American International Journal of Business and Management Studies
Vol. 1, No. 1; 2019
Published by American Center of Science and Education, USA

Macroeconomic Variables and Private Investment: A Two Dimensional Study from Nigeria Economy

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ABSTRACT
The study investigated the impact of macroeconomic variables on private investment in Nigeria for the period 1990 to 2016. To achieve these objectives, the study tests for the study modeled private equity and private real investment as the function exchange rate, financial sector development, and interest rate, openness of the economy, real gross domestic product, inflation rate and broad money supply. Ordinary least square method of data analysis was used.
From model one, the study found that real gross domestic product have positive but insignificant effect, openness of the economy have positive and insignificant effect, interest rate have positive and significant effect, financial deepening have positive and insignificant effect while interest rate, inflation rate and exchange rate have negative effect on private real investment. The coefficient of determination (R^2) proved that the independent variables can explain 62 percent variation on private real investment; the f- statistics found that the model is significant while the Durbin Watson statistics proved the presence of serial autocorrelation. The effect of macroeconomic variables on private equity investment was presented in model two. The study found that openness of the economy; real gross domestic products, broad money supply, and interest rate have negative and insignificant effect on private equity investment except openness of the economy with significant effect. Inflation rate, financial sector deepening and exchange rate have positive and insignificant effect on private equity investment except financial deepening with significant effect. The R^2 proved that the independent variables can predict 66.9 percent variation on private equity investment. The f- statistics found that the model is significant while the Durbin Watson statistics proved the presence of serial autocorrelation. We conclude that macroeconomic variable have significant effect on private investment in Nigeria. We recommend that interest rate must be able to encourage higher private investment by increasing the real interstate on private savings or household savings so that larger amount of income would be saved to accumulate more capital and hence private investment. Policies should be formulated by investors and government to discourage factors that affect negatively private investment.

Keywords: Macroeconomic Variables, Private Investment, Nigeria Economy, Interest Rate, Money Supply.

INTRODUCTION

The neoliberal view by Galbis (1979) emphasizes the importance of financial deepening and high interest rates in stimulating growth through investment. The proponents of this approach, McKinnon (1973) and Shaw (1973) offered a theoretical and empirical foundation for the relationship between financial factors and investment in developing countries. They argue that developing countries suffer from financial repression and that if these countries were liberated from their repressive conditions, savings, investment and growth would be induced to increase.
The underlying assumption of the model is that saving is responsive to interest rates, thus higher saving rates would finance a higher level of investment, leading to higher growth Gemech and Struthers, 2003). Financial repressive policies such as interest rate ceiling, minimum/maximum lending rates, quantity restrictions on lending, bank reserve requirements, capital controls, interalia, cause real interest rates to be negative and unstable especially in the presence of high inflation in an economy. According to their argument, a repressed financial sector discourages both saving and investment because the rates of return are lower than what could be obtained in a competitive market. As

a result, financial intermediaries do not function at their full capacity and fail to channel saving into investment efficiently, thereby hampering the development of the whole economic system (Reinert et al., 2008).

McKinnon and Shaw proposed that financial liberalization, which involves the removal or elimination of restrictions and controls on financial markets and financial institutions associated with higher real interest rates would stimulate saving and investment by reducing the financial constraint of firms and stimulate financial intermediaries to become more efficient, these will help to improve the efficiency of financial intermediation in a country, and contribute more to private sector investment thereby resulting in higher economic growth rates (Hermes and Lensink, 2005). Thus in the neoliberal view, investment is positively related to the real rate of interest. The reason for this is what McKinnon calls the conduit effect where a rise in interest rates increases the volume of financial savings through financial intermediaries and thereby raises investible funds.

The above theories and analysis on factors that determine investment are appealing but failed to explain the case of the developing countries like Nigeria. For instance Nigerian business environment is rated one of the most challenging in the world, there are various issues of policy conflict and policy mismatch. Increase in fiscal policy when there is contractionary monetary policy can affect macroeconomic variables and domestic real and portfolio investment. There are many studies on factors that determine investment, some of the studies focused on one type of investment. For instance Lucky and Uzah (2016) examined monetary policy transmission mechanism and domestic real investment in Nigeria. This study examined macroeconomic factors that determine real and portfolio investment in Nigeria.

LITERATURE REVIEW

Theory of Investment

Keynesian Theory of Investment

In the General Theory, Keynes (1936) emphasized the central role of investment as the driving force of influencing aggregate output, employment, and short run fluctuations in economic activity. The theory emphasizes that investment is the result of firms harmonizing the expected return on new capital, referred to as the marginal efficiency of capital (MEC), and with the cost of capital, which depends primarily on the real interest rate. The theory maintains that at lower rates of interest, more capital projects appear financially viable while higher interest rates lead to some projects being postponed or cancelled since the cost of borrowing to finance investment become higher. To the Keynes since investment is volatile and dependent on firms' expectations of the profitability of investment, so long as the expected yield on their investment exceeds the real interest rate, new investment will take place. Keynes rejected the notion that investment was based exclusively on technological conditions of capital productivity, but emphasized monetary factors and finance and uncertainty as the basic determinants of investment (Fazzari, 1989).

The Rigid Accelerator Theory

The simplest theory of investment demand is the rigid accelerator model formulated by Clark (1917). In its simplest form, the rigid accelerator theory of investment states that investment is proportional to the increase in output which is proxy by changes in demand in the coming period. Thus, the accelerator model relates investment to changes in demand and proposes that an increase in a firms output will require a proportionate increase in its stock of capital. The theory basically assumes that firms‟ desired capital-output ratio is roughly constant and net investment takes place when output is expected to increase. In effect, the theory implies that the level of output or the changes in aggregate demand determines investment or the change in capital stock. Mathematically, this proposition of the theory is expressed as $Kt^* = \sigma Y$, where σ is the desired capital-output ratio which is assumed to be constant, Kt^* is the desired capital stock in period t, and Yt is the level of output in the same period.

The McKinnon-Shaw Hypothesis

The neoliberal view by emphasizes the importance of financial deepening and high interest rates in stimulating growth through investment. According the work of McKinnon and Shaw (1973), which offered a theoretical and empirical foundation for the relationship between financial factors and investment in developing countries, developing countries suffer from financial repression and that their liberation from these repressive conditions, investment, savings and growth would be induced to increase. The important assumption of the model is that saving is responsive to interest rates, thus a higher saving rates would finance a higher level of investment, leading to higher growth (Gemech and Struthers, 2003).

According to their argument, a repressed financial sector discourages both saving and investment because the rates of return are lower than what could be obtained in competitive market. As a result, financial intermediaries do not function at their full capacity and fail to channel saving into investment efficiently, thereby hampering the development of the whole economic system (Reinert et al., 2008).

Empirical Review

Yamori (1995) using instrumental variable technique from the period 1975-1988; Delke (1996) reported results consistent with the hypothesis of Feldstein-Horioka for Japanese data. Similarly, Palley (1996) tested the causal relationship between saving and investment over the sample period 1973-1995 using Granger causality test for United State. The results showed that investment has a negative effect on personal saving and independent of government saving. Also, personal saving negatively affects government saving, thereby concurring with the Keynesian paradox of thrift thereby disputing F-H puzzle. Ozmen and Parmaksiz (2003) used Johansen cointegration technique and Engle and Granger two-step residual-based approach to cointegration to test for the Feldstein-Horioka puzzle for UK economy in the period 1948-1998. The authors concluded that there exist a long run relationship between saving and investment, thereby lending support to the Feldstein-Horioka puzzle.

Payne (2005) employed Engle-Granger and error correction model (ECM) to study the relationship between saving and investment in Mexico over the period 1960-2002. The results showed that savings and investment are cointegrated, thereby indicating low capital mobility in accordance with F-H hypothesis. However, the coefficient of error correction model is positive and statistically significant with a binding intertemporal budget constraint and an adjustment parameter of 0.242.

Narayan (2005) studied the relationship between investment and saving for the period 1960-1999 by applying Autoregressive Distributed Lag (ARDL) Model and Granger causality test for Japan. The author found long run relationship between saving and investment which suggest that there must be granger causality in at least one direction. Therefore, the Granger causality test results suggest bidirectional causality relationship between saving and investment. Thus, lending support to Feldstein and Horioka (1980) hypothesis.

Singh (2008) examined the long run relationship between saving and investment to determine the degree of capital mobility using Two-step Residual-based test, Autoregressive Distributed Lag (ARDL) Model and Granger causality test from the period 1950-51 to 2001-02. The results revealed long run relationship between saving and investment in India, supporting the Feldstein-Horioka hypothesis.

Mishra et al. (2010) studied the dynamic relationship between savings and investment in India for the period 1950-51 to 2008-09 by employing Johansen cointegration technique and Granger causality test via Vector Autoregressive framework. The authors found the presence of long run equilibrium relationship between saving and investment in India. The Granger causality test revealed directional causal relationship between the variables under study.

Seth (2011) applied Engle-Granger and Error Correction Model (ECM) to investigate the long run relationship between saving and investment for India from the period 1980-2008. The results showed long run relationship between savings and investment. The results also revealed long run equilibrium relationship between corporate savings and corporate investment. The former supports low capital mobility into India, whereas the latter revealed that corporate sectors dependency on their fund for investment.

Tang and Lean (2008) applied Rolling Windows Bounds test to empirically investigate the relationship between savings and investment over the period 1960-2007 for Malaysia. The study showed that savings and investment are not cointegrated implying that capital is internationally mobile over the same period.

Shahbaz et al. (2010) analyzed savings and investment correlation through the application of Autoregressive Distributed Lag (ARDL) bounds testing for cointegration through Error Correction Model (ECM) for Pakistan from period1976-2006. The authors reported long run relationship among savings, domestic investment, inflation, real exchange rate, and financial development which invariably indicate inadequate capital mobility in the country.

Adebola and Dahalan (2012) investigated the relationship between savings and investment nexus for Tunisia from the period 1970-2009 by employing Autoregressive Distributed Lag (ARDL) Model and Granger causality test. The

authors found the existence of long run relationship when investment is taken as dependent variable. The results of Granger causality test revealed two-way relationship justifying the low capital mobility as suggested by FH hypothesis. Empirical studies also emerged from a panel of OECD countries. Krol (1996) examined the relationship between saving and investment using data for 21 OECD countries covering the period 1962-1990 by employing fixed effects estimates. The results reject the idea that capital is highly mobile internationally.

Jansen (1996) re-examined the relationship between savings and investment for 23 OECD countries spanning the period 1951-1991 using Error Correction Model (ECM). The author revealed evidence of cointegration between saving and investment which invariably indicating an in capital mobility within the OECD. Another study by Hussein (1998) for 23 OECD countries over the period 1960-1993 to test the Feldstein-Horioka hypothesis by applying Dynamic Ordinary Least Square (DOLS). The results revealed that international capital mobility in 18 out 23 is very low, while the results suggest a moderate change in Canada, Denmark, Finland, Greece and Sweden.

Kasuga (2004) investigated the relationship between savings-investment nexus for 23 OECD and 79 non-OECD countries spanning 1980-1995. The author employed Ordinary Least Square (OLS) and instrumental variables. The results revealed that if domestic saving increases net worth, it increases domestic investment. Therefore, the study suggests that the impact of domestic saving depends on financial system and their development. Pelgrin and Schich (2008) applied a panel Error Correction Model (ECM) to analyze the long run relationship distinctly from the short run adjustment via the Autoregressive Distributed Lag (ARDL) Model in addition to Dynamic Fixed-Effects Estimator (DFE), Pooled Mean Group (PMG) estimator and Mean Group Estimator (MGE) for 20 OECD countries from 1960-1999. The authors found that saving and investment have long run cointegration relationship that is consistent with the interpretation that a long run solvency constraint is binding for each country.

Raoet al. (2010) applied the Bludell and Bound systems GMM method and Structural Breaks tests of Mancini-Griffoli and Pauwels to test the Feldstein-Horioka from the period 1960-2007 for a panel of 13 OECD countries. The results evidenced that the Feldstein-Horioka hypothesis is valid in the pre-Bretton Woods period and international capital mobility was negligible even though there has been a significant improvement in international capital mobility in the OECD countries. Last but not least, another group of studies examine if the puzzle also holds in country groups other than the OECD countries. Mamingi (1997) tested the savings and investment correlation by employing Ordinary Least Squares and Fully Modified Least Squares for 58 developing countries over the period 1970 1990. The author revealed that many developing countries are financially integrated in the long run. The results further showed that saving and investment correlation for low-income countries is higher than those for middle-income countries, using Japan and 10 other Asian countries data by employing Johansen framework covering the period 1950-1999.

Sinha (2002) revealed long run relationship between savings and investment for Myanmar and Thailand. The study also showed that the growth of the saving rates granger causes the growth rate of investment rates for Malaysia, Singapore, Sri Lanka and Thailand. However, causality runs from investment rates to saving rate for Hong-Kong, Malaysia, Myanmar and Singapore.
Chakrabarti (2006) re-examined the relationship between saving and investment by employing Multivariate Heterogeneous panel cointegration for the panel of 126 countries spanning 1960-2000. The author found a significant positive association between the ratio of gross domestic investment to GDP and the ratio of gross domestic saving to GDP ranging from 0.58 to 0.81. The evidence of cointegration and a significant positive correlation between saving and investment may indicate a low degree of financial integration in the world capital markets, which is the basis for the FH hypothesis.

Telataret al., (2007) studied the relationship between savings and investment for 10 European countries over the period 1970-2002 by applying a Markov-Switching Model which allowed data to be drawn from two different states-high capital mobility and low capital mobility-and extent it to allow variances to change among different regimes. The authors found a low correlation between savings and investment for Belgium, Denmark, Finland, France, Italy and Sweden. While, no single switching point in the regime of capital mobility measuring the degree of correlation between national savings and national investment was reported for the remaining countries. Kim et al. (2007) applied Generalized Least Square (GSL) estimation by iterating the Seemingly Unrelated Regression (SUR) system using the newly computed covariance and system equation estimates for Big three (China, Malaysia, and Korea), ASEAN countries and Greater China (Hong Kong, Taiwan, and China) covering the period 1980-2002. The

authors concluded that the saving-investment correlation in East Asia steadily decreases over time but is still higher than that of the OECD countries.

Ketenci (2012) used Gregory and Hansen and Johansen approach to cointegration to measure long run relationship between savings and investment for 23 EU countries for the period 1995-2009. The author showed that there is evidence of cointegration in all cases except for Estonia and Portugal. The low level saving-retention coefficient estimated in the presence of structural breaks revealed high capital mobility in most of the countries under study disputing the Feldstein-Horioka hypothesis. Dixit and Pindyck (1994) suggested that increased uncertainty caused by exchange rate variations reduces investment given the irreversibility of investment projects and, hence, increases the value option of delaying expenditures. Jayaraman (1996) in his cross-country study on the macroeconomic environment and private investment in six Pacific Island countries observed a statistically significant negative relationship between the variability in the real exchange rate and private investment. Thomas (1997) in his study of 86 developing countries examined data on terms of trade, real exchange rates, and property rights and concluded that while factors including credit availability and the quality of physical and human infrastructure are important influences, uncertainty in the foreign exchange rate was negatively related to private investment in sub-Saharan countries.

Gómez (2000) in a study titled exchange rate volatility effects on domestic investment in Spain argue that there is no unique expected exchange rate effect on investment, its sign and importance remaining as a mainly empirical question. Bakare (2011) carried out an empirical analysis of the consequences of the foreign exchange rate reforms on the performances of private domestic investment in Nigeria adopting the ordinary least square multiple regression analytical method. The multiple regression results showed a significant but negative relationship between floating foreign exchange rate and private domestic investment in Nigeria. The findings and conclusion of the study support the need for the government to dump the floating exchange regime and adopt purchasing power parity which has been considered by researchers to be more appropriate in determining realistic exchange rate for naira and contribute positively to macroeconomic performances in Nigeria.

Kanagaraj and Ekta (2011) examined the level of foreign exchange exposure and its determinants in Indian firms and it was found that only 16 percent of the firms had exchange rate exposure at 10 percent level of significance. About 86 percent of the firms are negatively affected by an appreciation of the rupee which confirms that Indian firms are net exporters. On the determinants of exchange rate exposure, the study reveals that export ratio is positively and hedging activity is negatively related to the exchange rate exposure of pure exporter firms.
Nazar and Bashiri (2012) investigates the relationship between real exchange rate uncertainty and private investment in Iran for the period of 1988 to 2008 by using quarterly data and applying bivariate generalized autoregressive conditional heteroskedasticity (Bivariate GARCH) model in the Iranian economy. The study reveal that real exchange rate uncertainty significantly influences private investment and has a negative effect on it and that private investment uncertainty affects the level of private investment, negatively.

Lucky and Kingsley (2016) examined factors that determine Nigerian capital formation. The objective was to test Jhingans propositions for sources of capital formation in Nigeria. Time series data were sourced from Central Bank of Nigeria (CBN) Statistical Bulletin. Nigerian Gross Fixed Capital Formation (GFCG/GDP) was modeled as the function of Broad Supply (M2/GDP), Credit to Private Sector (CPS/GDP), Gross National Savings (GNS/GDP), Commercial Banks Lending Rate, Exchange Rate (EXR), Inflation Rate (INFR), External Debt (EXTD/GDP), Public Expenditure (PEX/GDP), Government Revenue (GR/GDP), Terms of trade (TT/GDP) and Operating Surplus (OPS/GDP). Cointegration Test, Augmented Dickey Fuller Unit Root Test, Granger Causality Test and Vector Error Correction Model were used to test the dynamic relationship between the variables. Findings proved that M2/GDP, GNS/GDP, EXR, EXTD/GDP, TT/GDP have negative and insignificant effect on capital formation while CPS/GDP, LR, INFR, PEX/GDP, GR/GDP and OPS/GDP have positive and insignificant effect. The model summary revealed 86.0% explained variation and f-statistics 12.38458 probability of 0.000004. The study concludes that the variables have significant impact on Nigerian Gross Fixed Capital Formation and confirm the Jhingan's proposition.

Adelowokan Adesoye & Balogun (2015) examines the effect of exchange rate volatility on investment and growth in Nigeria over the period of 1986 to 2014. The vector error correction method, impulse responses function, co-integration and Augmented Dickey Fuller (ADF) test for stationarity were employed to capture the interactions between the variables. The results confirm the existence of long run relationship between exchange rate, investment,

interest rate, inflation and growth. Finally the results show that exchange rate volatility has a negative effect with investment and growth while exchange rate volatility has a positive relationship with inflation and interest rate in Nigeria.

Chowdhry and Wheeler (2008) in an empirical analysis studied the relationship between volatility of exchange rate for the four developed countries of Canada, Japan, United State and United Kingdom. Using a number of variables this study applied vector auto regressive (VAR) approach and found that shocks to exchange rate volatility have positive and significant impact on flow of FDI. Akeju (2014) examined the impact of real exchange rate on terms of trade and economic growth which relies on cointegration techniques and error correction model using annual data covering from 1980-2012. It was revealed that a real exchange rate moves along the same direction with terms of trade in the long run.

Rasaq (2013) examined the impact of exchange rate volatility on the macro economic variables in Nigeria and findings shows that exchange rate volatility has a positive influence on GDP, FDI and trade openness with a negative influence on the inflationary rate in the country. Ndikumana (2014) searched the implications of monetary policy for domestic investment through its impacts on bank lending to the private sector and interest rates in sub-Saharan African countries, the study based on a sample of 37 sub-Saharan African countries over 1980-2012, the study found that monetary policy affects domestic investment negatively indirectly through the bank lending or quantity channel, as well as directly through the interest rate or cost of capital channel.

Zulkefly Abdul Karim (2010) searched the impacts of monetary policy on institutions‟ investment in Malaysia, the study used dynamic neoclassical framework in an autoregressive distributed lagged (ARDL) mode, the study showed the impact of monetary policy on institutions investment spending, the study also reveal that the impact of monetary policy channels to the institutions investment are heterogeneous, therefore the small institutions that faced financial constraint responded more to monetary tightening as compared to the large institution. Tobias and Mambo (2012) searched the impacts of monetary policy on private sector investment in Kenya during (1996-2009) by tracing the impacts of monetary policy through the transmission mechanism to explain how investment responded to changes in monetary policy, they founded that government domestic debt and Treasury bill rate are inversely related to private sector investment, while money supply and domestic savings have positive relationship with private sector investment consistent with the ISLAM model.

Lucky and Uzah (2017) examined the effects of monetary policy transmission mechanisms on the domestic real investment in Nigeria, time series data were sourced from Central Bank of Nigeria statistical bulletin from 1981 to 2015. Domestic real investment was modeled as the function of percentage of credit to private sector to gross domestic product, naira exchange rate per US dollar, maximum lending rate, monetary policy rate, prime lending rate, net domestic credit, savings rate and Treasury bill rate. Granger causality test and Johansen co-integration test in the vector error correction model (VECM) setting were employed. Durbin Watson, β Coefficient, R-Square (R2) and F-Statistics were used to determine the relationship between the dependent and independent variables as formulated in the regression models. The result proved that CPS/GDP, MLR, MPR, NDC and SR have positive relationship with Nigeria real domestic investment while EXR, PLR, and TBR have negative relationship with domestic real investment. The cointegration test proved the present of long run relationship between monetary policy variables and domestic real investment. The ADF test prove that the variables are stationary at first difference, the granger causality test proved both bi-directional, uni-directional and independent relationship running from the independent variables to the dependent variable and from the dependent variable to the independent variables. The error correction model proved that the speed of adjustment is adequate while the parsimonious error correction model proved that MPR and SR have positive relationship while EXR and PLR have negative relationship. From the regression summary, the study concludes that monetary policy transmission mechanism has significant relationship with Nigeria domestic real investment.

RESEARCH METHODOLOGY

The research objectives were addressed using empirical analysis of macroeconomic variables that determine corporate investment in Nigeria. Private real investment and private traded equities on the floor of Nigerian stock exchange as dependent variable. The required data was sourced from Central Bank of Nigeria statistical bulletin from 1990-2016.

Model specification

The model specified in this study is based on the Classical monetary theory of interest rate and investment.

PEI = f(EXR,FD,INTR,OPE,RGDP,IFR,M2)

$$PEI = \beta_0 + \beta_1 EXR + \beta_2 FD + \beta_3 INTR + \beta_4 OPE + \beta_5 RGDP + \beta_6 IFR + \beta_7 M2 + \mu \quad 1$$

PRI = f(EXR,FD,INTR,OPE,RGDP,IFR,M2)

$$PRI = \beta_0 + \beta_1 EXR + \beta_2 FD + \beta_3 INTR + \beta_4 OPE + \beta_5 RGDP + \beta_6 IFR + \beta_7 M2 + \mu \quad 2$$

Where

PEI	=	Private Equity Investment
PRI	=	Private Real Investment
EXR	=	Exchange Rate
FD	=	Financial Sector Development
INTR	=	Interest Rate
OPE	=	Openness of the Economy
RGDP	=	Real Gross Domestic Products
IFR	=	Inflation Rate
M2	=	Broad Money Supply
μ	=	Error Term

Stationarity (Unit Root) Tests

The study investigates the stationarity properties of the time series data using the Augmented Dickey Fuller (ADF) test. According to Nelson and Plosser (1982), Chowdhury (1994) there exist a unit root in most macroeconomic time series. Non stationary time series will have a time varying mean or a time- varying variance or both. If a time series is non stationary, we can study its behaviour only for the time period under consideration, and cannot generalize it to other time periods, and hence remain of little practical value if we intend to forecast (Gujarati, 2003). It should be noted that a time series is a set of observations on the values that a variable takes at different times (daily, weekly, monthly, quarterly, annually, etc). Stationary test therefore checks for the stationarity of the variables used in the models. If stationary at level, then it is integrated of order zero which is 1(0). Thus, test for stationarity is also called test for integration. It is also called unit root test. Stationarity denotes the non existence of unit root.

$$\Delta y_t = \beta_1 + \beta_2 + \delta y_{t-1} + \alpha i \sum_{i-1}^{m} \Delta y_{t-1} + Et \quad 3$$

Where:

Δy_t	=	change time t
Δy_{t-1}	=	the lagged value of the dependent variables
Σ_t	=	White noise error term

If in the above δ =0, then we conclude that there is a unit root. Otherwise there is no unit root, meaning that it is stationary. The choice of lag will be determined by Akaike information criteria.

Decision Rulet-ADF (absolute value) > t-ADF (critical value) : Reject Ho (otherwise accept H1)

Note that each variable will have its own ADF test value. If the variables are stationary at level, then they are integrated of order zero i.e 1(0). Note that the appropriate degree of freedom is used. If the variables are stationary at level, it means that even in the short run they move together. The unit root problem earlier mentioned can be explained using the model:

$Y= Yt-1 + \mu I$ 4

Where; Yt is the variable in question; μi is stochastic error term. Equation (a) is termed first order regression because we regress the value Y at time "t" on its value at time (t- 1). If the coefficient of Yt-i is equal to 1, then we have a unit root problem (non stationary situation). This means that if the regression.

$Y= Yt-1 + \mu I$
5

Where Y and I are found to be equal to 1 then the variable Yt has a unit root (random work in time series econometrics). If a time series has a unit root, the first difference of such time series are usually stationary. Therefore to salve the problem, take the first difference of the time series. The first difference operation is shown in the following model:

$\Delta Y=(L-1)Yt-1\mu I$
6

$\delta Yt-1 + \mu I$ 7
(Note: δ =1-1= 0; where L =1; $\Delta Yt = Yt - Yt-i$) 8

Integrated Of Order 1 or I (I)

Given that the original (random walk) series is differenced once and the differenced series becomes stationary, then the original series is said to be integrated of order I or I (1).

Integrated of Order 2 or I (2)

Given that the original series is differenced twice before it becomes stationary (the first difference of the first difference), then the original series is integrated of order 2 or 1(2).

Therefore, given a time series has to be differenced Q times before becoming stationary it said to be integrated of order Q or I (q). Hence, non stationary time series are those that are integrated of order 1 or greater.

The null hypothesis for the unit root is: Ho: a = 1;

The alternative hypothesis is Hi: a < 1.

We shall test the stationarity of our data using the ADF test.

Co-integration Test (The Johansen Test)

It has already been warned that the regression of a non stationary time series on another non stationary time series may lead to a spurious regression. The important contribution of the concept of unit root and co-integration is to find out if the regression residual are stationary. Thus, a test for co-integration enables us to avoid spurious regression situation. If the residuals from the regression are 1(1) or 2(2), i.e. stationary, then variables are said to be co-integrated and hence interrelated with each other in the long run. This approach is based on conducting unit root test on residual obtained from the estimated regression equation. If the residual is found to be stationary at level, we conclude that the variables are co-integrated and as such as long-run relationship exists among them.

$$TA_t = w_O + \sum_{i=1}^{i} \vartheta_t TA_{t-i} + \sum_{i=1}^{j} \varpi_i TA_{jt-i} + \mu_{1t} \quad 9$$

Granger Causality Test

One of the objectives of this study is to investigate the causality between the independent and the dependent variables. Granger causality test according Granger (1969) is used to examine direction of causality between two variables. Causality means the impact of one variable on another, in other-words; causality is when an independent variable causes changes in a dependent variable. The rationale for conducting this test is that it enables the researcher to know whether the independent variables can actually cause the variations in the dependent variable. Thus, Granger causality test helps in adequate specification of model. In Granger causality test, the null hypothesis is: no causality between two variables. The null hypotheses is rejected if the probability of F* statistic given in the Granger causality result is less than 0.05.

The pair-wise granger causality test is mathematically expressed as:

$$Y_t \pi_o + \sum_{i=1}^{n} x_1^{\ y} Y_{t-1} \sum_{i=1}^{n} \pi_1^{\ x} x_{t-1} + u_1 \quad 10$$

$$x_t dp_o + \sum_{i=1}^{n} dp_1^y Yt-1 \sum_{i=1}^{n} dp1^x x_{y-1} + V_1 \quad 11$$

Where xt and yt are the variables to be tested white ut and vt are the white noise disturbance terms. The null hypothesis $\pi_1^y = dp_1^y = 0$, for all I's is tested against the alternative hypothesis $\pi_1^x \neq 0$ and $dp_1^y \neq 0.$ if the co-efficient of π_1^x are statistically significant but that of $dp1y$ are not, then x causes y. If the reverse is true then y causes x. however, where both co-efficient of π_1^x and dp_1^y are significant then causality is bi – directional.

Data analysis method

The method of data analysis to be used in this study is the simple linear regression using ordinary least square method. This approach, which is a quantitative technique, includes tables and the test for the hypotheses formulated by using ordinary least square with Econometric View regression analysis at 5% level of significance.

RESULTS AND DISCUSSIONS

The tables below have details of the dynamic effect of macroeconomic variables and private investment in Nigeria.

Table i: Dynamic Effect of Macroeconomic Variables on Private Investment: Private Real Investment

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP	2.082194	1.228528	1.694870	0.1073
OPE	0.174101	0.303387	0.573860	0.5732
M2	-0.662831	0.227875	-2.908749	0.0094
INTR	1.370468	0.727841	1.882923	0.0260
IFR	-0.310196	0.216799	-1.430804	0.1696

FD	1.012108	0.651230	1.554149	0.1376
EXR	-0.167041	0.054051	-3.090413	0.0063
C	66.88343	23.53590	2.841762	0.0108
R-squared	0.621715	Mean dependent var		90.00923
Adjusted R-squared	0.474605	S.D. dependent var		21.47513
S.E. of regression	15.56606	Akaike info criterion		8.575723
Sum squared resid	4361.442	Schwarz criterion		8.962830
Log likelihood	-103.4844	Hannan-Quinn criter.		8.687196
F-statistic	4.226175	Durbin-Watson stat		0.995530
Prob(F-statistic)	0.006391			

Private equity investment

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPE	-3.152819	1.298010	-2.428964	0.0252
RGDP	-1.539837	5.232390	-0.294289	0.7717
M2	-0.935558	0.957003	-0.977592	0.3406
INTR	-2.389049	3.109726	-0.768251	0.4518
IFR	0.804723	0.897337	0.896790	0.3811
FD	5.962534	2.779894	2.144878	0.0451
EXR	1.061988	0.222540	4.772128	0.0001
C	102.1102	95.58864	1.068225	0.2988
R-squared	0.758691	Mean dependent var		105.0785
Adjusted R-squared	0.669788	S.D. dependent var		115.9589
S.E. of regression	66.63471	Akaike info criterion		11.47752
Sum squared resid	84363.51	Schwarz criterion		11.86147
Log likelihood	-146.9466	Hannan-Quinn criter.		11.59169
F-statistic	8.533908	Durbin-Watson stat		0.938425
Prob(F-statistic)	0.000094			

Source: extract from E-View 9.0

From model one, the study found that real gross domestic product have positive but insignificant effect, openness of the economy have positive and insignificant effect, interest rate have positive and significant effect, financial deepening have positive and insignificant effect while interest rate, inflation rate and exchange rate have negative effect on private real investment. The coefficient of determination (R^2) proved that the independent variables can

explain 62 percent variation on private real investment; the f- statistics found that the model is significant while the Durbin Watson statistics proved the presence of serial autocorrelation.

The effect of macroeconomic variables on private equity investment was presented in model two. The study found that openness of the economy; real gross domestic products, broad money supply, and interest rate have negative and insignificant effect on private equity investment except openness of the economy with significant effect. Inflation rate, financial sector deepening and exchange rate have positive and insignificant effect on private equity investment except financial deepening with significant effect. The R^2 proved that the independent variables can predict 66.9 percent variation on private equity investment. The f- statistics found that the model is significant while the Durbin Watson statistics proved the presence of serial autocorrelation. The positive effect of the variables confirms the a-priori expectation of the study and various reforms in the Nigerian economy to attract foreign real and portfolio investment. Empirically it confirm the findings of Adelowokan Adesoye & Balogun (2015) confirm the existence of long run relationship between exchange rate, investment, interest rate, inflation and growth and that exchange rate volatility has a negative effect with investment and growth while exchange rate volatility has a positive relationship with inflation and interest rate in Nigeria. Rasaq (2013) that exchange rate volatility has a positive influence on GDP, FDI and trade openness with a negative influence on the inflationary rate in the country. Ndikumana (2014) that monetary policy affects domestic investment negatively indirectly through the bank lending or quantity channel, as well as directly through the interest rate or cost of capital channel. Zulkefly Abdul Karim (2010) that the impact of monetary policy channels to the institutions investment are heterogeneous, therefore the small institutions that faced financial constraint responded more to monetary tightening as compared to the large institution. Tobias and Mambo (2012) that government domestic debt and Treasury bill rate are inversely related to private sector investment, while money supply and domestic savings have positive relationship with private sector investment consistent with the ISLAM model.

Table ii: ADF Unit Root Test

Variable	ADF Stat	Mackinnon value			Prob.	Order of integration	Remark
		1%	5%	10%			
PRI	-4.729164	-3.724070	-2.986225	-2.632604	0.0009	I(I)	Stationary
PEI	-1.725512	-3.752946	-2.998064	-2.638752	0.4059	I(0)	Not Stationary
OPE	-8.642427	-3.724070	-2.986225	-2.632604	0.0000	I(I)	Stationary
RGDP	-6.857014	-3.724070	-2.986225	-2.632604	0.0000	I(I)	Stationary
M2	-5.359404	-3.724070	-2.986225	-2.632604	0.0002	I(I)	Stationary
INTR	-4.153126	-3.711457	-2.981038	-2.629906	0.0035	I(I)	Stationary
IFR	-5.804288	-3.724070	-2.986225	-2.632604	0.0001	I(I)	Stationary
FD	-4.560431	-3.808546	-3.020686	-2.650413	0.0020	I(I)	Stationary
EXR	-6.888586	-3.737853	-2.991878	-2.635542	0.0000	I(I)	Stationary

Source: extract from E-View 9.0

From the table, all the variables are stationery at first difference and integrated in the order of 1(I), we accept alternate hypothesis except private equity investment.

Table iii: Cointegration test: Trace test: Private real investment

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**

None *	0.999924	364.1848	125.6154	0.0000
At most 1 *	0.955999	155.6037	95.75366	0.0000
At most 2 *	0.885879	86.88569	69.81889	0.0012
At most 3	0.611499	39.13480	47.85613	0.2549
At most 4	0.375376	18.33471	29.79707	0.5415
At most 5	0.301734	7.981377	15.49471	0.4674
At most 6	0.003628	0.079953	3.841466	0.7773

Private equity investment

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.994167	337.3117	159.5297	0.0000
At most 1 *	0.969372	208.7053	125.6154	0.0000
At most 2 *	0.847933	121.5593	95.75366	0.0003
At most 3 *	0.638880	74.47340	69.81889	0.0202
At most 4 *	0.588725	49.00978	47.85613	0.0388
At most 5	0.451685	26.79747	29.79707	0.1067
At most 6	0.274106	11.77485	15.49471	0.1680
At most 7	0.139845	3.766064	3.841466	0.0523

Source: extract from E-View 9.0

The table above shows the co-integration results of the variables; it shows at least two cointegrating equations in model one and four cointegrating equation in model two. This indicates the presence of long run relationship between the variables in the time series. The null hypotheses of no cointegration are rejected and the alternate accepted.

Table iv: Normalized cointegration test: Private real investment

PEI	RGDP	OPE	M2	INTR	IFR	EXR
1.000000	8.084933	-0.269303	1.239984	-2.571665	0.811905	-0.123045
	(0.03993)	(0.00413)	(0.00490)	(0.01587)	(0.00395)	(0.00125)

Private equity investment

PRI	OPE	RGDP	M2	INTR	IFR	FD	EXR
1.000000	0.134291	67.91182	6.059239	24.50820	-6.391699	-18.22613	-2.232333
	(0.18116)	(1.84531)	(0.23791)	(0.52915)	(0.19363)	(0.54170)	(0.05376)

Source: extract from E-View 9.0

From the table, model one found that openness of the economy, interest rate and exchange rate have negative long run effect on private real investment while real gross domestic products, broad money supply and inflation rate have

positive long run effect on private real investment. Financial deepening was eliminated in the model due to the insignificant effect on private real investment in the previous results. Model two revealed that openness of the economy, real gross domestic products, broad money supply and interest rate have positive long run effect on private equity investment while inflation rate, financial deepening and exchange rate have negative long run effect on private equity investment.

Table v: Granger Causality test: Private real investment

Null Hypothesis:	Obs	F-Statistic	Prob.
OPE does not Granger Cause PRI	25	3.91712	0.0367
PRI does not Granger Cause OPE		1.99542	0.1621
RGDP does not Granger Cause PRI	25	2.23044	0.1335
PRI does not Granger Cause RGDP		1.47896	0.2518
M2 does not Granger Cause PRI	25	0.24676	0.7837
PRI does not Granger Cause M2		0.86216	0.4374
INTR does not Granger Cause PRI	25	0.70304	0.5069
PRI does not Granger Cause INTR		0.72839	0.4951
IFR does not Granger Cause PRI	25	0.31345	0.7344
PRI does not Granger Cause IFR		0.24184	0.7874
FD does not Granger Cause PRI	25	1.95776	0.1673
PRI does not Granger Cause FD		0.12008	0.8875
EXR does not Granger Cause PRI	25	2.61825	0.0977
PRI does not Granger Cause EXR		1.33744	0.2850
Private equity investment			
RGDP does not Granger Cause PEI	25	4.89035	0.0187
PEI does not Granger Cause RGDP		1.93215	0.1709
OPE does not Granger Cause PEI	25	1.97295	0.1652
PEI does not Granger Cause OPE		0.40675	0.6712
M2 does not Granger Cause PEI	25	1.16322	0.3327
PEI does not Granger Cause M2		3.22333	0.0412
INTR does not Granger Cause PEI	25	0.19881	0.8213
PEI does not Granger Cause INTR		0.38062	0.6883
IFR does not Granger Cause PEI	25	0.32198	0.7284
PEI does not Granger Cause IFR		6.04796	0.0088

FD does not Granger Cause PEI	25	0.04266	0.9583
PEI does not Granger Cause FD		0.54564	0.5879
EXR does not Granger Cause PEI	22	2.57553	0.1054
PEI does not Granger Cause EXR		4.37035	0.0294

Source: extract from E-View 9.0

From the table, model one proved uni-directional causality from openness of the economy to private real investment. Other variables in the model have no causality. Model two have uni-directional causality from real gross domestic product to private equity investment, from private equity investment to broad money supply, from private equity investment to inflation rate and from private equity investment to exchange rate.

Table vi: **Estimated Error Correction Model**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	61.67099	6.786586	9.087189	0.0698
D(PRI(-2))	1.110710	0.127279	8.726601	0.0726
D(PRI(-1))	1.465196	0.206280	7.102945	0.0890
D(PRI(-3))	-0.531717	0.195600	-2.718394	0.2244
D(M2(-1))	-2.172671	0.384825	-5.645867	0.1116
D(M2(-2))	3.109482	0.332386	9.355034	0.0678
D(M2(-3))	10.09627	1.240691	8.137617	0.0778
D(IFR(-1))	-6.617139	0.795251	-8.320817	0.0761
D(IFR(-2))	-1.800661	0.243833	-7.384804	0.0857
D(IFR(-3))	-1.350795	0.279543	-4.832146	0.1299
D(FD(-1))	-13.76491	1.760872	-7.817095	0.0810
D(FD(-2))	-33.26903	4.380346	-7.595068	0.0833
D(FD(-3))	4.912709	0.355352	13.82492	0.0460
D(EXR(-1))	-0.238797	0.063297	-3.772648	0.1650
D(EXR(-2))	-4.052002	0.522179	-7.759791	0.0816
D(EXR(-3))	-4.437919	0.512569	-8.658191	0.0732
D(RGDP(-1))	11.97662	2.858124	4.190378	0.1491
D(INTR(-1))	12.43416	1.378582	9.019535	0.0703
D(INTR(-2))	6.939735	0.872340	7.955309	0.0796
D(OPE(-1))	1.122627	0.189212	5.933158	0.1063

D(OPE(-3))	-5.109912	0.601508	-8.495164	0.0746
ECM(-1)	-1.540626	0.172322	-8.940399	0.0709
R-squared	0.999449	Mean dependent var		12.77913
Adjusted R-squared	0.987874	S.D. dependent var		25.11979
S.E. of regression	2.766156	Akaike info criterion		3.650343
Sum squared resid	7.651617	Schwarz criterion		4.736468
Log likelihood	-19.97895	Hannan-Quinn criter.		3.923501
F-statistic	86.34610	Durbin-Watson stat		1.969954
Prob(F-statistic)	0.084678			

Private equity investment

C	13.48995	38.10975	0.353976	0.7412
D(PEI(-1))	1.233222	0.778601	1.583894	0.1884
D(RGDP(-2))	0.164366	2.357362	0.069725	0.9478
D(RGDP(-3))	-0.277705	1.797497	-0.154496	0.8847
D(OPE(-1))	0.182172	0.456118	0.399395	0.7100
D(OPE(-2))	0.072823	0.574272	0.126809	0.9052
D(OPE(-3))	-0.097954	0.593885	-0.164938	0.8770
D(M2(-1))	-0.177295	0.609113	-0.291071	0.7855
D(M2(-2))	-0.279461	0.299462	-0.933210	0.4035
D(M2(-3))	-0.054750	0.428185	-0.127865	0.9044
D(INTR(-1))	-0.384271	1.036109	-0.370879	0.7295
D(INTR(-2))	-0.169910	0.868934	-0.195538	0.8545
D(INTR(-3))	-0.343503	0.889287	-0.386267	0.7190
IFR	-0.444788	0.516950	-0.860409	0.4381
FD	0.510249	0.893614	0.570995	0.5986
EXR	-0.148439	0.130436	-1.138019	0.3186
ECM(-1)	-0.039495	0.954548	-0.041376	0.9690
R-squared	0.909374	Mean dependent var		-3.619524
Adjusted R-squared	0.546868	S.D. dependent var		16.61566
S.E. of regression	11.18484	Akaike info criterion		7.627815

Sum squared resid	500.4024	Schwarz criterion	8.473381
Log likelihood	-63.09206	Hannan-Quinn criter.	7.811324
F-statistic	2.508581	Durbin-Watson stat	2.348027
Prob(F-statistic)	0.193265		

Source: extract from E-View 9.0

The Parsimonious error correction model shows that the macroeconomic variable can explain 99 and 90 % variation on the private real and equity investment the model summary shows that the model is significant. However, the Durbin Watson statistics justifies that there is no autocorrelation problem among the variables in the time series. The macroeconomic variables shows that narrow money supply is negatively related to the private real and equity investment at lag 1 but positive at lag 2 and lag 3, interest rate is negatively related at lag 2 while broad money supply is negatively related at lag 1 and positive at lag 2. Model one found speed of adjustment of 154 percent while model two found speed of adjustment of of3 percent annually.

CONCLUSION AND RECOMMENDATIONS

This study investigated the impact of macroeconomic variables on private investment in Nigeria for the period 1990 to 2016. As such the study sought to investigate other determinants of private investment in Nigeria. From model one, the study found that real gross domestic product have positive but insignificant effect, openness of the economy have positive and insignificant effect, interest rate have positive and significant effect, financial deepening have positive and insignificant effect while interest rate, inflation rate and exchange rate have negative effect on private real investment. The coefficient of determination (R^2) proved that the independent variables can explain 62 percent variation on private real investment; the f- statistics found that the model is significant while the Durbin Watson statistics proved the presence of serial autocorrelation.

The effect of macroeconomic variables on private equity investment was presented in model two. The study found that openness of the economy; real gross domestic products, broad money supply, and interest rate have negative and insignificant effect on private equity investment except openness of the economy with significant effect. Inflation rate, financial sector deepening and exchange rate have positive and insignificant effect on private equity investment except financial deepening with significant effect. The R^2 proved that the independent variables can predict 66.9 percent variation on private equity investment. The f- statistics found that the model is significant while the Durbin Watson statistics proved the presence of serial autocorrelation.

We conclude that macroeconomic variables have significant effect on private real and equity investment in Nigeria.

Recommendations

There is need to increasing the real interest rate on private savings or household savings so that larger amount of income would be saved to accumulate more capital and hence private investment. By this, the higher real interest rate would increase private savings which would also increase capital accumulation and hence private investment.

Investment related activities should be encouraged in order to promote private investment. Ensuring macroeconomic growth in the economy will undoubtedly enhance investment by the private sector. Economic policies to reduce inflation need to be practiced. In other words Nigerian inflation rate should be kept at a manageable level since uncertainty arising from persistent levels of inflation impedes the rate of private investment in the country. This can be done by reducing money supply.

Availability of funds ensures an adequate and efficient financial system easing funds from savers to investors that can expand the frontier of finance in private investments. There is the need to adopt policies that can encourage appreciation of the local currency as depreciation inhibits private investment.

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