al. 2012) found causal relation in opposite direction from lagged growth to investment. Whereas the study conducted in Iranian data show that the role of investment is imprecise (Verma et al. 2007).

The causal relationship between savings and investment indicates also to have no consensus results. The study by (Ngouhouo & Mouchili 2014) and (Obi et al. 2012) found unidirectional cause effect from investment to savings and not other way round. On the other hand other studies by Serieux (2008) and Wong (1990) on 19 African countries found that both investments and savings depends on economic growth (Seka 2011). In addition Seka has also cited Mersch (2003) stating that fluctuation of investments automatically affects variability of savings through dispersion of income growth.

The review revealed there are different determining factors of national savings, investment and economic growth. International capital inflow found to displace domestic savings in Asia and Latin America though export found to contribute positive on savings in both region Asia and Latin America (Thanoon & Baharumshah 2012). Similarly foreign direct investment found to displace domestic savings in Malaysia, whereas shock on short term debt found to have positive effect on saving in short run but negative over the long run (Thanoon & Baharumshah, 2003). Other determinants of savings are interest rate, dependence ratio and bank density by Pradeep Agrawal & Pravakar Sahoo, (2008). Whereas Obi, Wafure, & Menson, (2012) added economic liberalization to have significant influence on savings. On the other hand, Keynesian stated that investment depends on effective demand. According to him interest rate assist in determining the allocation of savings whether financial placement or hoarding (Seka 2011). Besides, Asare, (2013) stated that increase in private investment in developing countries would be achieved by ensuring foreign and unproductive assets such as cash and gold are channeled through banking sector. That means, banking sector play significant role by mobilizing savings then accelerate investment hence economic growth.

Therefore from review above we noted existence of the important link between savings, investment and economic growth. However, we see no unique agreement on the link between these three variables either in similar country or in different countries. Also there are different factors influencing savings, investment and economic growth. Therefore, this study intend to include short term and long term external debt due its importance in bridging saving gap in developing countries in order to examine relationship between investment, savings and economic growth.

3. Description of Data

The study utilized annual time series data of Tanzania which covering a period of 42 years from 1972 to 2012. The selection of the period was based on data availability for all variables. The sources of data include World Bank database, National Bureau of Statistic reports and Economic survey bulletin from Tanzania. The data includes national savings (SV), Gross capital formation as a proxy of domestic investments (INV), GDP per capita (GDPC) as a proxy of economic growth, short term external debt (EDS) and long term extern debt(EDL) as adapted from different studies such as Chaudhri & Wilson, (2000), Seka, (2011) and Thanoon & Baharumshah, (2003). All variables are transformed into natural logarithms to account for nonlinearity (Dasgupta 2009). Thus every variable is preceded by a letter L to indicate log. The study considered the external debt because found to play significant role in financing investment-saving gap especially in developing countries as revealed in the literature review section. Table 2 presents descriptive statistics of these variables. Using Jarque-Bera statistics all variables found normally distributed because probabilities are not statistically significant to reject the null hypothesis.

Table 2: Descriptive Statistics

	LGDPC	LINV	LSV	LEDL	LEDS
Mean	10.48529	12.17496	11.30771	13.28634	11.68974
Median	10.90106	12.82945	12.19602	14.37095	12.07173
Maximum	13.84024	16.55322	14.69488	16.45299	15.02158
Minimum	6.682109	7.799343	6.683361	9.122374	6.698362
Std. Dev.	2.394754	2.828138	2.586012	2.529854	2.345893
Skewness	-0.200711	-0.095201	-0.296743	-0.419781	-0.454030
Kurtosis	1.509653	1.597223	1.605120	1.511856	2.001080
Jarque-Bera	4.069719	3.423562	3.925608	4.987373	3.113293
Probability	0.130699	0.180544	0.140464	0.082605	0.210842
Sum	429.8969	499.1735	463.6160	544.7398	479.2793
Sum Sq. Dev.	229.3938	319.9346	267.4982	256.0064	220.1285
Observations	41	41	41	41	41

4. Model Specification and Analysis

Due to complexity and presence of feedback relationship between investment, savings and economic growth as noted in the literature review, VAR estimation method applied in our analysis as adapted from (Thanoon & Baharumshah 2003). The VAR is among the model proposed in literatures in the presence of simultaneity among variables. According to Christopher Sims all variables requires equal footing if truly there is a simultaneity among them, that means no distinction of variables i.e. exogenous and endogenous (Gujarati 2004). The term autoregressive is due to a presence of lagged values of the dependent variables on RHS of the equations while the term vector is due to a fact that it deals with a vector of two or more variables. Equation 1 represents a general VAR model of k variables generated by p order process with Gaussian errors (Thanoon & Baharumshah 2003).

$$y_t = \alpha + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \ldots\ldots\ldots + \phi_p y_{t-p} + \varepsilon_t \quad (1)$$

Where Yt denotes vector of k variables, α is kx1 vector of constants, φ is a kxk coefficient matrix of Y lag variables, Yt-i represents kx1 vector of lagged variables by p-order. Whereas εt represents stochastic error terms for unpredictable innovation in each variable which is not captured by past values of the variables. This study uses five variables LINV, LSV, LGDP, LEDL and LEDS thus making VAR-5 system. In this study all variables entered the system in logarithm form.

4.1 Unit Root Analysis

It is a standard practice to examine unit root of individual series before analyzing time series data. This is a preliminary stage in analyzing cointegration or long-run relationship among the series and also to avoid spurious regression results (Dasgupta 2009). The unit root test enables to determine the order of intergration for each series. There are numerous number of unit root test such as Augmented Dickey Fuller (ADF), Phillip Perron (PP), Kwiatkowski, Phillips, Schmidt, and Shin (KPSS), Ng and Perron (NP) etc. However this study applied two tests i.e. Augmented Dickey Fuller (ADF) test and Phillip Perron (PP) test as adapted from Thanoon & Baharumshah, (2003). The ADF and PP test said to perform well in large sample though PP perform better than ADF (Dasgupta 2009). It is also frequently recommended to use of alternate tests to check whether outcomes are same or not for reliability purpose.

The ADF test is an extension of DF test that allows serial correlation in the residual by adding lagged difference terms of regressand. ADF is estimated based equation 2 (Gujarati, 2004pp817)

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

Where $\Delta Y_t = Y_t - Y_{t-1}$ and $\Delta Y_{t-1} = Y_{t-1} - Y_{t-2}$ etc, ε_t is a pure white noise error term. β_1, β_2, δ and αi are the estimated coefficients. However ADF test is centered on the significance of Y_{t-1} coefficient (δ). If it is less than zero and significant from zero then the null hypothesis is rejected, that means there is no unit root in the variable. In this study we conducted ADF test which include drift and time trend at level and included only drift at first difference for each variable using E-view 8 software where automatic lag length using Schwarz-Information Criterion is adapted.

Moreover, the study employed Phillip Perron (PP) test which assume asymptotic distribution as ADF but it uses a non parametric statistical approach to take care of residual serial correlation without adding difference term (Gujarati, 2004pp817). We also conducted PP test with drift and time trend at level and only drift at first

difference for each variable. The results for all two tests are presented in Table3. Results indicates similar conclusion for both ADF and PP. All variables were found non stationary at level either with drift only or with drift and trend, but stationary at first difference with the inclusion of drift only.

Table 3: Unit Root Test Results

	AUGEMENTED DICKEY FULLER			PHILLIPS–PERRON (PP)			
	Level		First difference	Level		First diff	
VARIABLE	Drift	Drift & Trend	Drift	Drift	Drift & Trend	Drift	REMARK
LGDPC	-0.9518	-1.2624	3.5473*	-0.8587	-1.0474	-3.5525*	I (1)
LSV	-1.1595	-2.7525	-8.0209*	-0.6726	-2.7633	-8.5299*	I (1)
LINV	-0.2434	-1.6200	-11.0592*	-0.2671	-3.0344	-10.380*	I (1)
LEDS	-1.8316	-3.0037	-7.8406*	-2.3578	-2.9301	-8.0947*	I (1)
LEDL	-1.3781	-1.1052	-3.9247*	-1.1583	1.0288	-3.9144*	I (1)

* indicates rejection of null hypothesis at 1% significant level

Note

1. GDP stands for GDP per capita, SV stands for Saving, INV stands for Gross Capital Formation, EDS stands for short-term external debt and EDL stands for Long term external debt
2. These variables were measured in natural logarithmic form
3. I (1) indicates variable is stationary at first difference

4.2 Cointegration Analysis

The test is normally applied to series which are non stationary but integrated of the same order. Since unit root test results above indicates variables to be non-stationary and integrated at same order I(1), Our next step is to determine the existence of long-run relationship among variables. The linear combination of two or more non stationary series are likely to be stationary if they are cointegrated and this is considered a long-run or equilibrium relationship among variables (Brooks, 2008 pp335). Conventionally there are two tests for cointegration commonly used; Engle and Granger approach and Johansen approach. However, the Johansen approach is stated to be superior over Engle and Granger especially if variables portray feedback relationship and if there is a possibility of more than one cointegrating vectors (Brooks, 2008 pp342). The Johansen has ability to identify and isolate r cointegrating vectors among a set of k cointegrated variables. The presence of coitegrating vectors forms a basis of vector error correction model (VECM) specification. Thus Johansen approach uses VECM model which incorporate error correction term (ECT) in the model as presented in equation 3 which is transformation of equation 1.

$$\Delta Y_t = \Pi Y_{t-p} + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + ... + \Gamma_{p-1} \Delta Y_{t-(p-1)} + \varepsilon_t \qquad t=1, 2\ldots\ldots\ldots\ldots T \qquad (3)$$

Where, Δ is a difference operator for variables in left hand side (LHS) of the equation and p-1 lags of the dependent variables on the right hand side (RHS) each with coefficient matrix (Γ). Johansen is centered on ∏ coefficient matrix since in long-run differenced variables (ΔY_{t-i}) will be zero and the error term (ε) is set to its long run expected value which is zero. That means in long-run the equation will be set as $\prod Y_{t-k}=0$. The ∏ is kxk matrix of the form ∏=αβÜ where β contains r cointagrating relationship and α is equilibrium adjustment term for each vector (Dasgupta 2009). Thus cointegration between Ys is determined by rank of ∏ matrix using eigen-values which are significantly different from zero. Johansen approach provides two test statistics which are trace statistics and maximum eigenvalue statistics, however, Johansen results are affected by lag length thus determination of optimal lag length before estimation is essential (Table 4 present lag length selection criteria results). The sequential modified likelihood ratio (LR) and Final prediction error (FPE) information criterion indicate the optimal lag length to be 3 while Akaike information criterion (AIC) and Hannan-Quinn information criterion (HQ) indicates 5 to be optimal lag length. More Schwarz information criterion (SC) indicates two to be optimal lag length. We chose 2 as optimal lag length suggested by SC because using 3 lags suggested in LR and FPE lead to serial autocorrelation problem in our VECM model. Moreover too many lags may consume degree of freedom also may result into multicollinearity problem (Brooks, 2008 pp350).

Table 4: Lag Length Selection Criteria Results

VAR Lag Order Selection Criteria						
Endogenous variables: LINV LSV LGDPC LEDS LEDL						
Exogenous variables: C						
Sample: 1972 2012						
Included observations: 36						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-124.9386	NA	0.000939	7.218810	7.438743	7.295573
1	34.90409	266.4044	5.32e-07	-0.272449	1.047150	0.188126
2	83.95284	68.12327	1.52e-07	-1.608491	**0.810774***	-0.764103
3	127.4089	**48.28447***	**6.89e-08***	-2.633826	0.885105	-1.405625
4	157.1342	24.77110	8.82e-08	-2.896344	1.722253	-1.284330
5	198.7224	23.10459	1.01e-07	**-3.817913***	1.900350	**-1.822086***
* 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						

Determination of optimal lag length allowed us to conduct Johansen test. The test conducted by allowing linear deterministic trend in data and taking lag 2 for differenced endogenous variable and results are presented on Table 5. Results indicates two null hypothesis i.e. no cointegration hypothesis and at most 1 cointegration hypothesis were rejected at 0.05 by both trace and max-eigen test statistics. Whereas hypothesis that at most 2 cointegration could not be rejected, hence tests suggested the existence of two cointegrating equations among five variables (LGDPC, LINV, LSV, LEDS and LEDL). This confirms the existence of long-run relation among our macro economic variables.

Table 5: Cointegration Test Results

Unrestricted Cointegration Rank Test: Variables: LGDPC, LINV, LSV, LEDS, LEDL						
Hypothesized			Trace		Max-Eigen	
Ho	Ha	Eigenvalue	Critical Value	Statistic	Critical Value	Statistic
r=0	r=1	0.707178	69.81889	123.1680*	33.87687	45.44300*
r≤1	r=2	0.662369	47.85613	77.72503*	27.58434	40.17465*
r≤2	r=3	0.557090	29.79707	37.55038*	21.13162	30.13237*
r≤3	r=4	0.150746	15.49471	7.418011	14.26460	6.045690
r≤4	r=5	0.036410	3.841466	1.372321	3.841466	1.372321
Note: r indicates number of cointegrating relation (rank) * Indicates rejection of the hypothesis at the 0.05 level Both Trace statistic and Max Eigen statistic indicates 3 cointegrating equation at 0.05 level						

Since the rank of ∏ matrix (r=2) is less than number of variables (k=5), it implies that, the system is non stationary but there two cointegrating equations. This necessitates normalization process to allow identification of long-run parameters of cointegrating vectors. Normalization is automatically done on LINV and LSV by E-view 8 as presented in equations 4 and 5. The figures in parenthesis indicates t-statistics

$$\underset{(-6.819)}{LINV(-1) = 1.428 * LGDPC(-1)} + \underset{(-4.015)}{0.598 * LEDS(-1)} - \underset{(3.919)}{0.686 * LEDL(-1)} - 0.720 \quad (4)$$

$$\underset{(0.069)}{LSV(-1) = -0.023LGDPC(-1)} + \underset{(-5.172)}{1.198 * LEDS(-1)} + \underset{(-0.119)}{0.032 * LEDL(-1)} - 2.695 \quad (5)$$

The above equations provide long run relationship. From equation 4 we see, in long run, there is a significant positive correlation between domestic investment and per capita GDP and EDS. whereas significant negative correlation found between domestic investment and EDL. Specifically, when GDPC increases 1%, the domestic investment rise by 1.43%, whereas, an increase 1% in EDS, the domestic investment rise by 0.59%. Besides, a 1% increase in EDL, leads to 0.69% fall in domestic investment.

Moreover normalization on savings presented on equation 5 indicates, in long run, there is significant positive correlation between savings and EDS. whereas the equation provides no significant evidence of the

correlation between EDL and GDPC. We see that when EDS increases 1%, the savings rise by 1.198%.

4.3 Vector Error Correction Model (VECM)

The existence of cointegration indicates the presence of long run equilibrium among variables and short run disequilibrium of generation of dynamic process (Li & Liu 2012). The usual VAR in the presence of cointegration is mis-specified because in the longrun differenced variables converge into zero, thus, vector error correction model (VECM) is recommended (Thanoon & Baharumshah 2003). The VECM describe the short term dynamic among variables. Equation 6 is a representation of the VECM model. Every variable in VECM is I(0) either because of first difference or because of linear combination of the variables.

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} - \phi(\lambda' Y_{t-k}) + \varepsilon_t \quad (6)$$

Where Δ is a difference operator, Yt represents a 5x1 vector of INV, SV, GDP, EDL and EDS, α represents 5x1 vector of constant term, β represent 5x5 matrix of coefficient for short term relationship among variables, λ represents long-run coefficient while φ is kxr matrix representing the speed of adjustment to correct equilibrium error if $(\lambda' Y_{t-k}) \neq 0$. Whereas, r represent the number of cointegrating vector and p is a lag length. ε is a 5x1 vector of stochastic error terms. According to Granger (1988) and Toda & Phillips (1993) as cited from Thanoon & Baharumshah, (2003) the term (λY_{t-k}) represent error correction term (ECT) which incorporate the lost information from differentiating process allowing long-term equilibrium as well as short-term dynamics. The estimates from VAR approach are difficult to interpret due to theoretical nature, large number of parameters and sign changing of coefficients of lagged variables across lags and across equations (Brooks, 2008 pp296). However when there is a changing sign among lags of the same variable then the sign of the lag order with bigger absolute value relative to the other order of the same variable should prevail (Li & Liu 2012). Also application of block significance test, impulse responses and variance decomposition are recommended to enrich VAR interpretation.

Table 6 presents results of VECM for variables of our interest which are LINV, LSV and LGDPC. Each of these three variables represents one equation. We have applied the coefficients restrictions test using Wald test to check the joint significance of all lags for each variable in each equation (results attached in Table 6). The ECT1 and ECT2 represent error correction terms form equation 4 and 5 respectively.

Results for LINV equation indicates, in short run, the coefficients of LINV and EDL both first order lag and second order lag have weak positive correlation with current domestic investment (LINV). Besides, lags of EDS found to have significant positive correlation with current domestic investment. Other parameters like GDPC and SV found to have no short run influence on domestic investment. The ECT1 coefficient is found to be negative and significant at 5% which is necessary for model stability. This ECT1 coefficient indicates that if disequilibrium occurs in previous year will automatically adjust and 31.1% of previous year's domestic investment deviation from its long run equilibrium value will be corrected each year. ECT2 found to be insignificant implying no short run adjustment in savings to explain percentage change in investment. The robustness check reveal the LINV model is robust with R square 0.84, F-statistic was significant at 1% level. Residual diagnosis was done where LM test indicates no serial correlation, hetereskedasticity test indicates homogeneity, and Normality test indicates residuals were normally distributed.

Results for LSV equation indicates there is no short run adjustment from long run disequilibrium because both coefficients of ECT1 and ECT2 found insignificant. The short run parameters were also found insignificant except EDS which found to have weak positive correlation with savings. The LSV equation diagnosis check indicates that the model is robust with no residuals serial autocorrelation, no heteroskedasticity on residuals and residuals found to be normally distributed. The R square is 0.53 and F-statistic found significant at 5% level.

Results for LGDPC equation indicates, in short run, the coefficients of EDS found to have significant negative correlation with GDPC. Moreover, SV indicates weak positive correlation with per capita GDP, whereas lags of INV, EDL and GDPC found to have no influence on per capita GDP. The ECT2 coefficient is found to be negative and significant at 1% which is necessary for model stability. This ECT2 coefficient indicates that if disequilibrium occurs in previous year will automatically adjust. The 13.4% of previous year's savings deviation from its long run equilibrium value will be corrected each year. The ECT1 coefficient is positive and significant at 1%. This indicates no short run adjustment for investment in LSV model. The model diagnosis check indicates that the model is robust with no residuals serial autocorrelation, also no heteroskedasticity in residuals and normal distribution of residuals is reported. The R square is 0.81 and F-statistic found significant at 1% level.

Table 6: Results Of Error Correction Model Based on Three Variables (INV,SV & GDPC)

	DEPENDENT VARIABLES		
	D(LINV)	D(LSV)	D(LGDPC)
CointEq1 (ECT1)	-0.3114**	-0.0284	0.1909***
CointEq2 (ECT2)	0.1304	-0.0224	-0.1340***
D(LINV(-1))	-0.0807	-0.1149	-0.0393
D(LINV(-2))	0.2416	0.0357	0.0381
D(LSV(-1))	-0.0508	-0.232	0.0820**
D(LSV(-2))	-0.0558	-0.2422	0.0248
D(LGDPC(-1))	0.0447	0.2464	0.2334
D(LGDPC(-2))	0.2679	1.4341	0.0674
D(LEDS(-1))	-0.3842***	-0.3412	-0.2225***
D(LEDS(-2))	0.4786***	0.3621	-0.0625
D(LEDL(-1))	0.3795**	0.4082	0.0324
D(LEDL(-2))	0.2472	-0.1804	0.0275
C	0.0112	-0.0352	0.1518***
DIAGNOSTIC TEST			
R^2	0.84	0.53	0.81
F-STAT	10.91***	2.37**	8.96***
DW	1.99	2.09	2.08
RESIDUAL TESTS			
Breusch-Godfrey LM TEST (Prob. Chi-Square(2))	0.2777	0.2612	0.6041
Heteroskedasticity Test Prob. Chi-Square(15)	0.3287	0.4099	0.2846
Normality test: Jarque-Bera Prob	0.8387	0.7646	0.7558
COEFFICIENTS RESTRICTIONS: WALD TEST (REPORTED IS CHI-SQUARE STAT)			
Null hypothesis	D(LINV)	D(LSV)	D(LGDPC)
Coefficients of INV (-1&-2)=0	5.560*	0.157	1.842
Coefficients of SV (-1&-2)=0	0.49	1.619	4.757*
Coefficients of GDPC (-1&-2)=0	0.7731	3.761	3.511
Coefficients of EDS (-1&-2)=0	46.97***	5.590*	51.578***
Coefficients of EDL (-1&-2)=0	5.543*	1.074	0.330
*** Indicates rejection of the hypothesis at the 0.01 level ** Indicates rejection of the hypothesis at the 0.05 level * Indicates rejection of the hypothesis at the 0.10 level (-1&-2) indicates lag one and two			

4.4 Granger Causality Analysis

The above analysis established the long-run and short-run relationship between domestic investment, savings, per capita gross domestic product and external debt. However regression analysis deals with relationship between variables it does not necessarily imply causality (Gujarati, 2004 pp696). In examining causality there are three possible results; unidirectional, bidirectional, independence among variables. Consider equation 6 and 7, it is unidirectional causality if estimated coefficients on lagged X in equation 6 are statistically different from zero (as a group) while estimated coefficients on lagged Y in equation 7 are not statistically different from zero. Bidirectional causality if both estimated coefficients are statistically significant from zero in all equations. Finally, independence between the two variables happens if all estimated coefficients are not statistically significant from zero from all two equations.

For the Granger causality test to be conducted several assumption should be taken into account; variables are supposed to stationary. uncorrelated error terms and direction of causality critically depends on number of lagged terms included in the model, in our case it is determined by SC information criteria (Gujarati, 2004 pp696).

$$Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j=1}^{n} \beta_j Y_{t-j} + u_{1t} \quad (6)$$

$$X_t = \sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{j=1}^{n} \sigma_j Y_{t-j} + u_{2t} \quad (7)$$

This study adapted VAR Granger Causality/Block Exogeneity Wald Tests to examine causality between LINV,

LSV, GDPC, EDS, and EDL. From this test, chi-square (Wald) statistics used to test the joint significance of all lags of each variable against endogenous variable in each equation and also it test the joint significance of all other variables for all lags in each equation. Table 7 reports the VAR Granger Causality results. Result indicates significant bidirectional causality between EDS and INV, significant unidirectional from EDS to GDPC. Besides, there is weak unidirectional from SV to GDPC and also weak unidirectional from EDS to SV. In addition there is a weak unidirectional from EDL to INV. However, all lagged values of other variables taken together in each equation found to have joint significant influence on dependent variable with exception EDL equation. This gives a view that these macroeconomic variables are influenced much by joint variables than individual effect.

Table 7: Granger Causality/Block Exogeneity Wald Tests Result

	DEPENDENT VARIABLES				
	D(LINV)	**D(LSV)**	**D(LGDPC)**	**D(LEDS)**	**D(LEDL)**
D(LINV)	-	0.1568	1.8422	9.0615***	0.2242
D(LSV)	0.4902	-	4.7569*	1.7011	1.0484
D(LGDPC)	0.7731	3.7605	-	0.0231	1.0250
D(LEDS)	46.965***	5.5897*	51.578***	-	1.7851
D(LEDL)	5.5425*	1.0735	0.3299	1.8009	-
ALL TAKEN TOGETHER	82.097***	21.455***	59.267***	16.714**	4.099

*** denotes statistically significant at the 1% level.
** denotes statistically significant at the 5% level.
* denotes statistically significant at the 10% level.
Note: Figures reported in each cell represents Chi-square statistics
Each column for each dependent variable represent one equation

4.5 Impulse Response and Variance Decomposition

Impulse response is explained as reaction of dynamic system in response to external shocks that has affected the model (Li & Liu 2012). It represents the responsiveness of each dependent variable in the system when a unit shock is applied to each variable. The impulse response can also identify the length of time in which shock in a particular variable will affect the other dependent variable. The shocks may be any factor which is not in the model e.g. for our case it may be fiscal policies, exchange rates, interest rate etc. On the other hand variance decomposition explains amount of information contributed by each variable to other variable in the model.

4.5.1 Impulse response results

The result for impulse response is presented in figure 3 (see appendix). The generalized impulse response function to Investment, per capita GDP and savings to various shocks was calculated using E-view 8. We aimed to examine the reaction of investment, per capita GDP and savings to future changes of any of the five variables LINV, LSV, LGDPC, LEDS and LEDL.

The reaction of investment to shock of per capita GDP and long term external debt noted to be positive with long lasting effects. The reaction of investment on the saving shock reported tobe positive but gradually decreasing and dies away in 8th period. Moreover the response of investment on short term external debt shocks is higher in short period and gradually decreases in long run.

In addition reaction of per capita GDP on long term external debt and investment shocks noted to be long lasting with positive effects, however, these shocks starts with smaller effects but gradually increase to almost 4th period where constant long lasting effects noted. The long term external debt effect seems to be higher than that of investment. Also short term external debt shock have positive long lasting effect on per capita GDP but relative smaller than that of investment and long term debt. The savings shock noted to be negative and long lasting effect on per capita GDP.

Moreover, the calculation of savings responses to shocks also is reported. Results show that savings itself, investment, per capita GDP and long term external debt shocks have positive long lasting effect, though constant effect is noted from period six relative to the fluctuating effect from period 1 to 4. In addition the long term debt effect is higher than that of investment, whereas effect of investment is higher than that of per capita GDP but the per capita GDP effect is higher than that of savings. Besides the effect of short term external debt is highly fluctuating but start to die away from 6th period.

4.5.2 Variance decomposition results

The results for variance decomposition are presented in table 8-10. The analysis is only based on two extreme periods (short and long term). We have considered period 2 to be a short term effect and period ten to be long term effect.

Table 8: Variance Decomposition of Investment

Period	S.E.	LINV	LGDPC	LSV	LEDS	LEDL
1	0.172070	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.270288	82.40037	0.262169	1.170090	14.81362	1.353753
3	0.381925	74.55326	4.642389	0.641424	19.42829	0.734638
4	0.454408	73.73771	5.094002	0.715472	15.92452	4.528289
5	0.507321	75.60627	5.974323	0.626603	12.79637	4.996429
6	0.566984	75.78875	7.838920	0.717354	10.29171	5.363259
7	0.616312	73.16235	10.21571	1.073560	8.725760	6.822616
8	0.670188	69.26815	12.57665	1.463125	8.446539	8.245536
9	0.712658	66.48317	13.57476	1.681074	7.469835	10.79116
10	0.749711	64.36805	14.54977	1.951967	7.036390	12.09382
Cholesky Ordering: LINV LGDPC LSV LEDS LEDL						

Table 8 show, variance contribution of investment to itself is more in short run that is 82.4% but decreases with period, in the long run it reach 64.4%. The shock on per capita GDP has low contribution in short run only 0.26% but increases in the long run to about 14.5%. Moreover the shock on savings has low contribution to the variation of investment, more lower in short run of about 1.2% but gradual increase to almost 2.0% in long run.

Table 9: Variance Decomposition of Per Capita Gdp

Period	S.E.	LINV	LGDPC	LSV	LEDS	LEDL
1	0.065615	53.12992	46.87008	0.000000	0.000000	0.000000
2	0.132787	52.41309	25.11800	0.473904	15.95668	6.038330
3	0.201619	53.34267	25.75236	3.160628	9.148241	8.596105
4	0.283726	44.15179	31.11124	6.450338	4.759805	13.52683
5	0.367808	34.99198	33.12337	7.700320	2.952693	21.23164
6	0.445036	29.23170	32.74811	8.221472	2.031269	27.76745
7	0.515459	25.39150	32.09421	8.937059	1.515694	32.06153
8	0.582307	22.42748	31.81042	9.749996	1.256914	34.75519
9	0.646012	20.12251	31.39138	10.24919	1.105866	37.13106
10	0.704328	18.46239	30.76238	10.43464	0.966034	39.37455
Cholesky Ordering: LINV LGDPC LSV LEDS LEDL						

Table 9 show, variance contribution of per capita GDP to itself is 46.8% in short run but decreases over the long run to about 30.8%. Whereas the variance contribution of long term external debt to per capita GDP is higher over the long run than that of investment about 39.4% and 18.5% respectively. Moreover, savings has increasing contribution from 0.5% in short run to about 10.4% in long run.

Table 10: Variance Decomposition of Savings

Period	S.E.	LINV	LGDPC	LSV	LEDS	LEDL
1	0.418832	29.58065	25.93880	44.48055	0.000000	0.000000
2	0.551267	31.51185	22.30328	41.55210	2.741852	1.890932
3	0.618055	37.28767	17.74843	37.91442	5.541998	1.507483
4	0.700284	42.07757	14.05382	33.74030	5.913124	4.215187
5	0.773038	46.48238	11.67022	30.28199	5.108402	6.457007
6	0.844572	49.73040	10.05954	26.13283	4.985677	9.091554
7	0.913732	49.37169	8.969065	22.96361	4.310626	14.38501
8	0.983329	48.68144	7.949609	20.48527	3.864071	19.01961
9	1.049365	48.04699	7.056512	18.48740	3.401294	23.00781
10	1.108236	47.63505	6.483224	16.88033	3.144715	25.85668
Cholesky Ordering: LINV LGDPC LSV LEDS LEDL						

Table 10 show, variance contribution of savings to itself decreases with time from 41.6% in short run to 16.8% in long run. Whereas the variance contribution of investment to savings increases with time from 31.5% in short run to about 47.6% in long run. Moreover long term external debt seems to have high low contribution in short run but high in long run from 1.9% to 25.9%. In addition per capita GDP contribute high in short run about 25.9% but low in long run which is 6.7% variations on savings.

5. Conclusion

The study examined the interdependence between investment, savings and economic growth. Cointegration

analysis, Vector Error Correction Model (VECM), Granger causality analysis, Impulse Response and Variance response were employed to capture not only correlation and causality but also dynamic behavior on the relationship among these variables. The result indicates no evidence of the existence of short run or long run correlation between savings and investment. The weak short run positive correlation is observed between savings and per capita GDP, perhaps this is because of the existing low rate of savings. Moreover, there is long run positive correlation between investment and per capita GDP. Interestingly EDS found to have a long run significant positive correlation to both investment and savings which is contrary to (Thanoon & Baharumshah, 2003) who found negative correlation between domestic savings and short term debt in Malasia. From the existing growth trend in Tanzania we may say it is contributed by external debt which fills the savings gap. But on the other hand significant negative correlation between EDS and per capita GDP in short run. EDL found negatively correlated with investment over the long run, this brings the question of sustainability on growth by depending on external debts which might be in to (Kasidi & Said 2013) who found external debt servicing has negative impact in Tanzanian economy.

On the other hand, Granger causality result provides strong evidence of joint influence of variables than individual causality. The shock imposed on investment found to have positive long lasting effect on itself, savings and per capita GDP unlike savings shocks which dies away after short period on investment and long lasting negative impact on per capita GDP. Moreover, shock on per GDP is having long lasting effect on itself, investment and savings.

We therefore suggest proactive policy which would encourage investment and promote growth. As a result, over the long run domestic saving will automatically increase and lead to sustainable economic growth. However future studies may incorporate more variables which influence savings, investment and economic growth such as interest rate, foreign direct investment and dependence ratio and bank density as identified in existing literatures.

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Appendix 1

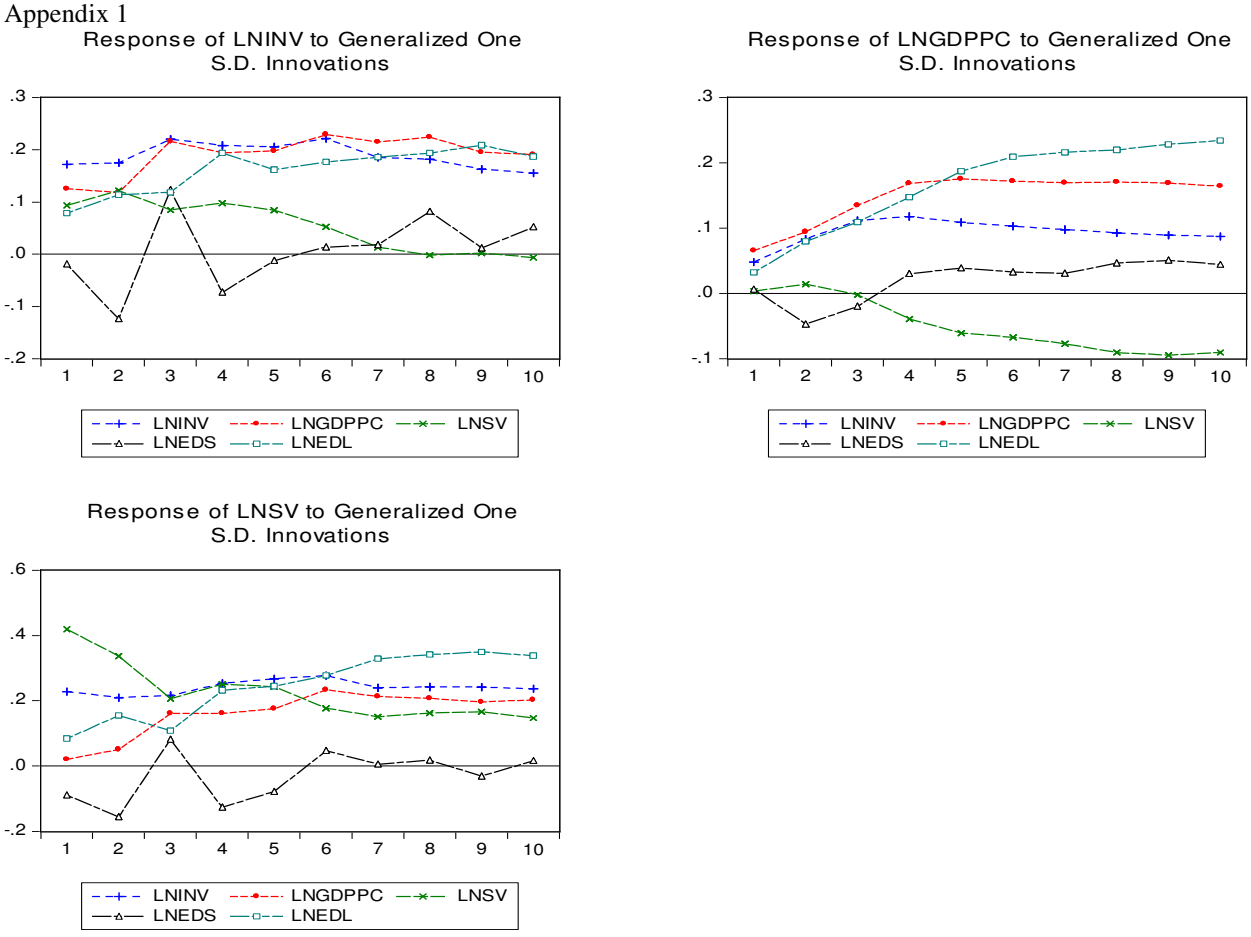

Figure 5: Impulse Response Results

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