American Journal of Business and Management
Vol. 3, No. 1, 2014, 21-27
DOI: 10.11634/216796061403519

Interest Rate and Investment Decision in Nigeria: A Cointegration Approach

Victor E. Oriavwote[*1] and Dickson O. Oyovwi[2]

[1]*Department of Social Sciences, Economics and Development Studies Programme, Federal University, Otuoke, P.M.B. 126, Yenagoa, Bayelsa State, Nigeria. * Corresponding author*
[2]*Department of Economics, College of Education, Warri, Delta State, Nigeria*

The objective of this paper empirically investigated the influence of interest rate on investment decisions in Nigeria. The cointegration technique with its implied ECM was applied to estimate the data which covered the period between 1980 and 2012. The result shows that while high minimum rediscount rate and high prime lending rates have detrimental impact on aggregate investment, high treasury bill rates and high government stock rates have positive and significant impact of the level of aggregate investment in Nigeria. The ECM result shows a satisfactory speed of adjustment and a long run relationship also exists among the variables. The study shows that interest rates have differential impact on aggregate investment. The result recommends amongst others that to increase aggregate investment, the minimum rediscount rate and the prime lending rate should be lowered.

Key Words: Interest rates, investment, cointegration, Nigerian economy

Introduction

Investment is considered to be an important factor in economic growth (Al-Tarawneh, 2004). Investment plays a very important role for the progress of any country. Since countries rely on investment to solve economic problems such as poverty, unemployment amongst others, economists and policy makers have been interested in what determines investment level. Fluctuations in interest rate is determined by many factors, which include taxes, risk of investment, inflationary expectations etc. Prior to the introduction of the Structural Adjustment Programme (SAP) in Nigeria, interest rate was controlled administratively by the monetary authority through the Central Bank of Nigeria. Since the introduction of SAP, interest rate was liberalized and hence controlled by market forces. Commercial banks therefore compete with each other in determining the interest rate. However, in a policy reversal, the government in January 1994 out-rightly introduced some measure of regulation into interest rate management. It was claimed that there were "wide variations and unnecessary high rate" under total deregulation of interest rates. Immediately, deposit rates were once again set at 12% to 15% per annum while a ceiling of 21% per annum was fixed for lending rate. The cap on interest rate introduced in 1993 was retained in 1994 with little modification to allow for flexibility. The cap stayed in place until it was lifted in 1997, to facilitate the pursuit of flexible interest rate regime in which bank deposit and lending rates were largely determined by the forces of demand and supply for funds (Omole & Falokun 1999).

However, the interest rate policy in Nigeria seems not to have significantly increased the level of investment, particularly private investment. The high interest rate on investment funds and sometimes demand for excessive collateral securities have not significantly benefited investment in Nigeria. The financial repression was largely manifested through indiscriminate distortions of financial prices including interest rates and this has reduced the real rate of growth and the real size of financial system. More importantly, financial repression has stifled the development process in Nigeria. This has reduced the availability of funds for investment in Nigeria. Decline in investment as a result of decline in the external resource transfer since 1982, has been especially sharp in the highly indebted countries, including Nigeria. This has the tendency of slowing down medium to long term growth possibilities in Nigeria which have the potentials to further reduce long-term per capital consumption and income, endangering the sustainability of reform efforts. The observed reduction in investment in Nigeria seems to be the result of several factors. For example, low availability of foreign savings has not been matched by a corresponding increase in domestic savings and this has reduced investment funds in Nigeria. The increased level of macroeconomic instability in Nigeria associated with external shocks and the

difficulties of domestic government to stabilize the economy has hampered private investment. The debt overhang has also discouraged investment, through its implied credit constraints in international capital markets as a result of flawed interest rate policies by successive monetary authorities in Nigeria. It is widely accepted that investment volatility in Nigeria has been a prime contributor to aggregate output fluctuations. Also, anemic investment expenditures might signal various economic problems like unemployment, high inflation rate etc. The objective of this study is thus to empirically investigate the influence of interest rate policies on investment decisions in Nigeria. This is significant since the interest rate policy is important to the survival of investment in Nigeria. Other than this introductory section, the rest of the paper is divided into four sections. The second section reviews relevant literature s and the third section is on the econometric procedure. The fourth section is on the results and discussions and the fifth section concludes the paper.

Literature Review

There are two conflicting views on the effect of the real interest rate on the level of private investment. A high interest rate level raises the real cost of capital and therefore dampens the private investment level. On the other side, poorly developed financial markets in less developing countries (LDCs) and inadequate access to foreign financing for most private projects, both imply that private investment is constrained largely by domestic savings. (Greene and Villanueva, 1990). Majed and Ahmad (2010) investigated the impact of interest rate on investment in Jordan. Using the cointegration technique and data covering the period between 1990 and 2005. The study found that real interest rate has a negative impact on investment. An increase in the real interest rate by 1% reduces the investment level by 44%. Greene and Villanueva (1990) studied the determinants of private investment in less developing countries for 23 countries over the 1975-1987 period, and found that the real deposit interest rate has a negative impact on private investment. Hyder and Ahmad (2003) investigated the slowdown in private investment in Pakistan. They found that higher real interest rates reduce private investment. Larsen (2004), in a study on the United States, has found that low mortgage interest rates make direct real estate investments attractive to suppliers of the real estate units. Aysan et al (2005) studied the determinants of unsatisfying private investment growth in the Middle East and North Africa (MENA) throughout the 1980s and 1990s. Their findings have shown that the real interest rate appears to exert a negative effect on a firm investment projects. Wang and Yu (2007) examined the role of interest rate in investment decisions for firms in Taiwan. Their results reveal that interest rate plays an important role in investment decisions. Larsen (2004) studied the impact of interest rates on direct real estate investment holding in the United States. He found that low mortgage interest rates make direct real estate investments attractive to suppliers of the real estate units.

Statistical procedure

The conventional approach to time-series econometrics is based on the implicit assumption of stationarity of time-series data. A recent development in time-series econometrics has cast serious doubt on the conventional time-series assumptions. There is substantial evidence in the recent literature to suggest that many macroeconomic time series may possess unit roots. That is, they are non-stationary processes. A time-series integrated of order zero I(0), is level stationary, while a time-series integrated of order one, I(1), is stationary in first difference. Most commonly, series are found to be integrated of order one, or I(1). The implication of some systematic movements of integrated variables in the estimation process may yield spurious results. In the case of a small sample study, the risk of spurious regression is extremely high. In the presence of I(1) or higher order integrated variables, the conventional t-test of the regression coefficients generated by conventional OLS procedure is highly misleading (Granger and Newbold, 1977).

Resolving these problems requires transforming an integrated series into a stationary series by successive differencing of the series depending on the order of integration (Box and Jenkins, 1970). However, Sargan (1964), Hendry and Mizon (1978) and Davidson, Hendry, Sbra and Yeo (1978) have argued that the differencing process loses valuable long run information in data, especially in the specification of dynamic models. If some, or all, of the variables of a model are of the same order of integration, following the Engle-Granger theorem, the series are cointegrated and the appropriate procedure to estimate the model will be an error correction specification. Hendry (1986) supported this view, arguing that error correction formulation minimizes the possibilities of spurious relationships being estimated as it retains level information in a non-integrated form (Hendry, 1986). Davidson, Hendry, Sbra and Yeo. (1978) proposed a general autoregressive distributed lag model with a lagged dependent variable, which is known as the 'error-correction' term. Davidson, Hendry, Sbra and Yeo

(1978) also advocated the process of adding lagged dependent and independent variables up to the point where residual whiteness is ensured in a dynamic specification. Therefore, error correction models avoid the spurious regression relationships.

To guard against the possibility of estimating spurious relationships in the presence of some nonstationary variables, estimation is performed using a general-to-specific Hendry-type error correction modelling (ECM) procedure. This procedure begins with an over-parameterised autoregressive distributed lag (ADL) specification of an appropriate lag. The consideration of the available degrees of freedom and type of data determine the decision on lag length. With annual data, one or two lags would be long enough, while with quarterly data a maximum lag of four can be taken. Under this ECM procedure, the long run relationship is embedded within the dynamic specification.

The model that was estimated for this study is stated below:

$$INV = b0 + b1MRR + b2PLR + b3TBR + b4GSR + et$$

Where:

INV = aggregate investment
MRR = Minimum Rediscount Rate
PLR = Prime lending rate
TBR = Treasury bill rate
GSR = Government stock rate
et = Error term

Results and Discussions

The result of the Augmented Dickey Fuller (ADF) unit root test which was used to test the order of integration of the variables is shown in Table 1 below:

Table1: Summary of ADF unit root test

Variables	Level data	First difference	1% critical value	5% critical value	10% critical value	Order of Integration
MRR	-2.16	-6.00*	-3.67	-2.96	-2.62	I(1)
INV	-2.47	-6.67*	-3.67	-2.96	-2.62	I(1)
GSR	-2.16	-.3.31*	-3.67	-2.96	-2.62	I(1)
TBR	-2.06	-6.21*	-3.67	-2.96	-2.62	I(1)
PLR	-2.18	-5.15*	-3.67	-2.96	-2.62	1(1)

NB: * indicates significant at the 1% level

The result of the ADF test shows that all the variables were non stationary at the levels. They however became stationary after the first difference was taken. This thus sets the pace for the next test which is the cointegration test.

The result of the Johansen cointegration test which was used to test for the existence of a long run relationship among the variables is shown in Table 2 below:

Table2: Summary of Johansen cointegration test result

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.923538	155.4208	68.52	76.07
At most 1 **	0.813909	78.29217	47.21	54.46
At most 2	0.463143	27.84661	29.68	35.65
At most 3	0.258508	9.185893	15.41	20.04
At most 4	0.007080	0.213155	3.76	6.65
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.923538	77.12866	33.46	38.77
At most 1 **	0.813909	50.44556	27.07	32.24
At most 2	0.463143	18.66072	20.97	25.52
At most 3	0.258508	8.972738	14.07	18.63
At most 4	0.007080	0.213155	3.76	6.65

Both the trace statistic and the max-eigen value indicate two cointegrating equations. This suggests the existence of a long run relationship among the variables. The Vector Error Correction (VEC) result is shown in Table 3 below:

Table3 : VEC result

Cointegrating Eq:	CointEq1				
LINV(-1)	1.000000				
LMRR(-1)	-40.09908				
	(4.04671)				
	[-9.90905]				
LPLR(-1)	-15.02842				
	(1.87372)				
	[-8.02064]				
LTBR(-1)	9.758320				
	(0.85822)				
	[11.3705]				
LGSR(-1)	37.48434				
	(2.89766)				
	[12.9361]				
C	15.41253				
Error Correction:	D(LINV)	D(LMRR)	D(LPLR)	D(LTBR)	D(LGSR)
CointEq1	-0.065120	-0.001566	0.004103	-0.059163	-0.027519
	(0.03110)	(0.01647)	(0.01598)	(0.01429)	(0.02097)
	[-2.09403]	[-0.09507]	[0.25681]	[-4.14096]	[-1.31253]

The VEC result indicates that the aggregate investment equation and the treasury bill rate equation constitute the true cointegrating equations. The rest are statistically flawed since they are either not significant or have the wrong sign.The overparameterize ECM result include two lags each of the independent variables. The summary of the overparameterize ECm result is shown in Table 4 below:

Table 4: Summary of overparameterize ECM: Modeling DLINV

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLMRR	-0.483866	0.105695	-4.577960	0.0001
DLMRR(-1)	-0.660636	0.920206	-0.717922	0.4832
DLMRR(-2)	-0.039144	1.044746	-0.037467	0.9706
DLPLR	-0.110002	0.511417	-0.215093	0.8324
DLPLR(-1)	-0.454316	0.167069	-2.719327	0.0105
DLPLR(-2)	-0.373295	0.481611	-0.775097	0.4496
DLTBR	0.064986	0.404830	0.160527	0.8745
DLTBR(-1)	0.136905	0.435484	0.314375	0.7573
DLTBR(-2)	0.103853	0.030688	3.384101	0.0019
DLGSR	0.032162	0.014401	2.233269	0.0371
DLGSR(-1)	0.013906	0.701502	0.019823	0.9844
DLGSR(-2)	0.242673	0.784191	0.309457	0.7610
ECM(-1)	-0.098964	0.326724	-0.302897	0.7659
C	0.168296	0.093343	1.802993	0.0903

R^2= 0.63, AIC= 1.54, SC= 2.20, Fstatistic = 28.10, DW = 2.15

The parsimonious ECM result was gotten by deleting insignificant variables from the overparameterize ECM model. The Akaike criterion and Schwarz criterion will be used to select the appropriate lag length. The summary of the parsimonious ECM result is shown in Table 5 below:

Table 5: Summary of parsimonious ECM result: Dependent variable: DLINV

` .

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLMRR	-0.396659	0.141286	-2.807485	0.0109
DLPLR(-1)	-0.080611	0.026962	-2.989855	0.0063
DLTBR(-2)	0.322087	0.108432	2.970398	0.0056
DLGSR	0.187952	0.048026	3.913570	0.0007
ECM(-1)	-0.250501	0.118824	-2.108161	0.0485
C	0.177660	0.076963	2.308393	0.0299

R^2= 0.77, AIC= 1.26, SC= 1.48, Fstatistic = 25.02, DW = 2.04

The result of the parsimonious ECM indicates that the minimum rediscount rate and the prime lending rates were statistically and negatively related to the level of aggregate investment in Nigeria. The result showed further that the treasury bill rate and the government stock rate were statistically significant and positively related to the level of aggregate investment in Nigeria. The statistical significance of the ECM which is also negatively signed is an indication of a satisfactory speed of adjustment. The result of the diagnostic tests are shown in Table 6 below:

Table 6: Diagnostic tests results

Jarque-bera normality test			
Jarque-bera	0.93	Probability	0.63
Breusch-Godfrey serial correlation LM test			
Fstatistic	2.04	Probability	0.15
White heteroskedasticity test			
Fstatistic	0.58	Probability	0.81

The result of the Jarque-bera normality test indicates the acceptance of the null hypothesis that the errors are normally distributed. The Breusch-Godfrey serial correlation LM test indicates that the residuals are not serially correlated and the white heteroskedasticity tests suggests that the residual is homoskedastic. The result of the cumulative Sum of Recursive Residuals (CUSUM) stability test is shown in figure1 below:

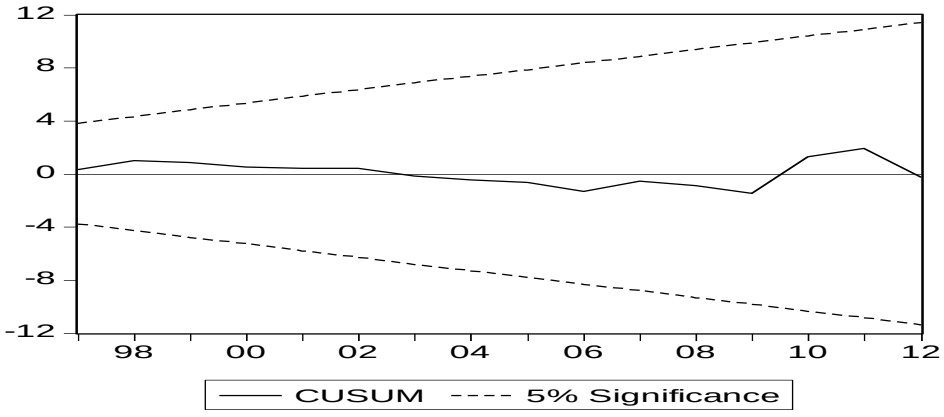

Figure 1: CUSUM Stability test result

Figure 1 indicates that the residual is stable since the CUSUM line is in-between the two 5 percent lines. The result of the Cholesky ordering variance decomposition is shown in table 7 below:

Table 7: Cholesky ordering variance decomposition

Variance Decomposition of LINV:					
Period	S.E.	LINV	LMRR	LPLR	LTBR
1	0.410874	100.0000	0.000000	0.000000	0.000000
2	0.625809	94.83459	0.286053	0.497341	0.570357
3	0.740505	88.78856	5.666589	2.313429	0.418386
4	0.873573	87.54049	5.274782	4.067105	0.694059
5	1.029282	88.01143	4.945449	4.023288	0.522084
6	1.157391	87.41754	5.312576	4.468348	0.436187
7	1.285912	86.40574	5.487939	5.453508	0.474518
8	1.405241	86.37293	5.707121	5.387379	0.413926
9	1.504954	85.94698	5.966220	5.629325	0.384725
10	1.605040	85.44340	6.061052	6.083709	0.392935
Variance Decomposition of LMRR:					
Period	S.E.	LINV	LMRR	LPLR	LTBR
1	0.217608	21.02903	78.97097	0.000000	0.000000
2	0.287059	18.26212	80.06505	0.017509	1.597619
3	0.361057	14.89341	75.02282	7.183587	1.408728
4	0.422383	16.74713	74.74532	5.973974	1.442864
5	0.479337	17.86846	73.82439	5.439182	1.966229
6	0.536480	19.63962	70.26296	7.583217	1.686606
7	0.594119	21.74579	68.79901	6.998568	1.754047
8	0.640689	21.44729	69.27900	6.771985	1.846292
9	0.684713	21.17333	68.85733	7.613601	1.713825
10	0.728186	22.24917	68.01034	7.392417	1.763869
Variance Decomposition of LPLR:					
Period	S.E.	LINV	LMRR	LPLR	LTBR
1	0.211112	8.611451	3.449504	87.93905	0.000000
2	0.294645	23.24818	10.45459	54.92674	10.54774
3	0.365514	26.55937	11.20333	52.47856	8.913540
4	0.441100	25.42321	13.81779	52.61079	7.232486
5	0.493955	26.09837	16.14065	48.38655	8.294250
6	0.544776	25.48763	16.28431	49.30726	7.842189
7	0.597662	26.15236	16.52714	48.79592	7.485798
8	0.644172	27.50031	16.80872	47.03293	7.649608
9	0.689161	27.43900	17.02893	47.12829	7.391803
10	0.730829	27.44150	17.44417	46.81821	7.273253
Variance Decomposition of LTBR:					
Period	S.E.	LINV	LMRR	LPLR	LTBR
1	0.188766	5.731903	11.37964	6.545502	76.34295
2	0.267497	2.966665	8.349546	3.354541	76.64763
3	0.299801	2.516445	7.430886	2.792760	76.48978
4	0.377697	5.677306	4.745292	8.199719	70.55492
5	0.446159	16.16835	4.406084	6.510023	61.10634
6	0.491457	18.18541	4.973676	6.261965	58.64349
7	0.542657	16.92984	5.417869	8.281898	58.06083
8	0.582629	18.09044	5.721395	7.847305	56.66359
9	0.622009	19.21863	5.550983	7.892687	55.36874
10	0.667140	20.16534	5.458118	8.626596	53.97290
Variance Decomposition of LGSR:					
Period	S.E.	LINV	LMRR	LPLR	LTBR
1	0.277016	20.89555	62.85576	0.844584	10.07324
2	0.357003	13.20693	69.31738	1.445072	12.23520
3	0.462571	9.357965	64.56835	10.54047	10.68445
4	0.550337	17.74788	58.12495	9.922993	10.57099
5	0.642069	21.19034	55.51927	9.448289	10.88215
6	0.724026	20.51753	55.28143	11.43387	9.900540
7	0.796961	20.85547	55.35288	11.41049	9.680643
8	0.859571	21.06683	55.23073	11.34195	9.829856
9	0.921840	21.30519	54.58603	12.17664	9.517944
10	0.984126	22.31855	53.85768	12.16579	9.380467
Cholesky Ordering: LINV LMRR LPLR LTBR LGSR					

The result shows that apart from shocks to itself, which is 100 percent in the first period, shocks to prime lending rate explained about 4 percent of the changes in aggregate investment in the 6th period which increased to 6 percent in the last period. Shocks to minimum rediscount rate explained 5 percent of shocks to investment in the 6th period which also increased to about 6 percent in the last period. Shocks to investment explained about 20 percent of shocks to the minimum rediscount rate in the 6th period which increased to 22 percent in the last period. Shocks to investment explained about 27 percent of changes in the pime ledning rate in the last period and 20 percent of shocks to treasury bill in the last period. Shocks to investment explained about 22 percent of shocks to government stock rates in the last period

Conclusion

Interest rate policy has been at the heart of monetary policy formulation and implementation in the world over. This is because of the important role played by interest rate in influencing investment behaviour in the world over. Economic crises in the world have been due to flawed interest rate policies. The effect on aggregate investment has been crippling. In Nigeria, the interest rate policy has been flawed and has not significantly benefited investment. Our result showed that high prime lending rate and high minimum rediscount rates have been detrimental to aggregate investment in Nigeria. The result showed however that the government stock rate and treasury bill rates has been favourable to investment in Nigeria. The result also showed a long run relationship among the variables. It is thus recommended that the prime lending rate and the minimum rediscount rate be further reduced to create more investment funds and accessibility to such funds by investors. Since high treasury Since high treasury bill and government rates investment, they should be further increased to facilitate investment.

References

Al-Tarawneh, S. (2004) "The policy of pricing of lending interest rate by commercial banks in Jordan: An econometric Study", *Al-Manarah, Al al-Bayt University, Jordan*, 10(2).

Aysan, A., Gaobo, P. and Marie-Ange Veganzones-Varoudakis (2005) "How to boost private investment in the MENA countries: The role of economic reforms", Topics in Middle Eastern and North African Economics, MENA, Online Journal, (VII): 1-15. http://www.luc.edu/orgs/meea/volume7/Aysan.pdf.

Box, G.E.P. and G. M. Jenkins, (1970). *Time Series Analysis, Forecasting and Control*, San Francisco: Holden-Day.

Davidson, J., Hendry, D., Sbra, F. and Yeo, S. (1978). 'Econometric modelling of the aggregate time Series Relationship between consumers' expenditure and income in the United Kingdom', *Economic Journal*, 88(352): 661–92.

Granger, C.W. and Newbold, P. (1977). "The time series approach to econometric model building", In Obadan, M.I. and Iyoha, M.A. eds. (1996). *Macroeconomic Analysis: Tools, Techniques and Applications*. NCEMA, Ibadan: Polygraphics Venture Ltd.

Greene, J. and Villanueva, D. (1990) "Determinants of private investment in LDCs", *Finance and Development*, December.

Gujarati, D. N., (2003). *Basic Econometrics* (4e). New York: McGraw-Hill Inc.

Harris, R., (1995). *Using Cointegration Analysis in Econometric Modeling*. London: Prentice Hall.

Hendry, D.F. (1986). "Econometric modelling with cointegrated variables: An overview", *Oxford Bulletin of Economic and Statistics*, 48(3): 201 – 12.

Hendry, D.F. and Mizon, G., (1978). "Serial correlation as a convenient simplification, not a nuisance: A comment on a study of the demand for money of the Bank of England", *Economic Journal*, 88(351): 549 – 63.

Hyder, K. and Ahmad, G.M. (2003) "Why private investment in Pakistan has collapsed and how can it be restored?", http://economics.cal/2003/papers/0454.pdf

Larsen, J.E. (2004) "The impact of loan rates on direct real estate investment holding period return", *Financial Services Review*, 13: 111-121.

Majed, B. and Ahmed, I.M.(2010) "The impact of interest rate on investment in Jordan: A cointegration analysis". *JKAU: Econ. and Adm.*, 24(1) : 199-209

Omole, A. And Falokun, G. (1999). "The impact of interest rate liberalization on the corporate financing strategies of quoted companies in Nigeria". *AERC*.

Sargan, J.D., (1964). "Wages and prices in the UK: A study in econometric methodology", in Hart,P., Mills,G. and Whittaker, J. (eds.), *Econometric Analysis for National Planning*, London: Butterworths..

Wang, D.H. and Yu, T.H. (2007) "The role of interest rate in investment decisions: A fuzzy logic framework", *Global Business and Economic Review*, 9(4), (September): 448-457.