DOMESTIC INVESTMENT AND ECONOMIC GROWTH IN SUB-SAHARAN AFRICA: AN ENGLE GRANGER RESIDUAL BASED TEST APPROACH

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Abstract

This paper investigates the effect of domestic investment on economic growth in Sub-Saharan Africa spanning the period 1970 to 2004. The study applied the ADF Stationarity test, Residual Based Test and Error Correction Model. Series variables are stationary at 1(1). The result for ADF residual based test STATRESID reveals a long run relationship between Domestic Investment and Economic Growth in Sub-Saharan Africa while theresult for error correction model also indicates a positive short run relationship between domestic investment and economic growth. Policy maker should consider making a friendly climate for domestic actors through sound macroeconomic fundamentals, policy efficacy and flexibility and soft loans to augment savings and investment capital this will positively impacts on per capital income and effective demand of Sub-Saharan populace reducing unemployment and poverty.

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1.Introduction

Although there are vast literatures on FDI growth nexus on both developed and developing economies, less focus has been directed towards domestic investment growth nexus making studies of the former plenitude and the latter relatively scanty.There may be concession on volume of domestic investment facilitating economic growth considering accelerated and ambiguous resource allocation and diversity, Domestic policy framework, efficacy and policy flexibility and above all sound macroeconomic fundamentals but this rarely has been established between FDI and economic growth perhaps owing unprecedented global financial meltdown and the Asian financial crisis subjects FDI to volatilities, thus the relevance of domestic investment cannot be de-emphasized or understated. While studies have been conducted on domestic investment, they are scaffold on the context of FDI Domestic investment nexus. See (Razin 2004; Al Khatib*et al*2002; Prasanna 2010 and Shah *et al* 2012). It is on this pretext that this study intends to investigate the effect of domestic investment (fixed capital formation) in Sub-Saharan Africa) therefore this paper is divided into five sections including this introduction, section two reviews literature on domestic investment growth nexus, section three examines the methodology, section four explains the empirical result and discussion while fivediscusses theconclusion and policy implication.

2.Literature Review

Alfa and Garba (2012) applied the ADFGLS stationarity test, KPSS test, Clemente Montanes Reyes test, Johansen cointegration and Granger causality to investigate the relationship between domestic investment, export and economic growth in Nigeria the authors report that series are stationary at 1(1) and there exist a positive and significant long run relationship between domestic investment and economic growth and export respectively. They also reported a bi directional flow between domestic investment and growth in Nigeria. Ghazali (2010) used the pairwise granger causality test to show the causal relationship between FDI and Domestic investment for Pakistan economy spanning 1981 t0 2008 and applying the ADF stationarity test and Johansen cointegration analysis the author for found series stationary at 1(1)and a positive long run relationship between FDI, domestic investment and economic growth and a bi directional relationship between domestic investment and economic growth in Pakistan. Tawiri

(2010) investigates the impact of domestic investment as a determinant of economic growth on Libyan economy for the period 1962 to 2008 using the cointegration approach, result revealed that per capita GDP is directly and positively influenced by domestic investment both in the short run and long run. Although Javed*et al* (2012) found that domestic investment has a positive long run effect on economic growth in four South Asian economies (Bangladesh, India Pakistan and Sri- Lanka) using the Generalized Method Of Moment GMM the study is based on the framework as relationship Foreign Direct Investment (FDI), Trade and Economic Growth.

Osinubi and Amaghionyeodiwe (2010) using OLS, ADF and Johansen cointegration test for Nigerian data spanning the period 1970 to 2005, results of the analysis shows that Domestic investment positively influence economic growth in the short run and foreign private investment and export also have positive effect on economic growth in the short run respectively.

Tan and Lean (2010) applied the ADF Phillip Peron, Multivariate Johansen Cointegration analysis and the Granger Causality test toinvestigate the linkages between domestic investment export and economic growth for Malaysian economyfor sample period 1970 to 2008. The author found series stationary at 1(1) and a positive long run and a bidirectional relationship between a domestic investment and economic growth. Tang *et al* (2008) applying the ADF stationarity test, Johansen VAR test, Variance decomposition and impulse response and the granger causality test to examine the impact of FDI and Domestic investment on economic growth in China spanning the period 1988 to 2003, series are stationary at 1(1) and a long run relationship between FDI and Domestic investment while there is a bi directional relationship between domestic investment and growth with a Uni directional relationship running from FDI to Domestic investment and to economic growth

3.Methodology and Data

The data used for this study is time series data spanning 1970 to 2004 and it is source from World Bank Development Indicators.

Model Specification

$$GDP = \alpha DOMINV + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

While GDP means GDP Per capital, α implies the total factor productivity, DOMINV is the total Domestic investment proxy by fixed capital formation β_1 is the constant elasticity of domestic investment or the estimated parameter. Further conversion of equation 1 is presented in logarithmic

$$LOGGDP = LOG\alpha + LOGDOMINV + LOG\mu_t \text{.....(2)}$$

Where

LOGGDP= LOG of Gross Domestic Product per Capital

LOG α = Constant Parameter or Intercept

LOGDOMINV= LOG of Domestic Investment (fixed capital formation)

LOG μ_t =LOG of error term or disturbance term or white noise which is independently and identically distributed with zero mean and constant variance

ECONOMETRIC DIAGNOSTIC TEST

This study subjects estimated residuals from OLS to the traditionally unit root diagnostic test to confirm unit root.

$$\Delta Y_t = \gamma_0 + \gamma_1 Y_{t-1} + \beta_i \sum Y_{t-1} + \varepsilon_t \quad \text{..... (3)}$$

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{n} \alpha_1 \Delta y_i + \delta_t + e_t \quad \text{..... (4)}$$

Estimated residuals are differenced if non stationary and the differenced estimated residuals are regressed on their lags to verify the unit root of series variables stationary at 1(1).

Where y_t is a time series, t is a linear time trend, Δ is the first difference operator, α_0 is a constant, n is the optimum number of lags on the dependent variable and e_t is the random error term. The difference between equation (3) and (4) is that the first equation includes just drift.

Cointegration Test

The residual based test approach and the Error Correction Model is applied.

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_k x_{kt} + \mu_t \text{.....(5)}$$

μ_t Should be 1(0) if variables $y_{t,}x_{2t}.....x_{kt}$ are cointegrated but μ_t will still be non -stationary if they are not

Thus it is necessary to test the residuals of equation (5) to see whether they are non-stationary or stationary. The DF and DF test can be applied on μ_t , using a regression of the form

$$\Delta\mu_t = \psi\mu_t + v_t$$

With v_t $an\,iid$ error term

$$\Delta GDP = \alpha_0 + \alpha_1 \Delta DOMINV_t + \alpha_2 u_{t-1} + \varepsilon_t .....(6)$$

Δ Implies the first difference operator and ε_t is the error term,

$u_{t-1} = (GDP_{t-1} - \beta_1 - \beta_2 DOMINV_{t-1})$ is one lagged period of error in cointegration equation (6)

4.Empirical Result and Discussion

The result for stationarity test depicts that GDP Per capital and Domestic Investment are both stationary at first difference and integrated of order one 1(1).i.e GDP per Capital -3.113674 greater than -2.9558 at 5% and Domestic Investment -2.798360 greater than -2.6164 at 10% respectively. This permit the administering of Cointegration test which is residual based test and the result shows that there exist a long run relationship between GDP per Capital and Domestic Investment in Sub-Saharan Africa this is evident because after performing ADF test on residual series STATRESID the test was stationary at level value. Or since the test statistic is more negative -3.552859 than the critical value at 5% we strongly reject the null hypothesis of unit root inherent in the test regression residuals. Thus series are cointegrated or have long run relationship.The coefficient of Domestic investment is statistically significant at 1% as shown by the probability value 0.0000. This means that 1% increase in domestic investment increases GDP per capital by 64%. The short run equilibrium posit that domestic investment have positive impact on short run changes in GDP per capital by 0.424655.The Error Correction Term statresid(-1) 0.782060 over adjusted itself indicating positive instead of negative. The regression result shows that 86% variation in economic growth in Sub-Saharan Africa is explained by domestic investment while the remaining 14% is explained by variables not captured in the model.

5. Conclusion and Policy Implication

This paper examines the effect of domestic investment on GDP per capital in Sub-Saharan Africa using the ADF Stationarity test, Residual Based Test Approach and Error Correction Model. The result reveals that both series are stationary at 1(1) and the result of residual based test (ADF STATRESID) indicates stationary at level value with a given sign test statistic greater than the critical values which implies a long run relationship between series. There exist a positive long and short run relationship between series and a uni directional flow as domestic investment granger causes GDP per capital in the short run. Implication for policy is have long and short run relationship therefore policy maker should consider making a conducive friendly climate for domestic actors through sound macroeconomic fundamentals, policy efficacy and flexibility and soft loans to augment savings and investment capital this will positively impacts on per capital income and effective demand of Sub-Saharan populace reducing unemployment and poverty.

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APPENDIX

ADF Test Statistic	-2.388717	1% Critical Value*	-3.6422
		5% Critical Value	-2.9527
		10% Critical Value	-2.6148

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDPCAP)
Method: Least Squares
Date: 10/29/12 Time: 12:24
Sample(adjusted): 1972 2004
Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPCAP(-1)	-0.118267	0.049511	-2.388717	0.0234
D(GDPCAP(-1))	0.403977	0.159013	2.540533	0.0165
C	0.750992	0.307816	2.439741	0.0208

R-squared	0.372030	Mean dependent var	0.031982
Adjusted R-squared	0.330165	S.D. dependent var	0.097617
S.E. of regression	0.079893	Akaike info criterion	-2.129755
Sum squared resid	0.191486	Schwarz criterion	-1.993709
Log likelihood	38.14097	F-statistic	8.886474
Durbin-Watson stat	1.436027	Prob(F-statistic)	0.000931

ADF Test Statistic	-3.113674	1% Critical Value*	-3.6496
		5% Critical Value	-2.9558
		10% Critical Value	-2.6164

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDPCAP,2)
Method: Least Squares
Date: 10/29/12 Time: 12:25
Sample(adjusted): 1973 2004
Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDPCAP(-1))	-0.564631	0.181339	-3.113674	0.0041
D(GDPCAP(-1),2)	0.287496	0.186638	1.540392	0.1343
C	0.022908	0.015571	1.471197	0.1520

R-squared	0.250793	Mean dependent var	0.007164
Adjusted R-squared	0.199123	S.D. dependent var	0.093065
S.E. of regression	0.083286	Akaike info criterion	-2.044021
Sum squared resid	0.201159	Schwarz criterion	-1.906608
Log likelihood	35.70433	F-statistic	4.853794
Durbin-Watson stat	1.605288	Prob(F-statistic)	0.015196

ADF Test Statistic	-1.788621	1% Critical Value*	-3.6422
		5% Critical Value	-2.9527
		10% Critical Value	-2.6148

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DOMINV)
Method: Least Squares
Date: 10/29/12 Time: 12:25
Sample(adjusted): 1972 2004
Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOMINV(-1)	-0.074786	0.041812	-1.788621	0.0838
D(DOMINV(-1))	0.449164	0.159285	2.819873	0.0084
C	1.863421	1.026354	1.815574	0.0794

R-squared	0.350893	Mean dependent var	0.058819
Adjusted R-squared	0.307619	S.D. dependent var	0.112682
S.E. of regression	0.093762	Akaike info criterion	-1.809608
Sum squared resid	0.263739	Schwarz criterion	-

			1.673562
Log likelihood	32.85854	F-statistic	8.108665
Durbin-Watson stat	1.713435	Prob(F-statistic)	0.001530

ADF Test Statistic	-2.798360	1%	Critical Value*	-3.6496
		5%	Critical Value	-2.9558
		10%	Critical Value	-2.6164

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DOMINV,2)
Method: Least Squares
Date: 10/29/12 Time: 12:26
Sample(adjusted): 1973 2004
Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DOMINV(-1))	-0.544350	0.194525	-2.798360	0.0090
D(DOMINV(-1),2)	0.169414	0.196959	0.860146	0.3968
C	0.032600	0.020138	1.618830	0.1163

R-squared	0.227799	Mean dependent var	0.004178
Adjusted R-squared	0.174544	S.D. dependent var	0.108939
S.E. of regression	0.098976	Akaike info criterion	-1.698822
Sum squared resid	0.284090	Schwarz criterion	-1.561409
Log likelihood	30.18115	F-statistic	4.277501
Durbin-Watson stat	1.935266	Prob(F-statistic)	0.023555

Dependent Variable: GDPCAP
Method: Least Squares
Date: 10/29/12 Time: 12:30

Sample: 1970 2004
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-9.529928	1.099392	-8.668365	0.0000
DOMINV	0.641591	0.044946	14.27486	0.0000

R-squared	0.860625	Mean dependent var	6.160740
Adjusted R-squared	0.856402	S.D. dependent var	0.335387
S.E. of regression	0.127093	Akaike info criterion	-1.232355
Sum squared resid	0.533034	Schwarz criterion	-1.143478
Log likelihood	23.56621	F-statistic	203.7717
Durbin-Watson stat	0.320261	Prob(F-statistic)	0.000000

ADF Test Statistic	-3.552859	1% Critical Value*	-3.6852
		5% Critical Value	-2.9705
		10% Critical Value	-2.6242

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(STATRESIDS)
Method: Least Squares
Date: 10/29/12 Time: 12:34
Sample(adjusted): 1977 2004
Included observations: 28 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
STATRESIDS(-1)	-1.015667	0.285873	-3.552859	0.0015
D(STATRESIDS(-1))	-0.026516	0.220826	-0.120076	0.9054
C	-0.005158	0.013695	-0.376627	0.7096

R-squared	0.523016	Mean dependent var	-0.000396
Adjusted R-squared	0.484857	S.D. dependent var	0.100466

S.E. of regression	0.072108	Akaike info criterion	-2.320352

Dependent Variable: GDPCAP
Method: Least Squares
Date: 10/29/12 Time: 12:42
Sample(adjusted): 1976 2004
Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.167287	2.117774	-1.967768	0.0598
DOMINV	0.424655	0.085953	4.940525	0.0000
STATRESIDS(-1)	0.782060	0.294020	2.659884	0.0132

R-squared	0.484966	Mean dependent var	6.295143
Adjusted R-squared	0.445348	S.D. dependent var	0.127618
S.E. of regression	0.095043	Akaike info criterion	-1.771270
Sum squared resid	0.234864	Schwarz criterion	-1.629825
Log likelihood	28.68341	F-statistic	12.24107
Durbin-Watson stat	1.033384	Prob(F-statistic)	0.000179

Sum squared resid	0.129988	Schwarz criterion	-2.177616
Log likelihood	35.48493	F-statistic	13.70633
Durbin-Watson stat	1.990846	Prob(F-statistic)	0.000096