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Time Series Analysis of Interest Rate on Investment in Nigeria

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The paper examines the impact of interest rates on investment in Nigeria from 1986 to 2018, using co-integration and vector error correction approach. The specific objectives were to estimate the short-and long-run elasticities as well as the error correction mechanism of interest rate, inflation rate and exchange rate on investment in Nigeria. The outcome of the exercise validated the hypothesis that interest rate has impact on investment in Nigeria, albeit with mixed results as the first lag period of all the three indicators used indicated positive relationship with the growth of investment but the lag of the second period all indicated negative impact on investment. The error-correction equation of investment indicates a feedback of 53.1 per cent, of the first period lag but 47.1 per cent, of second period lag. Also, the error-correction term indicated low speed of adjustment with only 2.0 per cent.

Keywords: Time series, interest rate, investment, Nigeria

INTRODUCTION

Interest rate in every economy is an important monetary policy instrument aimed at promoting economic growth and development especially through investment process. The short and long-term variability in interest rates is a prominent feature in any economy. Interest rate changes in response to a different of economic conditions such as changes in federal policy, crises in domestic and international financial markets and changes in the prospects for long term economic growth, inflation rate, business environment and investment. However, macroeconomic developments such as these tend to be irregular (Acha and Acha, 2011). There is a more regular variability of interest rates associated with the business cycle, the expansion and contraction that the economy experiences over time. For instance, short-term interest rate rise during business expansion and fall in economic recession. Long-term interest rate does not appear to co-vary much with the level of economic activities, especially investment which is the main driver of economic growth. The term cyclical volatility of interest rate refers to the variability of interest rate over periods that correspond to the length of the typical business cycle.

Interest rate variations affect decisions on investment and savings pattern. Investment behaviour is mainly affected by the level of interest rate obtainable in an economy. Investors differ in their willingness to hold risky assets such as bonds and stocks. When the returns to holding stocks and

bonds are highly volatile, investors who rely on these assets to finance their consumption profile face relatively large chance of having low consumption. For example, before retirement, people receive a steady stream of income that helps to buffer the changes in wealth associated with changes in the returns on their investment portfolios. This steady return from working helps them maintain a relatively steady level of consumption. After the retirement, steady stream of income from working ceases to exist, hence, a less volatile investment portfolio is called for. The lower volatility of investment returns allows retirees to maintain relatively less consumption over time.

Nigeria experienced severe macroeconomic problems towards the end of the 1970s through the first half of the 1980s when output declined substantially. The real gross domestic product (GDP) growth rate averaged only 1.5 per cent, per annum during the period 1973-1980 (registering negative growth rate in six years during the period), (CBN, 1990). In response to the deteriorating economic situation, the Nigerian government launched policy programmes contained in the Structural Adjustment Programme (SAP). Several forms of corrective measures were undertaken including financial sector reforms policies.

Prior to 1986 in Nigeria, the common practice has been the support of certain economic projects considered to be essential part of development strategy. Government adopted policies aimed at accomplishing specified objectives such as interest rate ceiling and selective sectoral policies. Those policies were introduced with the intention of directing credit to the priority sectors and securing inexpensive funding for their activities. The ceiling on interest rate and quantity restrictions on loanable funds for certain sectors ensured that larger share of funds was made available to favoured sectors. Such practice hinders financial intermediation since the financial markets would only be accommodating the credit demands of the government and ignoring risks associated with the strategy. The practice has been disfavoured as growth policy led by McKinnon (1973) and Shaw (1973) was not achieved.

According to their proposition, financial repression paradigm, government's effort to promote savings by such indiscriminate measures has repressed the financial system. This discourages financial intermediation. Thus, they call for financial liberalisation (the removal of ceilings on interest rates among others) as a growth promoting policy. According to them, the removal of interest rate ceilings will raise aggregate savings because the interest rate elasticity of private savings is positive. Interest rate policy in Nigeria is perhaps one of the most controversial of all financial policies. The reason for this may not be far-fetched because interest rate policy has direct bearing on many other economic variables including investment decision. Interest rate plays a crucial role in the efficient allocation of resources aimed at facilitating economic growth and economic development of an economy as well as a demand management technique for achieving both internal and external balances.

Interest rate policy is among the emerging issues in current economic policy in Nigeria in view of the role it is expected to play in the deregulated economy by inducing savings which can be channeled to investment and thereby, increasing employment, output and promotes efficient financial resource utilization. Also, interest rate can have a substantial influence on the rate and pattern of economic growth by influencing the volume and disposition of savings as well as national productivity.

The financial system of most developing countries like Nigeria has come under stress as a result of economic shocks of 1980s and in recent time the global financial crisis of 2007. The financial repression largely manifested through indiscriminate distortions of the financial prices, including interest rates. This tends to reduce the rate of growth and the real size of the financial system. More importantly, financial repression has retarded development as envisaged by Shaw (1973). This led to insufficient availability of investible funds, which is regarded as a necessary catalyst for promoting investments in an economy. This decline in investment as a result of a drop in the external resource transfer since the 1982 has been enormous in the highly indebted countries, and has been accompanied by a slow-down in growth in all the less developed countries (LDCs). Both private and public investment rate have been falling, although the former was more drastic than the latter. If this trend is maintained, it will lead to a slowdown in medium term growth possibilities in these economies and will reduce the level of long-term per capita consumption and income, endangering the sustainability of the adjustment efforts.

The observed reduction in investment in LDCs seems to be the result of several factors. First, the low availability of foreign savings has not been matched by the corresponding increase in domestic savings. Secondly, the determination of fiscal conditions due to the cut in foreign lending to the rise in domestic interest rate, the acceleration in inflation forced a contraction in public investment and, the increase in macroeconomic instability associated with external shocks and the difficulty of domestic government to stabilize the economy has hampered private investments. Finally, the debt overhang has discouraged investment through its implied credit constraints in international capital markets (Omole and Falokun, 2004). In order to curb the adverse effect of the 1980s financial repression, Nigerian government deregulated interest rates in 1987 as part of the Structural Adjustment Programme (SAP) policy target. The official position was that interest rate liberalization among other things enhanced the provision of sufficient funds for investors, especially manufacturers (a priority sector) which was considered to be prime agents and by implication, promoter of economic growth.

The following research questions will be answered in this paper: has the level of interest rate being a contributory factor to declining or increasing investment in Nigeria? is there a positive relationship between interest rate and investment? and does investment drives growth in any economy? The broad objective of this paper is to investigate the impact of interest rate on investment in Nigeria. Specifically, the aims are to: examine the impact of interest rate shocks on investment components; investigate if there is a positive relationship between interest rate and investment; and examine how monetary policy variables affect investment in Nigeria.

Accordingly, the paper is arranged in five parts. Part one presents the introduction, while part two examines the literature review and theoretical framework. It discusses the conceptual review, theoretical review and determinants of investment. It explores the empirical review of existing work and identifies gap in the literature. Part three examines the methodology, covering model specification, sources and methods of data analysis. Part four presents data analysis and interpretation of results and part five contains summary of findings, conclusion and recommendations.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Conceptual Review

Interest rates rank among the most important variables in macroeconomics and in the functioning of financial markets. It plays a crucial role in the determination of the value of financial instruments, and generally affects economic agents‟ decision or behaviour on whether to consume, save and invest. It also affects the way wealth is distributed between borrowers and lenders. Interest rates influence the prices of key financial assets such as stocks, bonds, and foreign currencies. For individuals, interest rates are of interest as it determines monthly payments on car loans and home mortgages. It also determines the income earned on savings account, term deposits and other forms of market instruments.

Ajilore (2014), in his work distinguished between the nominal and real interest rates at the outset, as well as identify the variants of rates of interest in its deposit and lending rates forms:

Nominal Interest Rate

It is defined as the rate paid for the use of money or credit before taking into consideration the inflation rate over the rental period. In other words it embeds both the effects of inflation and uncertainty. That is, the interest rates were not adjusted for changes in purchasing power caused by changes in the price level. In fact, inflation can reduce the purchasing power of returns on any investment. In addition, inflation causes the purchasing power of the principal to decline. For example, if inflation is 5.0 per cent per year, the purchasing power of the ₦1, 000 principal falls by ₦50 each year.

Black (2002) defined interest rate as the price that a borrower has to pay in order to have access to the use of cash, which he or she does not own, and the return that a lender enjoys for foregoing consumption or liquidity in the current period. This definition connotes interest rate as both a cost and a reward. Interest rate is a cost of capital, which influences the demand for loanable funds by borrowers in need of such. When conceived in this way, interest rates are seen as lending rates on different forms of loans and advances in the financial market.

Real Interest Rate

This is the nominal interest rate adjusted for expected inflation. To encourage savings, real interest rate is expected to be positive. Lenders and borrowers know that inflation reduces the purchasing power of interest income, so they base their investment decisions on interest rates adjusted for changes in purchasing power. Such adjusted interest rates are called real interest rates. Lending and borrowing parties are actually not sure of what the real interest rate will be over the tenor of the loan, they have to base their decisions concerning savings and investments on their expectations about the real interest rate. Savers and borrowers must decide what they expect the inflation rate to be in order to estimate the expected real interest rate. The expected real interest rate, r, equals the nominal interest rate, i, minus the expected rate of inflation, i.e., πe i.e. $r = i - \pi^e$.

Note that this equation also means that the nominal interest rate equals the real interest rate plus the expected inflation rate: $i = r + \pi^e$. It is possible to generalise by noting that the actual real interest rate equals the nominal interest rate minus the actual inflation rate. If the actual inflation rate is greater than the expected inflation rate, the actual real interest rate will be less than the expected real interest rate; in this case, borrowers will gain and lenders will lose. If the actual inflation rate is less than the expected inflation rate, the actual real interest rate will be greater than the expected real interest rate; in this case, borrowers will lose and lenders will gain.

Savings Deposit Rate

The savings deposit rate is the interest rates paid by banks and other deposit taking institutions for cash deposited by savings deposit account holders. The payment of interest on the account is subject to the restriction that funds could only be withdrawn from the account after seven days" notice. This restriction is however, seldom applied by banks nowadays, probably to gain competitive advantage in deposits mobilisation.

Fixed Deposit Rate

Fixed deposit account is an investment account with a specified amount invested at an agreed and specified interest rate and term to maturity. In Nigeria, fixed deposits have tenor of 30, 90 or 180 days. The interest rates paid on this form of account are called fixed deposit rates. They normally attract higher interest rates than the savings deposit rates.

Investment

Investment can be broadly defined as the acquisitions of an asset with the aim of receiving a return (Odoko, 2002). It could also mean the production of capital goods; goods which are not consumed but instead used in future production. Examples include building a rail road, or a factory, clearing land, or putting oneself through college. There are several motives for investment. The basic motive is profit/return. According to Keynes' theory, this motive depends on the under-utilisation of capital.

In addition, Soludo, (2001) described investment as generally conceptualised in terms of "physical" capital formation. The explanation derives from the neoclassical production function with separable input factors – mainly capital and labour, and with investment adding to the stock of capital.

Economic Growth

Economic growth refers to the increase in the value of goods and services produced by an economy. It is conventionally measured as the rate of increase in Gross Domestic Product (GDP). Growth is usually calculated in real terms (netting out the effect of inflation on the price of goods and services produced). It can be studied in two time paths: short-run and long-run paths. The short-run variation of economic growth is known as business cycle, and all economies experience periodic recessions. The long-run path of economic growth is one of the central questions of economics: over long periods of time, even seemingly small rates of growth, through compounding, can have large effects, (Odoko, Okafor and Kama, 2008).

Growth in output can be divided into two major categories: growth through increased input and that through improvements in productivity. Given that labour and capital inputs cannot be increased indefinitely without encountering diminishing marginal returns, technological progress is needed to increase the standard of living in the long-run, (Odoko, Okafor and Kama, 2008).

Theoretical Review

Theories of Interest Rate

There exist some well-known theories of interest rates. They include the Abstinence or Waiting Theory of Interest; the Agio Theory or Time Preference Theory; the Marginal Productivity Theory; Savings and Investment Theory (the Classical Theory); Loanable Funds Theory; and the Liquidity Preference Theory.

According to the Abstinence Theory of Nassau Senior, interest is the reward for abstaining from immediate consumption of wealth. When people save, they abstain from present consumption. That involves some sacrifice. To make them save, interest is offered as a reward. But Marshall preferred the word, "waiting" to "abstinence".

The "Agio" theory of interest of Bohm-Bawerk tells us that as the present period carries a premium (agio) over the future, and as people prefer present consumption to future consumption, we have to pay a price for them by way of compensation, and that is interest. The Time Preference Theory of Irvin Fisher is more or less the same as Agio Theory of Interest. The Marginal Productivity Theory of distribution is nothing but the application of the marginal productivity theory of distribution. It shows that interest rate tends to equal the marginal productivity of capital.

In the case of the Classical Theory of Interest Rate, it infers that the rate of interest is determined by the supply of capital which depends upon savings and the demand for capital for investment. The theory is based on the assumption that there exists, a direct relationship between the rate of interest, savings and direct relationship between interest rate and investment. The Classical Economist believed that savings would increase when the interest rate is high, and that investment would increase given a fall in interest rate. Meanwhile, the rate of interest would establish the equilibrium between savings and investment.

The Loanable Funds Theory (Neo-Classical Theory) of interest rate was developed by Knut Wicksell, Dennis Robertson and others. The loanable funds theory is wider in its scope than the classical theory of interest. The terms "loanable funds" includes not only saving out of current income but also bank credit, dishoarding and disinvestments. But by savings, the classical economists referred only to savings out of current income. Hence, we know that bank credit is an important source of funds for investment.

In the classical theory, saving was demanded only for investment. But according to loanable funds theory, the demands for funds arose, not only for investment but also for hoarding wealth.
There is no doubt that the loanable funds theory is an improvement over the classical theory of interest, but it has been criticised. The criticism is on the ground that it assumes that savings is a

function of the rate of interest. Secondly, it has been criticised as ignoring the influence of the changes in the level of investment on employment, income and on savings.

Another theory of interest rate is the Liquidity Preference Theory, otherwise known as the Keynesian Theory of Interest. Generally, people prefer to hold part of their assets in the form of cash. Cash is a liquid asset. According to Keynes, interest is the reward for parting with liquidity for a specified period of time. In other words, it is the reward for not hoarding.

According to Keynes, people have liquidity preference for three motives. They are: transaction motive; precautionary motive; and speculative motive. The transaction motive refers to the money held to finance day-to-day spending. Precautionary motive is held to meet unforeseen expenditure.

Keynes defines speculative motive as "the object of securing profit from knowing better than the market what the future will bring forth". Of the three motives, speculative motive is more important in determining the rate of interest. Keynes believed that the amount of money held for speculative motive would vary inversely with the rate of interest.

Keynes was of the view that the rate of interest was determined by liquidity preference on the one hand and the supply of money on the other. The Keynesian theory is a general theory of interest and it is far superior to the earlier theories of interest. But critics say that Keynes has over emphasised liquidity preference factor in the theory of interest. Moreover, it is only when a person has savings that the question of parting with liquidity can arise. In the words of Jacob Viner, "without saving, there can be no liquidity to surrender. The rate of interest is the return for saving without liquidity".

Theories of Investment

Generally, there exist some theories that are associated with investments.

These theories are presented below:

a. Investment Multiplier Theory

The investment theory is an integral part of the Keynesian theory of employment. According to Keynes, "the multiplier establishes a precise relationship, given the propensity to consume, between aggregate employment and income and the rate of investment.

The important element in the multiplier theory is the multiplier coefficient, K which is the power by which any initial investment expenditure is multiplied to get a final increase in income. The marginal propensity to consume determines the value of the multiplier.

b. The Principle of Acceleration Theory

The principle of acceleration was first introduced into economics by J.M. Clark in 1917 but was further developed by Hicks, Samuelson and Harrod in relation to the business cycle. This principle is based on the fact that the demand for capital goods is derived from the demand for consumer goods which the former help to produce. It explains the process by which an increase

(decrease) in the demand for consumption goods leads to an increase (or decrease) in investment on capital goods. This version of the accelerator principle has been more broadly interpreted by Hicks as the ratio of induced investment to changes in output it calls forth.

c. Financial Theories of Investment

Some economists have emphasised on the effect of financial factors on investment. Among the financial theories of investment is the profit theory. The profit theory of investment regards profits, in particular undistributed profits, as a source of internal funds for financing investment. Investment depends on profits and profits, in turn depend on income. In this theory, profits relates to the level of current profits and of the recent past. If total income and total profits are high, the retained earnings of firms are also high, and vice versa. Retained earnings are of great importance for small and large firms when the capital market is imperfect because it is cheaper to use them. Thus, if profits are high, the retained earnings are also high. The cost of capital is low and the optimal capital stock is large. That is why firms prefer to reinvest their extra profits for making investments instead of keeping them in banks in order to buy securities or to give dividends to shareholders. In contrast, when their profits fall, they cut their investment projects. This is the liquidity version of the profit theory.

Another version is that the optimal capital stock is a function of expected profits. If the aggregate profits in the economy and the business profits are rising, they may lead to the expectation of their continued increase in the future. Thus, expected profits are some function of actual profits in the past.

$$K_t^* = f(\pi_{t-1}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where K_t^* the optimal capital is stock and $f(\pi_{t-1})$ is some function of past actual profits.

Edward Shapiro has developed the profit theory of investment in which total profits vary directly with the income level. For each level of profits, there is an optimal capital stock. The optimal capital stock varies directly with the level of profit. The interest rate and the level of profits, in turn, determine the optimal capital stock. For any particular level of profits, the higher the interest rate, the smaller will be the optimal capital stock, and vice versa.

Another financial theory of investment is the Duesenberry's financial theory of investment. Duesenberry in his book, *Business Cycle and Economic Growth* gave another version of the financial theory of investment known as the cash flow theory. In his version, he integrates the profit theory and the acceleration theory of investment. He emphasises that the aggregate cash flow is the main determinant of investment. Duesenberry has based his theory on the following propositions that: gross investment starts exceeding depreciation when capital stock grows; investment exceeds savings when income grows; and the growth rate of income and the growth rate of capital stock are determined entirely by the ratio of capital stock to income. Duesenberry regards investment as a function of income (Y) , capital stock(K), profit (π) and capital consumption allowances (R). All these are independent variables and can be represented as:

$$I = f(Y_{t-1}, K_{t-1}, \pi_{t-1}, R_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, (t) refers to the current period and $(t-1)$ the previous period. According to Duesenberry, profits depend positively on national income and negatively on capital stock.

d. Jorgenson's Neoclassical Theory of Investment

This theory of investment behaviour is based on the determination of the optimal capital stock. His investment equation has been derived from the profit maximisation theory of the firm. Jorgenson's theory is based on the following assumptions: the firm operates under perfect competition; there is no uncertainty; there are no adjustment costs; there is full employment in the economy where prices of labour and capital are perfectly flexible; there is perfect financial market which means the firm can borrow or lend at a given rate of interest; the production function relates output to the inputs of labour and capital; labour and capital are homogenous inputs producing a homogenous output; inputs are employed up to a point at which their marginal propensity to produce (MPP) are equal to their real unit costs; there are diminishing returns to scale; there is the existence of "putty-putty" capital which means that even after investment is made, it is instantly adapted without any costs to a different technology; the capital stock is fully utilised; changes in current prices always produce ceteris paribus proportional changes in future prices; the price of capital goods equals the discounted value of the rental charges; and the firm maximises the present value of its current and future profits with perfect foresight in relation to all future values.

e. Tobin's q Theory of Investment

Nobel Laureate economist, James Tobin has proposed the q theory of investment which links an industry's investment choices to variations in the stock market. When an industry finances its investment by issuing shares in the stock market, its stock prices replicates the investment choices of the industry. Industry's investment choices is based on the following ratio, called Tobin's q:

$$q = \frac{Market\ Value\ of\ Principle\ Stock}{Replacement\ Rate\ of\ Principle} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The market value of industry's principle stock in the numerator is the value of its principle as indomitable by the stock market. The replacement rate of industry's principle in the denominator is the original rate of existing principle stock if it is acquired at today's price. Thus, Tobin's q describes net investment by relating the market value of industry's fiscal assets (the market value of its shares) to the replacement rate of its real principle (shares).

According to Tobin, net investment would be based on whether q is higher than 1 $(q > 1)$ or less than $1(q < 1)$. If $q > 1$, the net value of the industries equities in the stock market is greater than the replacement rate of its actual principle, machinery, etc. The industry can purchase more principle and issue additional shares in the stock market. In this way by selling new equities, the industry can bring in profits and finance new investment. Conversely, if $q < 1$, the market value of its shares is less than its replacement rate and the industry will not replace principle (machinery) as it obsoletes.

Determinants of Investment

According to Keynes, employment depends on investment. Employment fluctuates on account of fluctuations in investment. He therefore posits that investment is determined by two factors: expectations of future profitability or business confidence; and rate of interest. Chete (2006) noted that firms either invest from their own profits or by borrowing. Households having savings, have to decide whether to invest the money for profit or lend/deposit for interest. If the expected profit is higher than the rate of interest, then the household will invest. Otherwise, they will lend or deposit their own money for interest. Firms who invest their own profit will also decide in same manner. Suppose the firms borrow for investment, then they have to pay interest for that. Hence, firms will invest borrowed money only when the expected profit is high enough to pay the interest and the cost of initial capital. Thus, in all of the above, the decision to invest will be based on the rate of interest and business confidence. Of these two, business confidence or expectations about future profitability have greater significance than the rate of interest. This is because rate of interest is stable in the short-run. The expectation about profitability involves several considerations of the future about which there cannot be any certainty. Bleak prospects will lead to a reduction of investment and it will affect employment and vice versa, (Chete, 2006).

Savings and Investment

Savings is directly connected with investment. Saving and investment are the basic economic activities of an economy, Sleka (2004). Saving is inevitably for capital formation and economic growth. Saving itself has nothing to do with economic growth unless savings are properly mobilised and effectively channel and invested to enhance capital stock to increase production and wealth of the economy. Thus aggregate saving and investment are equal.

But they may not always be in equilibrium. The classical economist believed that savings were automatically invested. They thought the decision to save and the decision to invest were made by the same person. But Keynes argued that savings and investment were made by different persons for different reasons and were influenced by different factors. Thus, sometimes savings might exceed investment. When this happens, there would be deficiency of aggregate demand and general unemployment.

Keynes thought the gap between savings and investment can be filled by government intervention either directly by increasing government expenditure or indirectly by actions influencing the supply of money. Thus,

$$S = I \quad \text{……..(4)}$$
$$\therefore Y = C + I \quad \text{……(5)}$$
Or $$Y = C + S \quad \text{……(6)}$$

Where s = savings; I = Investment; Y = Income; and C = Consumption

Government Spending

Government spending is public expenditure made by government. It is made to produce public goods like literacy, public health, defence, child nutrition, social welfare, infrastructure and many more for the collective well-being of the society.

The classical economist held the view that government was unproductive. Keynes rejected their idea and argued that government activities (taxing and spending) strongly influence the level of economy. According to Keynes, taxation and public spending can be used to achieve macroeconomic goals like growth and economic stability. In this sense, fiscal policy is being described.

Keynes proved that fiscal policy is more effective in recovering economies from depression. Public expenditure can be used to increase effective demand during depression. The injection of money in the economy will generate higher demand and this will increase investment and employment. Thus, public expenditure will put back the economy again on its growth path.

Many countries have adopted his suggestions and recovered from Great Depression of the 1930s. Since then, the role of government and fiscal policy became important in macroeconomic management.

Empirical Review of Literature

Relationship between Interest Rate and Economic Growth

Several researchers have investigated the relationship between interest rate and economic growth in both developed and emerging economies. Hence, there exist several literatures on this subject. Some of the studies are reviewed below:

Oosterbanan (2009) examined the relationship between the annual economic growth rate and the real rate of Interest. The study employed the ordinary least squares method of econometric analysis. The study revealed that the relationship between the real rate of interest and economic growth might be an inverted U-curve.

Owosu and Odhiambo (2001) investigated the relationship between interest rate liberalisation and economic growth in Nigeria using autoregressive distributed lag bounds testing approach. The conclusion from the study was that, interest rate liberalization policies have positive effect on economic growth in Nigeria. Therefore, interest rate liberalisation policies together with increase in the productivity of labour, increase in capital stock and increase foreign direct investments determines economic growth in Nigeria.

Chete (2006) in his own study investigated the relationship between real interest rate and economic growth in Nigeria using error correction model estimation technique. The result showed that there was a unique long-run relationship between interest rate and economic growth and that interest rate is an important determinant of economic growth in Nigeria. Furthermore, he however concluded that the deregulation of interest rate in Nigeria may not optimally achieve its goal if those other factors that affect investment negatively are not addressed out and tackled.

Obamuyi (2009) studied the relationship between interest rates and economic growth in Nigeria using time series data. He employed the co-integration and error correction model techniques of analysis to capture both the long-run and short-run dynamics of the variables in the model. Results revealed that real lending rates have significant positive effect on economic growth and that; there also exists a unique long-run relationship between economic growth and its determinants including interest rate. This study recommended that the formulation and implementation of financial policies that enhance investment friendly rate of interest as a necessity for promoting economic growth in Nigeria because of the relationship that exist between interest rate and investment growth in the country's development process.

Furthermore, Oosterbanan (2009) examined the relationship between the annual economic growth rate and real rate of interest. The study employed the ordinary least square method of econometric analysis. The study revealed that the relationship between the real rate of interest and economic growth might be an inverted u-curve. Bruce, Ananth and Hansen (2013) examined the relationship between Real Interest rates and Economic Growth. They employed sensitivity analysis and VAR estimate in their analysis and found that there exist a moderately negative correlation between real interest rate and productivity that measures economic growth. This negative correlation implies that long-run costs due to a period of low interest rates will tend to be slightly offset by a period of high productivity growth. Conversely, long-run benefits during a period of high interest rates will be offset by low productivity growth. Bruce *et. al.*, (2013) examined the implications for the variability of long-term projections of trust fund accumulation and found that a negative correlation reduces the variability in the stochastic intervals. Obansa, Okoroafor, and Millicent (2013) established empirically the relationship existing among exchange rate, interest rate and economic growth in the Nigerian economy using time series which was separated into two economic regimes - the regulation and the deregulation regimes. Obansa *et. al.*, (2013) utilised vector autoregression (VAR) technique and it was revealed that exchange rate had a stronger impact on economic growth than interest rate, particularly, interest rate impact was found to be positive but declined as the time horizon increased.

Relationship between Interest Rate and Investment

Banks have the primary responsibility of financial intermediation to make funds available for economic agents. Banks as financial intermediaries move surplus funds from sector/units of the economy to deficit sector/units by accepting deposits and channeling them to lending activities. The extent to which this could be done depend upon the rate of interest and level of development of financial sector as well as the savings habit of the people in the country. Hence, the availability of investible funds is therefore regarded as a necessary starting point for all investment in the economy which will eventually translate to economic growth and development (Uremadu, 2008).

Few researchers have done studies on the impact of interest rate on investment. In Nigeria, (Uchendu, 2013) found out that only few of the variables were significant at both the 95.0 per cent, and 90.0 per cent, confidence limits in explaining the behavior of investment during the (1976-90) period. Specifically, he found out that:

> "Contrary to expectation and to change's stock adjustment hypothesis, the existing stock of capital goods (plants and machinery) was not a major determinant of investment behavior of forms in Nigeria; and Interest rate was significant in influencing investment decision noting that" this is not surprising since in a situation of limited residual funds as in Nigeria, the cost of capital should exert significant influence on both the frequency and volume of demand for invisibles funds by investors".

Adebiyi (2001) explained that the investment demand curve is always a backward bending function of the interest rate in a model with non-convex adjustment costs and the potential to learn. At low interest rates, an increase in the rate of return raises the cost of learning and increases aggregate investment by enlarging the set of firms for when the interest rate exceeds the rate of return to delay. An increase in interest rate is more likely to stimulate investment when the potential to learn is larger and in the short run rather than the long run.

Uchendu (2013), studied interest rate policy, savings and investment in Nigeria using time series data spanning from 1976 - 2006. He found out that the behaviour of interest rate and inflation rate have significant influence on investment.

Albu (2006) studied the trends in the interest rate, investment, GDP growth relationship. The study used two partial models to examine the impact of investment on GDP growth and the relationship between interest rate and investment in the case of the Romanian economy. The study found that the behaviour of the national economy system and interest rate-investment relationship tend to converge to those demonstrated in the normal market economy.

Akintoye and Olowolaju (2008) examined optimising macroeconomic investment decision in Nigeria. The study employed both the ordinary least square and vector auto regression frame works to stimulate and project inter-temporal private response to its principal shocks namely: public investment, domestic credit and output shocks. The study found low interest rate to have constrained investment growth. The study resolved that only government policies produce sustainable output, steady public investment and encourage domestic credit to the private sector will promote private investment.

Mahmudul and Gazi (2009) in their study in Jordan on stock investment (based on the monthly data from January 1988 to March 2003) found that interest rate exerts significant negative relationship with share price for markets of Australia, Bangladesh, Canada, Chile, Colombia, Germany, Italy, Jamaica, Japan, Malaysia, Mexico, Philippine, South Africa, Spain, and Venezuela. For six countries from this sample, they argued on the availability of significant negative relationship between changes of interest rate and changes of share price.

Olubanjo et al. (2010) simulated the inter-relationships among interest rates, savings and investment in Nigeria between 1993 and 2010 using two stages least square method. The result from their study suggested that a marked decrease in the real lending rate would not result automatically into increased domestic investment.

Eregha (2010) examined variations in interest rate and investment determination in Nigeria. The study employed dynamic model of two equations using instrumental variable technique of

estimation. The study revealed that variations in interest rate posits negative but highly significant role in investment decision in Nigeria and demand for credit had a negative significant influence on interest rate variations in both the short-run and the long-run.

Ojima and Emerenini (2015) in their study of interest rate and investment in Nigeria applied the ordinary least square method (OLS). Their study revealed that high interest rate affect investment negatively. The study therefore suggested that the monetary authority should evolve policies that will encourage savings and reduce prime lending rate to genuine investors and others. They further recommended that since there is a between income and savings, relevant authorities should consider economic policies that will increase income level of the people in order to mobilize investments.

Theoretical Framework

The theoretical background on interest rate and investment behaviour can be attributed to the seminal work of McKinnon and Shaw in the early 1970s'. McKinnon and Shaw postulated that financial repression had retarded the growth of many less developed countries (LDCs). They emphasised on interest rate policy, which often resulted in the imposition of below market rates thereby creating a disincentive to save and retarding the process of financial deepening. They identified that investment function responds negatively to the effective real loan rate of interest and positively to the growth rate. Hence, given this backdrop, McKinnon and Shaw argued stalwartly for interest rate liberalisation as an important input into the process of growth and development. Therefore, the increasing acceptance of the model eventually led to financial reform becoming a standard element in structural reform programmes recommended by international financial institutions.

Theories of interest rates try to explain variables which determined interest rates. These theories differ because of differences of opinion as to whether rates are monetary or real phenomenon. Basic tenets of the neo classical loanable fund theory of interest rate propounded by Dennis Robertson, advocate that savings and investment are responsible for determination of interest rate in the long run. The rate of interest is the price that equates the demand for and supply of loanable funds (Jhingan 2007). The demand for loanable fund for investments such as purchase of capital goods, constructions etc., depends on the expected rate of profit as compared with the rate of interest. This demand is met by past savings or through dis-saving and are interest elastic. The loanable fund regards the rate of interest as a function of four variables: savings, investment, the desire to hoard and the money supply.

Loanable Funds Theory

According to loanable funds theory, the rate of interest is a function of four variables:
$r = f(I, S, M, L)$..... (2.7)

Where r is the rate of interest; $I =$ Investment; $S =$ Saving; $M =$ Bank Credit and $L =$ Desire to hoard or desire for liquidity.

Classical Theory of Interest Rate

The classical theory of interest rate defined the rate of interest as the element that equates savings and investment. The theory holds the proposition based on the general equilibrium theory of interest rate determined by the demand for and supply of capital. The demand for capital stems from investment decision while the supply of capital results from savings in the community.

The classical theory regarded interest as a function of savings and investment:

$r = f(S, I)$……………………………………….. (8)

2.4.3 Keynesian Liquidity Preference Theory

The Keynesian liquidity preference theory determines the interest rate by the demand for and supply of money in a stock theory. It emphasized that the rate of interest is purely a monetary phenomenon. It is a stock analysis because it takes the supply of money as given during the short run and determines the interest rate by liquidity preference or demand for money. The Keynesian theory implies that low interest rate as a component of cost administered is detrimental to increase savings and hence investment demand. They argue that increase in the real interest rate will have strong positive effects on savings which can be utilized in investment, because those with excess liquidity will be encouraged to save because of the high interest rate, thus banks will have excess money to lend to investors for investment purpose thereby raising the volume of productive investment.

$\frac{M^d}{P} = f(i, Y)$ …………………………………………………….. (9)

Where M is broad money supply, P is the price level, i is the rate of interest, M^d is the demand for money and Y is the real income.

Rewriting and multiplying both sides by Y and replacing M^d with M:

$V = \frac{PY}{M} = \frac{Y}{f(i, Y)}$ ……………………………………………………. (10)

Where V, is the velocity of money.

Investment Multiplier Theory

The investment theory is an integral part of the Keynesian theory of employment. It reveals that when there is an increment in investment, income will increase by an amount which is K times the increment of investment", i.e. $\Delta Y = K\Delta I$. In the words of Hansen as stated in Jhingan (2000), the Keynesian investment multiplier is the coefficient relating to an increment of investment to

an increment of income, i.e. $K = {}^{\Delta Y}/_{\Delta I}$, where Y is income and I is investment, Δ is change (increment or decrement) and K is the multiplier.

The relationship between the multiplier and the marginal propensity to consume is as depicted below:

$$\Delta Y = \Delta c + \Delta I \ldots\ldots (11)$$

$$\Delta Y = c\Delta Y + \Delta I \ldots\ldots (12)$$

Where $\Delta c = c\Delta Y$

Or $$\Delta Y - c\Delta Y = \Delta I \ldots\ldots (13)$$

$$\Delta Y(1 - c) = \Delta I \ldots\ldots (14)$$

$$\Delta Y = \frac{\Delta I}{1-c} \ldots\ldots (15)$$

$$\frac{\Delta Y}{\Delta I} = \frac{1}{1-c} \ldots\ldots (16)$$

$$K = \frac{1}{1-c} \ldots\ldots (17)$$

Where $K = \frac{\Delta Y}{\Delta I}$

With c being the marginal propensity to consume, the multiplier K is by definition, equal to $1 - {}^{1}/_{c}$. The multiplier can also be derived from the marginal propensity to save (MPS), which is the reciprocal of the MPS, i.e. $1/MPS$.

The Principle of Acceleration Theory

According to Jhingan (2000), the accelerator coefficient is the ratio between induced investment and an initial change in consumption expenditure. Symbolically, $\beta = {}^{\Delta I}/_{\Delta c}$ or $\Delta I = \beta\Delta c$ where β is the accelerator coefficient; ΔI is the net change in investment and Δc is the change in consumption expenditure.

Hence, accelerator v is equal to ${}^{\Delta I}/_{\Delta Y}$ or the capital-output ratio. It depends on the relevant change in output (ΔY) and the change in investment (ΔI). Hence, the acceleration principle can be expressed in the following form of equation:

$$I_{gt} = v(Y_t - Y_{t-1}) + R$$

$$= v\Delta Y_t + R \ldots\ldots (18)$$

Where I_{gt} is gross investment in period t, v is the accelerator, Y_t is the national output in period t, Y_{t-1} is the national output in the previous period $(t-1)$, and R is the replacement investment.

The equation shows that gross investment in period t depends on the change in output (Y) from period t-1 to period t multiplied by the accelerator (v) plus replacement investment R.

In order to arrive at that net investment (In), R must be deducted from both sides of the equation so that net investment in period t is:

$$I_{nt} = v(Y_t - Y_{t-1})$$

$$= v\Delta Y_t \quad \ldots\ldots (19)$$

This equation is nothing but$\Delta I = v\Delta Y$, since $\Delta Y = Y_t - Y_{t-1}$. As a matter of fact, there is little difference between $\Delta I = v\Delta Y$, as defined by Hicks and $\Delta I = \beta\Delta C$, as defined by Samuelson and other. The accelerator v and β are the same. Hicks take the increase in final output (ΔY) while Samuelson takes the increase in demand for consumer goods(ΔC). In Hicks model, net investment equals $I_{nt} = v(Y_t - Y_{t-1})$ while in Samuelson's model, $I_{nt} = \beta(C_t - C_{t-1})$. It has become necessary to explain the acceleration principle in terms of final output(Y).

If $Y_t > Y_{t-1}$, net investment is positive during period t. On the other hand, if$Y_t < Y_{t-1}$, net investment is negative or there is disinvestment in period t.

The Financial Liberalisation Theory put forth by Mckinnon and Shaw (1973) postulate that interest rate regulations usually lead to low and negative real interest rates, which stunts economic growth of developing countries. The financial repression which causes low interest rate discourages savings and thus, shrinks investment. The quality of investment will also be low because the projects that would be undertaken under a regime of repression would have a low rate of yield. They advocated that interest rate deregulation would increase interest rate rise which will encourage both savings and investment thereby boosting economic growth. Both Mckinnon and Shaw advocated that interest rates deregulation was needed to remedy the problems caused by financial repressive policy of developing countries. This study thus, looks at investment performance since the Structural Adjustment Programme of Nigeria when interest rate was deregulated so as to observe the directional flow of investment in this period. The body of literature reviewed indicate that some works have been done in the area of interest rate and investment within the Nigerian economy. Most of these studies concentrated on interest rate as it impacts positively on the behaviour of the naira. But not much has been done in trying to investigate the impact of interest rate on investment in Nigeria.

Therefore, this study adopts the investment multiplier theoretical framework to examine the impact of interest rate on investment behavior in Nigeria. This is done with some modification incorporating the peculiarities of the Nigerian economy, particularly introducing the exchange rate and lending rate.

From the available relevant works of other authors studied, it was identified that some of the studies focused on the relationship between interest rate and economic growth while others

examined foreign private investment nexus with interest rate. They did not examine the impact of interest rate on investment. Most of them adopted annual series and their estimation techniques were mainly static regression with long-run coefficients, through the ordinary least squares (OLS) without checking for the time series properties of their data. Also, the result of Ojima and Emerenini (2015) among others, were counter intuitive where it was revealed that high interest rate affect investment negatively. These identified gaps in the literature motivated the need to empirically investigate the impact of interest rate on investment in Nigeria, using quarterly data with higher degrees of freedom with more current data and higher frequency. Initial descriptive, trend analysis and unit root analysis were conducted to guide the appropriate estimation techniques to be adopted. The co-integration test showed the long-run relationship of the concerned macroeconomic variables. With these additional inputs, the outcome of the paper help to validate the objectives and address the research questions earlier stated.

METHODOLOGY

Econometric techniques such as unit root test, co-integration, and error correction model which combine both the long-run and short-run dynamics was applied. This helped in ascertaining the long-run and short-run behavioural relationships between interest rate and investment in Nigeria. It also helped to capture the period it took for the disturbed system to adjust back to equilibrium by estimating the error correction mechanism (ECM).

Model Specification

In line with the theoretical background, the paper investigated interest rate and investment behaviour in Nigeria. It adopted the work of Ojima and Emerenini (2015) founded on the investment multiplier theoretical framework with some modifications:

$$GCF_t = \alpha + \beta_1 RLR_t + \beta_2 INF_t + \beta_3 EXR_t + \mu_t \text{ ---------- (1)}$$

Ojima and Emerenini (2015) used lending rate, inflation, exchange rate as independent variables while gross fixed capital formation was used as the dependent variable. Hence, the model was developed to assess the relationship using data for the period 1986q1 to 2018q4. But there are other variables that affect interest rate as the proxy for investment, which was given consideration. This model was modified by introducing income and exchange rate. The model is therefore specified as follow:

$$GCF_t = \alpha + \beta_1 RLR_t + \beta_2 INF_t + \beta_3 EXR_t + \beta_4 Y_t + \mu_t \quad \text{---------- (2)}$$

Where GCF is growth in gross capital formation, RLR is real lending interest rate, INF is inflation rate (measuring macroeconomic instability), EXR is real exchange rate, Y is real gross domestic product, and μ_t is a white noise disturbance term.

The a priori expectation is summarised as follows:

$\beta_1 \prec 0, \beta_2 \prec 0, \beta_3 \prec or \succ 0, \beta_4 \succ 0, \beta_1 - \beta_4$ are parameters to be estimated.

The data employed were obtained from the Central Bank of Nigeria Statistical Bulletin and the National Bureau of Statistics (NBS). The estimation period covered from 1986 to 2018. The paper utilised the vector auto-regression estimation technique to examine the relationship as well as the impulse response of how investment responded to shocks on interest rate and other control variables. The measures of central tendency of the macro-variables was also investigated to guide and give first-hand information about the mean, median, mode, kurtosis, skewness and deviations of the macroeconomic variables used in this paper. The individual plot of all the variables used was done. A causal observation of each of them was useful in understanding the turning points, boom and bursts cycles, spikes and outliers that could exist in the series and appropriate cleaning exercise was done before going further to conduct the estimation.

Unit Root Test – Augmented Dickey Fuller (ADF) and Phillip Peron (PP)

Stationarity is defined as a quality of a process in which the statistical parameters (mean and standard deviation) of the process do not change with time (Challis and Kitney 1991). The assumption of the classical regression model necessitate that both the dependent and independent variables be stationary and the errors have a zero mean and finite variance. According to Newbold and Granger, the effect of non-stationarity includes spurious regression, high R^2 and low Durbin-Watson (DW) statistic.

Testing the stationarity of variables is relevant for the reason that it incorporates important behavior for these variables and making analysis with non-stationary variables may result in spurious correlation. A stationary time series is superior or more important than a non-stationary in economic analysis as it makes easier the study of the behavior of variables in the long run (Gujarati, 2004). Stationarity test was conducted for all the variables by employing Augmented Dickey- Fuller (ADF) and the Phillips Perron (PP) tests to avoid possible spurious regression results.

If it is assumed that the error term, μ_t , is uncorrelated, the DF test may be used. But in case the μ_t are correlated, Dickey and Fuller have developed a test known as the Augmented Dickey Fuller (ADF) test. The ADF test is used in this study as most tests of the DF type have low power. That is, they tend to accept the null of unit root more frequently than is required.

The ADF unit root test requires the estimation of the following regression:

$$\Delta Y_t = \alpha + \beta_1 t + \delta Y_{t-1} + \sum_{i=1}^{m}(\alpha_i \Delta Y_{t-i}) + \varepsilon_t \text{ ………………………………….. (3)}$$

Where ε_t is a pure white noise error term and ΔY_{t-1}= $(Y_{t-1} - Y_{t-2})$, ΔY_{t-1}= $(Y_{t-2} - Y_{t-3})$, etc. are consecutive lagged differences augmented, β_0 is intercept, β_2 is trend coefficient, t is time or trend variable, m the number of lag terms chosen.

The hypotheses of this test will be:

H_0: $\delta =$ 0, i.e., there is a unit root – the time series is non-stationary.

$H_1: \delta < 0$, i.e., there is no unit root – the time series is stationary

If the computed absolute value of the t statistic exceeds the ADF critical values, we do not accept the hypothesis that $\delta = 0$, in which case the time series is stationary and vice versa.

Phillips and Perron, on the other hand, proposed a nonparametric method of controlling for serial correlation when testing for a unit root. The PP method estimates the non-augmented DF test

equation and modifies the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. A test of unit root using the Phillips-Perron approach does not require a lag length determination (Waheed et. al., 2006).

The test regression for the PP tests is given by the following equation (Phillips 1998):

$$\Delta Y_t = c + \alpha Y_{t-1} + \mu_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

Where μ_t is $I(0)$ and may be heteroskedastic. The PP tests correct for any serial correlation and heteroskedasticity in the errors μ_t of the test regression by directly modifying the test statistics. These tests are known as Phillips Z_α and Z_t tests. The Z −tests allow for a wide class of time series with heterogeneously and serially correlated errors.

Cointegration Test

Non-stationary time series data could still be used for regression, provided the time series are co-integrated. Cointegration becomes one way to guard against spurious regression. Cointegration means, despite being individually non-stationary, linear combination of two or more time series can be stationary. Cointegration of two or more time series suggests that there is a long-run or equilibrium relationship between them.

The traditional regression methodology including the t and F tests is applicable to data involving nonstationary time series. The valuable contribution of the concepts of unit root, cointegration, etc. is to help to find out if the regression residuals are stationary, I(0) i.e. the series are integrated of order 1. As Granger notes, “A test for cointegration can be thought of as a pre-test to avoid ‘spurious regression’ situations.

In the language of cointegration theory, a regression such as:

$$Y_t = \beta_1 + \beta_2 X_t + \mu_t \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

is known as cointegrating regression and the slope parameter β_2 is known as the cointegrating parameter. The concept of cointegration can be extended to a regression model containing k regressors. In this case, we will have k cointegrating parameters.

The Johansen’s cointegration test has been the best method of testing cointegration. The Johansen’s Maximum Likelihood Estimation avoids the use of two-step Engle-Granger

procedure and can estimate and test for the presence of multiple cointegrating vectors. The procedure also allows testing restricted versions of cointegrating vector(s) and speed of adjustment in parameters.

Error Correction Model

The Error Correction Mechanism (ECM) was first used by Sargan and later popularized by Engle and Granger for the correction of disequilibrium. So, the ECM is a mechanism developed by Engle and Granger as a means of reconciling the short-run behaviour of an economic variable with its long-run behaviours.

An important theorem, known as the Granger representation theorem states that if two variables Y and X are cointegrated, then the relationship between the two can be expressed as ECM. To see what this means, let us revert to equation (5):

$$Y_t = \beta_1 + \beta_2 X_t + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Now conintegrating equation (5) above, gives the following model:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 \mu_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where Δ as usual denotes the first difference operator, ε_t is a random error term, and $\mu_{t-1} = (Y_{t-1} - \beta_1 - \beta_2 X_{t-1})$, that is, the one period lagged value of the error from cointegrating equation (5).

ECM equation (6) states that ΔY depends on ΔX and also on the equilibrium error term. If the latter is non-zero, then the model is out of equilibrium. Suppose ΔX is zero and μ_{t-1} is positive. This means Y_{t-1} is too high to be in equilibrium, that is, Y_{t-1} is above its equilibrium value of $(\alpha_0 + \alpha_1 \Delta X_{t-1})$. Since α_1 is expected to be negative, the term $\alpha_2 \mu_{t-1}$ is negative and, therefore, ΔY_t will be negative to restore the equilibrium. That is if Y is above its equilibrium value, it will start falling in the next period to correct the equilibrium error; hence the name ECM. By the same token, if μ_{t-1} is negative (i.e. Y is below its equilibrium value), $\alpha_2 U_{t-1}$ will be positive, which will cause ΔY_t to be positive, leading Y_t to rise in period$t$. Thus, the absolute value of α_2 decides how quickly the equilibrium is restored. In practice, we estimate μ_{t-1} by:

$$\hat{\mu}_{t-1} = (Y_{t-1} - \hat{\beta}_1 - \hat{\beta}_2 X_{t-1}) \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

DATA ANALYSIS AND INTERPRETATION OF THE RESULTS

In this part, the results obtained from the e-views estimation is presented and analysed. These results are as follows:

Unit Root Test

Table 4.1: Augmented Dickey-Fuller Test Statistic

Series	ADF Test Statistic	1% Critical Values	5% Critical Values	10% Critical Values	Order	Remark
GCF	2.9066	-4.3743	-3.6032	-3.2380	I (1)	Stationary
INTR	-2.885	-4.3743	-3.6032	-3.2380	I (1)	Stationary
INFR	-2.5911	-4.4163	-3.6220	-3.2486	I (1)	Stationary
EXR	-2.2460	-4.3098	-3.5742	-3.2217	I (1)	Stationary

Source: From E-views result.

Considering the ADF test statistics at 1.0 per cent, 5.0 per cent and10.0 per cent critical values, it is observed that test statistics are greater than the critical values. Thus, the series are stationary at levels. The unit root test shows that the variables GCF, INTR, INFR and EXR are integrated of order one. They are integrated of the same order 1(1). The level of their integrations indicates the number of times the series have to be differenced before they became stationary. From the above table, it is clear that since the series are integrated of order one, i.e. I (1), hence, the linear combinations of the series are said to be co-integrated.

Co-integration Test

The co-integration was based on the Johansen co-integration test. The result is presented below.

Hypothesized No of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.7150	66.5352	47.8561	0.0004
At most 1*	0.4669	31.3870	29.7971	0.0325
At most 2	0.3717	13.7719	15.4947	0.0894
At most 3	0.0268	0.7613	3.8415	0.3829

*denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

The result of the Johansen co-integration test above shows that there is a long-run relationship between the GCF and the explanatory variables; INTR, INFR and EXR. Johansen co-integration test for the series: GCF(1), INTR(1), INFR(1) and EXR (1), under the Johansen co-integration test and the results revealed two co-integrating vectors. In Johansen's Method, the trace statistic is used to determine whether the variables are co-integrated. The trace statistics are found as 66.5352, 31.3870, 13.7719 and 0.7613. The trace test indicated two co-integrating equations. In other words, the null hypothesis of no co-integration among the variables is rejected. The test

result shows the existence of a long-run equilibrium relationship among the variables under consideration at 5.0 per cent level of significance.

Analysis and Interpretation of Results

The confirmation of the existence of a co-integration vector among the series gives enough justification to conduct co-integration which makes it possible to estimate the error correction model (ECM). From the result of the over-parameterised model, a parsimonious (preferred) error correction model that is theory consistent and data admissible was obtained. The parsimonious error correction result is as shown below:

Variable	Coefficient	Std. Error	T-Statistic
C	117670.4	139317.0	0.84462
D(GCF(-1))	0.530717	0.27557	1.92588
D(GCF(-2))	0.471466	0.30376	1.55208
D(INTR(-1))	5995.190	38109.3	0.15732
D(INTR(-2))	-12620.97	30749.7	-0.41044
D(INFR(-1))	138.1383	7593.56	0.01819
D(INFR(-2))	-5403.436	9899.89	-0.54581
D(EXR(-1))	1384.819	7498.74	0.18467
D(EXR(-2))	-3770.014	7556.56	-0.49891
ECM(-1))	-0.015965	0.03631	-0.43976
R-squared	0.641820	Log likelihood	-387.9315
Adj. R-squared	0.452195	Akaike AIC	29.47640
Sum Sq. resid	4.77E+12	Schwarz SC	29.95634
S.E. equation	529773.5	Mean dependent	465541.0
F-statistic	3.384680	S.D. dependent	715776.0

Source: From E-views result

The parsimonious error correction model above shows that the error correction term has the expected negative sign and it is significant at 5.0 per cent level. This result affirms the earlier result of co-integration between investment represented by gross capital formation and its regressors. The coefficient of the error correction term represents the speed of adjustment. The R^2 of 0.64 indicates that about 64.0 per cent of the variations in the growth of investment is explained by the final variables that enter the parsimonious model. The coefficient of the ECM is -0.02. The negative sign is an indication of the existence of a long-run equilibrium relationship between investment and the independent variables that influence its short-run dynamics of the model. In fact, the result shows very low speed of adjustment of 2.0 per cent between the short-run and long-run equilibrium behaviours of investment and its explanatory variables. The F-statistics of 3.38 measuring the joint significance of all the regressors shows that the overall model is significant at 5.0 per cent level.

Discussion of the Results

From the result, it suggests that in the short-run, a unit change in in investment in the past two years will induce 0.47 unit change in investment in the current period and furthermore, a unit change in investment in the past one year will induce 0.53 unit change in investment and both conform to economic theory and are significant at the 5.0 per cent level of significance. The interest rate has the correct sign and significant at 5.0 percent. One unit change in the second lag will lead to 12621 units reduction in investment in the short-run and the coefficient is rightly signed and significant at 5.0 percent level. The first lag has the correct sign and is significant at 5.0 percent significant level. A unit change in the first lags of inflation rate induces 138.14 units and a reduction of 5403.44 units reduction the lag of the second period. The result further shows that in the short-run, a unit change in the first and second lags of exchange rate will induce 1384.82 units change in investment and a unit change in the second lag will lead to a reduction of investment by 3770.01 units.

Policy Implications

With the mixed impact between interest rate and investment, it follows that interest rate promotes/supports investment on one hand and on the other hand does not in Nigeria. This result is in line with the findings of Owosu and Odhiambo (2001), Obamuyi (2009) and, Ojima and Emerenini (2015).

The prospects for investment in the Nigerian economy can be explored further by reducing the rate of interest to encourage local investors and boost their investments. It indicates, therefore, the need to continuously encourage investment activities in the Nigerian economy by ensuring that macroeconomic environments become more conducive for investments. The decay in infrastructure which adds to the cost of borrowing will need to be addressed.

With the adverse effect of inflation on investment in Nigeria, this development significantly impacts the cost of inputs for farmers and borrowing for local investors. Also, it manifests in high costs of transportation and generally affects aggregate demand.

The results also show that exchange rate had a better impact on investment in the country compare to inflation rate. Though, the problems of depreciating exchange rate are still there which hampers investment in the Nigerian economy, it affects imports from foreign suppliers and makes Nigerian exports cheaper.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The paper examines the impact of interest rates on investment in Nigeria from 1986 to 2018, using co-integration and vector error correction approach. The specific objectives were to estimate the short-and long-run elasticities as well as the error correction mechanism of interest rate, inflation rate and exchange rate on investment in Nigeria. The outcome of the exercise validated the hypothesis that interest rate have impact on investment in Nigeria, albeit with

mixed results as the first lag period of all the three indicators used indicated positive relationship with the growth of investment but the lag of the second period all indicated negative impact on investment. The error-correction equation of investment indicates a feedback of 53.1 per cent, of the first period lag but 47.1 per cent, of second period lag. Also the error-correction term indicated low speed of adjustment with only 2.0 per cent.

The institutional and regulatory reforms in the banking sub-sector should be sustained with investment-friendly environment sustained. Furthermore, there should be increased awareness that will enhance investors' confidence in the economy, and ultimately lead to more participation of investors in order to increase the rate of investment in the economy. While much remains to be done to ensure that the rate of interest promotes investment in Nigeria, some growing evidences from previous research have indicated that interest rate in Nigeria promotes investment. To further spur the positive impact of interest rates on investment, the following policy recommendations should be considered.

Recommendations

Based on the findings from this study, the following recommendations are made:

1. The regulatory body should mandate banks to channel their mobilised savings to investors in form of loans at reasonable interest rate. Hence, the pointer should be to identify those constraints and bottlenecks that are making it difficult for banks to make loans available to investors. The issue of high interest rate with hidden transaction costs must be vigorously addressed by the monetary authorities;

2. There is the need to address the problem of inadequate infrastructures and improve the macroeconomic environment through the harmonisation of monetary and fiscal policies in order to ensure stability of the macroeconomic aggregates;

3. With expansion in output, there will be higher aggregate demand, this will jump start the need for financial institutions to provide more lending facilities to investors;

4. Government should continue with the diversification policies by investing massively on large-scale agricultural activities and encourage Small and Medium Scale Enterprises (SMEs);

5. Public Private Partnership (PPP) should be encouraged by government for efficient and productive allocation of resources; and

6. Monetary authorities should pursue policies that will encourage the saving culture of the people. This could be done by increasing the deposit rate which would lure people to deposit their money in banks thereby increasing the supply of loanable funds. This would lead to a fall in interest rate and eventually rise in investment.

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