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CAUSALITY BETWEEN REAL INTEREST RATE AND GROSS CAPITAL FORMATION IN KENYA: THE HICKSIAN HYPOTHESIS

Ochieng Otieno Benjack — *Department of Economics, Maseno University, Kenya*

Dr. Odondo Alphonce Juma — *Department of Economics,Tom Mboya University College, A constituent college of Maseno University, Kenya*

ABSTRACT

In 2016, the Government of Kenyan introduced interest rate cap of 14% per annum to spar investments through cheaper credit acquisition from commercial banks. This objective was not realized as evidenced by deteriorating levels of investments as reported by the Central Bank of Kenya (CBK) in 2017. In response to this incongruity, causal relationship between Real Interest Rate (RIR) and Gross Capital Formation (GCF) together with the relevance of Hicksian Hypothesis was tested in Kenya. Correlational research design was adopted and World Bank Time series data from 1980 to 2017 was used. Long run causality was tested using Vector error correction model (VECM) and revealed a long run causality with the speed of adjustment towards equilibrium = -1.696590 at p =0.0061. Wald test pointed to the existence of short run causality between the two variables. The study found a bi directional causality between RIR and GCF in the short and long-run periods. Consequently, investments decisions in Kenya closely follow the Hicksian hypothesis. Although bidirectional causality was established, a weak negative association existed between the two variables, suggesting the existence of other factors which determine GCF in Kenya given the outlined incongruity. Hence, the two variables should be jointly considered together with other GCF determinants during policy formulation in order to enhance investment activities in the economy.

KEYWORDS:

Granger Causality, Real Interest Rate and Gross Capital Formation

BACKGROUND

Building on the Rostow's growth theory of 1960, investment is important in spurring a county's economic growth. This is achievable only through domestic and foreign saving mobilization. In this case, gross capital formation, a proxy for investment, is regarded as an outlay in addition to the fixed assets of the economy plus net changes in the level of inventories. As observed by Pavelescu (2008), sustainable economic growth must enhance capital accumulation (investments). However, the cost of borrowed fund (RIR) is perceived to have a negative effect on the levels of investments (Kiley& Roberts, 2017).

In Kenya, there was a serious drop in the levels of investments from 21.9% in 2015 to 17% in 2016 (Trading Economics, 2018). During this period, interest rate capping (a fluctuating interest rate that is not allowed to surpass a stated *level) law became operational. The main objective was to help reduce* the high cost of credit which then discouraged many people from accessing funds from the financial intermediaries for investment purposes. However, despite the cap there was reduced financial intermediation by commercial banks as depicted by the declining loan accounts attributed to smaller borrowers being locked outside the loaning brackets (Central Bank of Kenya, 2018; (Onyango & Odondo, 2018). In giving the reasons as to what induces people to hold assets in the form of cash rather than securities, Hicks explained that movements in the rate of interest (the cost of borrowed funds) play a major role. He constructed a liquidity trap based on the notion that short-run nominal interest rate cannot be less than zero and that the long-run rate is formed by future expectations about the short-run rate plus the risk appetite (Mauro, 2003). Hick's theory was a major departure from the Keynesian theory which stated that interest rate has no bearing on the saving and investment and that the concept is purely a monetary policy.

Keynes observed that there is the potential of prospective marginal efficiency of capital relative to some interest rate that informs investment decisions (Ugochukwu & Chinyere, 2013). According to (Jhinghan, 2003), for capital formation to affect economic growth, there must be an increase in real savings and the financial institution must direct these savings into sectors that can invest them in capital goods.

However, the level of investments is dependent on the levels of interest rates.

A considerable number of empirical studies have been conducted on the relationship between interest rate and investment. These studies however, have yielded mixed results (Khurshid, 2015). When investment is considered as an endogenous variable in a monetary utility function, it generates a significant effect on the levels of interest rates (Meng & Yip, 2004). Khurshid (*ibid*), while studying the effect of interest rate on investment in Jiangsu Province of China, tested the causality between interest rates and investments. His study revealed a bi-directional causality between the two variables and concluded that interest rates and investments may promote each other.

According to Malawi & Bader (2010), high interest rate level dampens the level of private investments because of the rise in the real cost of capital especially in the Less Developed Countries (LDCs) where there are poorly developed financial markets with most people opting to save rather than investments. In Nigeria, Obamuyi (2009) conducted an investigation on the relationship between interest rates and economic growth during a period when there was an interest rate reform policy with an objective of engendering and deepening it within the financial sector. This undertaking is similar to what Kenya did with its interest rate capping. Using cointegration and error correction model, Obamuyi (2009) revealed that interest rate is an important determinant of economic growth in Nigeria but its link to investments is notautomatic hence may not achieve the intended goals of increasing investments. Although Nigeria and Kenya are both developing economies, the conflicting results call for a country specific study with the aim of formulating specific policies that would address the existing situation.

The purpose of this study was therefore, to assess the causality between Real Interest Rate (RIR) and Gross Capital Formulation (GCF), a proxy for investments, as well as look at whether the development of a regression model may hold true upon the Hicks assumption of an inverse relationship between the Real Interest Rate and Gross Capital Formation besides testing for the existence of a long run relationship between the two variables.

RESEARCH METHODOLOGY

Research Design

The study adopted correlation research design. According to Odondo (2017) and Mukras *et al* (2014), this design is suitable for determining relationships. In particular, the Johansen test for cointegration and vector error correction mechanism were used to observe the joint dynamic behavior of the variables. In order to show the direction of causality between interest rates and Gross Capital Formation, Granger causality test was used. Time series data were gathered from the World Bank data base from 1980 to 2017. To enhance reliability of the results, income proxied by percentage annual GDP increase, was used as a control variable. Correlation coefficients were also estimated to assess bivariate association between the study variables. A stochastic version of the Hicksian model which states that the level of investments equals to the level of interest rates and income was adopted. The model was specified as shown in Equation1.

$$GCF_t = {}_0 + {}_1RIR_t + {}_2GDP_t + \text{«}_t \ldots\ldots\ldots\ldots (1)$$

Where;

${}_0$ = Constant and is the intercept,

GCF_t = Gross Capital Formation at time (t),

RIR_t = Real Interest Rate at time (t),

GDP_t = Percentage annual GDP increase at time (t),

${}_1$ & ${}_2$ = The coefficients of

RIR_t & GDP_t respectively

«_t = The disturbance term

$\text{«}_t \sim IID(0, \pm_{£}^{2})$

RESULTS AND DISCUSSIONS

The variables were tested for a random walk using Augmented Dickey Fuller (ADF) and an automatic selection of Schwartz info criterion with a maximum lag of 7 and results captured in Table 1.1. The results indicate that at levels, the variables were stationary although they became better upon first differencing. With a null hypothesis of non stationarity at levels, the significance of the probabilities (i.e. $P < 0.05$) implied the rejection of the null hypothesis.

Table 1.1: Stationarity test

	At levels		At first difference	
Variable	t-statistics	probability	t-statistics	probability
RIR	-3.5403	0.0162	-3.5485	0
GCF	-3.5403	0.0077	-3.553	0.0005
GDP	-3.5403	0.0323	-3.5485	0.0001

The results in Table 1.2 show that there was an insignificant weak negative association between GCF and RIR ($r = -0.166545$; $p = 0.3390$) and an insignificant weak positive association between GCF and GDP($r = 0.041914$; $p = 0.8111$). The regression results are corroborated by the regression model in Table 1.9 of Appendix 1, which suggests an insignificant negative relationship between the RIR and GCF (β = -0.255938, P=0.3274) as well as GDP and GCF (β = 0.329983, 0.7201). The established negative relationship conforms to the Hicksian hypothesis that there is a negative relationship between the levels of interest rates and investments.

Table 1.2: Covariance Analysis of the Variables

	GCF	RIR	GDP
GCF	1.000000		

RIR	-0.166545	1.000000	
	0.3390	-----	
GDP	0.041914	0.123038	1.000000
	0.8111	0.4813	-----

However, on the test for long run association between the variables, Johansen technique using trace test with a lag interval of 1:1 and the Maximum Eigen value revealed three cointegration equations as shown in Tables 1.3 and 1.4. The results are pointing to the possibility of causality between the variables.

Table 1.3 Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.826867	135.7249	42.91525	0.0000
At most 1 *	0.773819	77.85305	25.87211	0.0000
At most 2 *	0.582205	28.80121	12.51798	0.0000

Trace test indicates 3 cointegrating eqn (s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 1.4 Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.826867	57.87185	25.82321	0.0000
At most 1 *	0.773819	49.05184	19.38704	0.0000
At most 2 *	0.582205	28.80121	12.51798	0.0000

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

An error correction model was estimated to assess whether the deviations from time (t-1) in the long run equilibrium influenced the short run dynamics, and the results captured in Table 1.5. The results show that RIR was significant at 5% level except GDP, suggesting that the short run coefficient of RIR was significant to explain the dependent variable- GCF. Residual of the regression model U (-1) was -1.524667and significant at 5% level

Table 1.5: An Error Correction Model (ECM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.000205	2.696902	0.370872	0.7133
D(RIR)	-0.287200	0.120554	-2.382329	0.0237
D(GDP)	0.644476	0.451901	1.426145	0.1642
U(-1)	-1.524667	0.148733	-10.25106	0.0000

R-squared	0.788253	Mean dependent var	0.672674
Adjusted R-squared	0.767078	S.D. dependent var	32.58147
S.E. of regression	15.72445	Akaike info criterion	8.458442
Sum squared resid	7417.750	Schwarz criterion	8.638013
Log likelihood	-139.7935	Hannan-Quinn criter.	8.519681
F-statistic	37.22621	Durbin-Watson stat	2.216109
Prob(F-statistic)	0.000000		

$$GCF_{t-1} = \underset{(2.696902)}{1.000205} - \underset{(0.120554)}{0.287200RIR_{t-1}} + \underset{(0.451901)}{0.644476GDP_{t-1}} - \underset{(0.148733)}{1.524667U_{t-1}} \quad\text{.................(3)}$$

The equation suggests that a unit increase in RIR_{t-1} resulted in a decrease in GCF_{t-1} by 0.287200 units; a unit increase in GDP_{t-1} resulted in an increase in $GCFC_{t-1}$by 0.644476. On the error term, U (-1) had a negative sign and a significance probability, validating the existence of a long run relationship between GCF and RIR, with a corresponding speed of adjustment of 1.524667 to correct the system's disequilibrium.

The estimated R^2 of 0.788253, implies that RIR and GDP explained approximately 78.8253% of GCF. The F-statistic of 37.22621 at P= 0.0000 and Durbin-Watson statistic of 2.216109 both show that the model was not spurious.

Table 1.6 shows results on Granger causality test between GCF and RIR. The test was done with a maximum lag of 2 against the null hypothesis of no causality between GCF and RIR. Since the p- values were greater than 5%, the study rejected the null hypothesis and accepted the alternative that there was a bi – directional causal relationship between RIR and GCF.

Table 1.6: Pair wise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
RIR does not Granger Cause GFC	33	0.93172	0.4057
GFC does not Granger Cause RIR		1.33847	0.2785

To confirm whether such causality was a long run or short run phenomenon, Vector Error Correction (VECM) model was performed and the results captured in Table 1.10 of Appendix1. From the results, coefficient of the cointegrating model/ speed of adjustment towards the equilibrium /error correction model [C (1)] was -1.696590 at p = 0.0061. This negativity and the level of significance implied that there was a long run bi-directional causality relationship between GCF and RIR. This finding contradicts Obamuyi (2009) findings that there is no automatic link between interest rates and investment in Nigeria but is in tandem with Khurshid (2015). In relation to the short run causality, a Wald test was conducted under the assumption (null hypothesis) that C (4)= C (5) = 0 i.e. there is no short run causality. The results shown in Table 1.7 show the probability of chi-square p = 0.0043 therefore, the study rejected the null hypothesis meaning that there was short run causality running from RIR to GCF in Kenya.

Table 1.7: Wald Test

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	5.449477	(2, 24)	0.0112
Chi-square	10.89895	2	0.0043

Null Hypothesis: C(4)=C(5)=0

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	1.908273	0.644813
C(5)	0.713088	0.352526

Diagnostic checking of the VECM was done using Jarque-Bera statistics for normality test and the Breusch-Pagan-Godfrey LM test for autocorrelation. The estimated Jarque-Bera statistic in Figure 1.0 below was 1.161737 at p = 0.559412, suggesting that the residuals were normally distributed.

Similarly the Breusch-Pagan-Godfrey LM test gives an observed R^2=11.75183 with Chi-Square Probability = 0.2277 > 0.05, suggesting absence of serial correlation in the residuals as shown in Table 1.8 below.

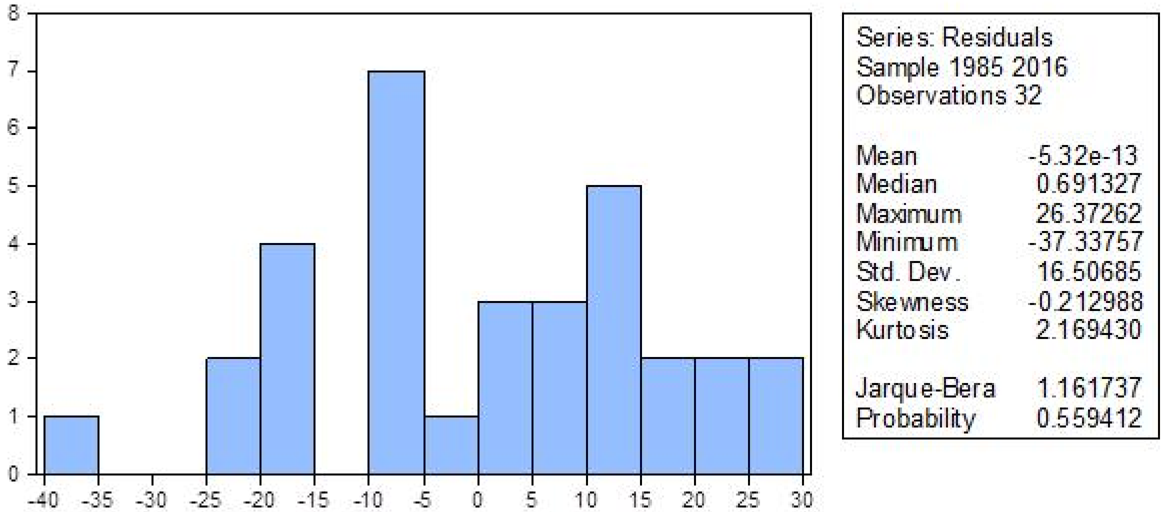

Figure 1.0: Normality test

Table: 1.8 Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.418730	Prob. F(9,22)	0.2398
Obs*R-squared	11.75183	Prob. Chi-Square(9)	0.2277
Scaled explained SS	3.865201	Prob. Chi-Square(9)	0.9201

RECOMMENDATION

The existence of a bidirectional causal relationship between RIR and GCF reveals that either has a potential to cause the other. In order to enhance investment in the Kenyan economy, there is need to review implementation of the interest rate cap and because of the weak bivariate association between the RIR and GCF, policy makers should besides focusing on the two variables, consider other potential determinants of GCF as identified in the existing literature

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APPENDIX

Table 1.9: Ordinary least square

Dependent Variable: GFCF

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.646626	3.201571	-0.201972	0.8412
RIR	-0.255938	0.257324	-0.994614	0.3274
GDP	0.329983	0.912825	0.361496	0.7201

R-squared	0.031691	Mean dependent var	-0.639433
Adjusted R-squared	-0.028828	S.D. dependent var	18.67115
S.E. of regression	18.93836	Akaike info criterion	8.802073
Sum squared resid	11477.17	Schwarz criterion	8.935389
Log likelihood	-151.0363	Hannan-Quinn criter.	8.848093
F-statistic	0.523658	Durbin-Watson stat	2.931078
Prob(F-statistic)	0.597339		

Table 1.10 Vector Error Correction Model (VECM)

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
GFCF(-1)	1.000000
RIR(-1)	1.510120
	(0.23381)
	[6.45883]
GDP(-1)	-2.516399
	(0.61187)
	[-4.11264]
@TREND(82)	0.030146
	(0.06823)
	[0.44179]
C	0.177472

Error Correction:	D(GFCF)	D(RIR)	D(GDP)
CointEq1	-1.696590	-1.132949	0.162399
	(0.56395)	(0.33410)	(0.11518)
	[-3.00839]	[-3.39108]	[1.40999]
D(GFCF(-1))	0.188861	0.984417	-0.039211
	(0.40713)	(0.24119)	(0.08315)
	[0.46388]	[4.08146]	[-0.47157]
D(GFCF(-2))	0.020024	0.535020	0.016428
	(0.21431)	(0.12696)	(0.04377)
	[0.09344]	[4.21409]	[0.37534]
D(RIR(-1))	1.908273	0.177806	-0.131044
	(0.64481)	(0.38200)	(0.13169)
	[2.95942]	[0.46546]	[-0.99508]
D(RIR(-2))	0.713088	-0.070527	-0.052225
	(0.35253)	(0.20884)	(0.07200)
	[2.02279]	[-0.33770]	[-0.72537]
D(GDP(-1))	-2.710887	-1.822719	-0.770205
	(1.06991)	(0.63383)	(0.21851)
	[-2.53376]	[-2.87570]	[-3.52480]
D(GDP(-2))	-1.061460	-0.855527	-0.613133
	(0.70045)	(0.41496)	(0.14305)
	[-1.51540]	[-2.06171]	[-4.28600]
C	-0.029389	0.804485	-0.179494
	(3.34316)	(1.98055)	(0.68278)
	[-0.00879]	[0.40619]	[-0.26289]
R-squared	0.710659	0.827587	0.716206
Adj. R-squared	0.626267	0.777300	0.633432
Sum sq. resids	8446.759	2964.477	352.3221
S.E. equation	18.76029	11.11395	3.831460
F-statistic	8.421002	16.45723	8.652616
Log likelihood	-134.6189	-117.8656	-83.78699
Akaike AIC	8.913679	7.866597	5.736687
Schwarz SC	9.280113	8.233031	6.103121
Mean dependent	-0.197681	0.144587	-0.027183
S.D. dependent	30.68732	23.55094	6.328304
Determinant resid covariance (dof adj.)		295069.8	
Determinant resid covariance		124482.6	
Log likelihood		-323.9288	
Akaike information criterion		21.99555	
Schwarz criterion		23.27807	

Dependent Variable: D(GFCF)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 05/25/18 Time: 15:36
Sample (adjusted): 1985 2016
Included observations: 32 after adjustments
D(GFCF) = C(1)*(GFCF(-1) + 1.51012004372*RIR(-1) - 2.51639851318
GDP(-1) + 0.0301455380321@TREND(82) + 0.177472025836) +
C(2)*D(GFCF(-1)) + C(3)*D(GFCF(-2)) + C(4)*D(RIR(-1)) + C(5)*D(RIR(
-2)) + C(6)*D(GDP(-1)) + C(7)*D(GDP(-2)) + C(8)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1.696590	0.563953	-3.008388	0.0061
C(2)	0.188861	0.407131	0.463883	0.6469
C(3)	0.020024	0.214307	0.093435	0.9263
C(4)	1.908273	0.644813	2.959421	0.0068
C(5)	0.713088	0.352526	2.022793	0.0544
C(6)	-2.710887	1.069908	-2.533756	0.0182
C(7)	-1.061460	0.700450	-1.515397	0.1427
C(8)	-0.029389	3.343163	-0.008791	0.9931

R-squared	0.710659	Mean dependent var	-0.197681
Adjusted R-squared	0.626267	S.D. dependent var	30.68732
S.E. of regression	18.76029	Akaike info criterion	8.913679
Sum squared resid	8446.759	Schwarz criterion	9.280113
Log likelihood	-134.6189	Hannan-Quinn criter.	9.035142
F-statistic	8.421002	Durbin-Watson stat	2.147796
Prob(F-statistic)	0.000033		