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MODELLING THE EFFECT OF STOCK MARKET VOLATILITY AND EXCHANGE RATE VOLATILITY ON FOREIGN DIRECT INVESTMENT IN NIGERIA: A NEW FRAMEWORK APPROACH

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ABSTRACT

Nigeria is in the forefront of African Nations who depend fully on foreign goods and services for consumption through high level of importation and has been one of the top destination countries for Foreign Direct Investment. Empirical literatures find mixed evidence of the effect of foreign direct investment (FDI) on stock market volatility and exchange rate volatility. This necessitates this research to investigate this gap and conclude based on this study result. This study employs the panel ARDL estimation technique to investigate the long run and short run effects of stock market volatility and exchange rate volatility on FDI in Nigeria using a time-series data which ranges (1990-2016). The ARCH/GARCH estimation technique was used to estimate the exchange rate volatility and stock market volatility values in which GARCH (1, 1) was employed. The pairwise granger causality test was used to check for the direction of relationship between FDI and (stock market volatility, exchange rate volatility). The result of the FDI ARDL equation reveals that there is a negative significant relationship between foreign direct investment (FDI) and exchange rate volatility (EXCHV) both short run and long run in Nigeria, and a positive insignificant relationship between stock market volatility (STMV) and foreign direct investment (FDI) of Nigeria in the long run but a positive significant relationship between stock market volatility (STMV) and foreign direct investment (FDI) of Nigeria in the short run.

Contribution/ Originality: This study uses a new framework which was developed by integrating the Keynesian aggregate demand equation and the simple accelerator theory of investment. This study employs the ARDL estimation technique to this framework to model the effect of stock market volatility and exchange rate volatility on FDI.

1. INTRODUCTION

In view of the wave of globalization and consequent substantial movement of capital across economies, enabled by improved information technology, the debate on the role of Foreign Direct Investment (FDI) in bringing about economic growth has received the attention of policy makers, researchers and international organizations. While

some have argued that FDI generates adoption of foreign technological knowhow, promotes international trade through access to foreign markets, permits to allocate production in the subsidiary that is cheapest, others have said that it has a negative impact on the economy.

According to Organisation for Economic Co-operation and Development (OECD), Foreign Direct Investment is a category of cross border investment in which an investor resident in another economy establishes a lasting interest in and a significant degree of influence over an enterprise resident in another economy. Griffin and Pustay (2007) defined FDI as the ownership or control of 10 percent or more of an enterprise's voting securities or the equivalent interest in an unincorporated business. FDI is a package of capital, technology, management and entrepreneurship which allows a firm to operate and provide goods and services in a foreign environment (Farrell, 2008).

The role of FDI as a source of capital has become increasingly important to sub-Saharan African countries. This stems from the fact that income and domestic savings from the region are very low. As a result, external capital is needed to supplement domestic saving in order to spur investment and growth (Asiedu, 2002). Nigeria is in the forefront of African Nations who depend fully on foreign goods and services for consumption through high level of importation and has been one of the top destination countries for Foreign Direct Investment.

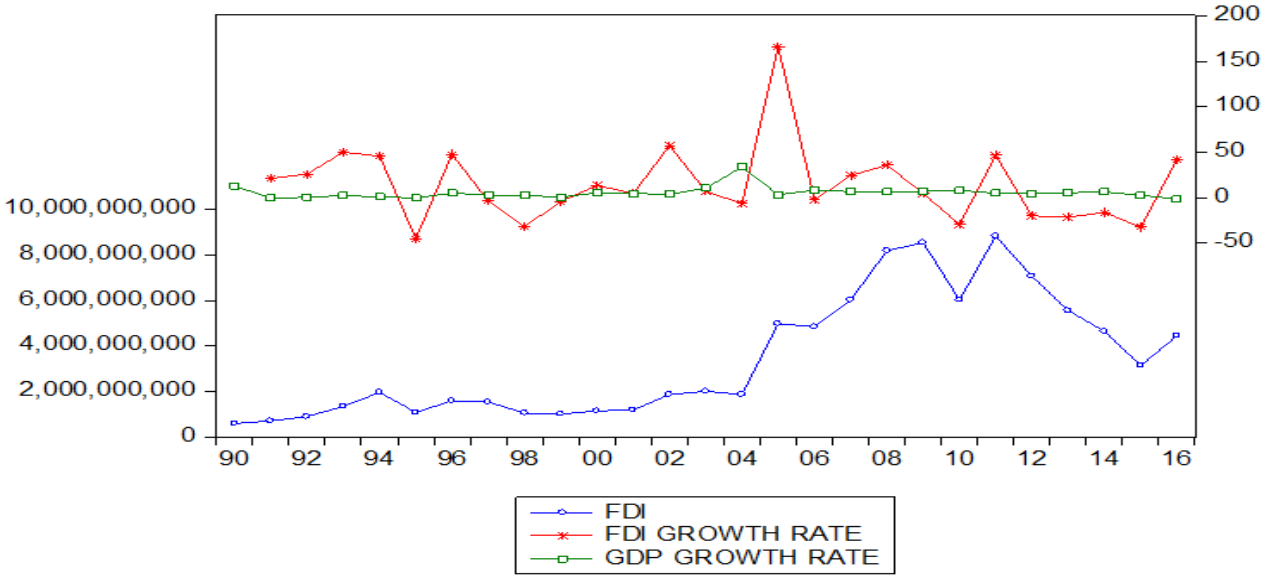


Figure-1. FDI, FDI Growth rate and GDP growth rate in Nigeria (1990-2106)

Source: Data from World bank; Figure drawn by the authors with the aid of Eviews 9.0

In the 1960s and 1970s, when the dependency thesis flourished, FDI was viewed as a vehicle for political and economic denomination of Nigeria. Possibly influenced by this motive, the policy thrust of government was to limit foreign investments in the country through Nigeria Enterprise Promotion Decree (NEPD) promulgated in 1972 (amended in 1977). The NEPD, otherwise known as the indigenization policy, regulated FDI in Nigeria allows only a maximum of 60% of foreign participation in the ownership of companies. This resulted in the decline in foreign investment and the economic pace of all activities in the sectors of the economy slowed down. The Structural Adjustment Program was introduced in 1986 to diversify the productive base of the in order to reduce dependence on oil and import; the policy attracted FDI into the economy with an increase of 216% in 1987. In 1995, the Nigerian Investment Promotion Commission was introduced, and it opened almost all the sectors to foreign participation and allowed for a 100% foreign ownership in all sectors except for the oil sector. Foreign Direct Investment in 1996 increased by 48%. Between 2005 and 2011,there was a rapid influx of FDI into the country due to the National Economic Empowerment and Development Strategy (NEEDS) adopted in 2003, made FDI attraction an explicit goal for the government and paid attention to drawing investment from wealthy Nigerians

abroad and from Africans in the diaspora and FDI inflow grew by an average of 77% over the period. The reform drive informed by NEEDS allowed Nigeria to become the first African country to settle its official debt. In 2006, Nigeria received a BB- rating similar to countries such as Brazil & Ukraine. FDI received a boost of 24% and 36% in 2007 and 2008 respectively. The Nigeria automotive policy was relaunched in 2013 to increase FDI inflow into the country. The policy includes credit purchase scheme, provision of infrastructure – Nearly 500 hectares of land have been provided in Oshogbo, Kaduna and Nnewi for automotive industry supplier parks. New companies such as Century Auto (Toyota), TATA, Coscharis, etc. have been issued certificates to assemble vehicle and start operations. However, FDI did not seem to respond positive to this reform. Foreign Direct Investment kept dwindling at a Compound Annual Growth Rate of -16% between 2011 and 2015. A survey of foreign assets and liabilities of enterprises in Nigeria was conducted in 2015 to determine the stock of foreign assets/ liabilities of Nigerian enterprises as at the end of 2014 by International Investments Statistics Office. The total private foreign liabilities as at the end of 2014 was ₦15,046.07 billion of which 99.8% came in the form of FDI, while foreign portfolio and other capital inflows accounted for 0.04% and 0.21% respectively. FDI in 2016 increased by 42%.

There are numerous reasons why research into the macroeconomic volatility on Foreign Direct Investment (FDI) inflows is important for a developing resource-based economy like Nigeria. First, macroeconomic volatility represents a measure of uncertainty that economic agents faced about the future. In turn, uncertainty affects the future level of economic growth and investment. Second, government policy is often directed towards reducing volatility by smoothing out the fluctuations in the time path of income, price and investment, among others. Third, with regards to FDI, domestic instability affects the value of the host's country's currency thus, reducing the value of investment as well as the future profits generated by the investment (Brada *et al.*, 2004).

Empirical literature finds mixed evidence on the effect of Foreign Direct Investments on economic growth. Various research papers have argued in support of the position that Foreign Direct Investment (FDI) has significant positive effect of the GDP of a country. Osuji (2015) reveals that in the short run, FDI has a positive and insignificant effect while in the long run, FDI has a negative and statistically insignificant impact on growth. Alobari *et al.* (2016) opines that if domestic firms can tap into the resources of FDI, it will boost productivity, output and quality products, and invariably increase the GDP of the economy. While exploring the existence of the relationship between long-term FDI and short-term stock market investment in Croatia, Vladimir *et al.* (2013) posit that in the long-run, FDI should through the transfer of know-how and technology directly influence economic growth and indirectly, influence the capital markets.

Given the positive and significant effect of FDI on the economy cited by empirical literature, it is important to determine the drivers of FDI into the economy. Bruce and Jeremy (2011) noted that the variables with consistently high inclusion probabilities are traditional gravity variables, cultural distance factors, parent-country per capita GDP, relative labor endowments, and regional trade agreements. Variables with little support for inclusion are multilateral trade openness, host country business costs, host-country infrastructure (including credit markets), and host-country institutions. According to Khondoker and Kaliappa (2010) countries with higher GDP growth rates, higher proportion of international trade and a more business friendly environment are more successful in attracting FDI. Asiedu (2002) found that openness to trade promotes FDI to SSA and non-SSA countries alike.

Thus, we find it seemingly important to find the effect of exchange rate volatility and stock market fluctuations on the FDI

Exchange rate is the price of one currency in relative to another currency and can affect many economic variables such as market prices of domestic goods, cost of production, import level, etc. Theories about FDI-exchange rates linkages emerged in the 1970s and 1980s (for example, Kohlhagen (1977); Cushman (1985)). Two theories that have been highly influential are Blonigen (1997) and Froot and Stein (1991). Blonigen (1997) argues that exchange rate movements may affect acquisition FDI and because acquisitions involve firm-specific assets which can generate returns in currencies other than that used in the purchase. Froot and Stein used an imperfect

capital markets approach to argue that exchange rates operate on wealth to affect FDI. Because of the assumption of imperfect capital markets, external costs of borrowing are more expensive than a firm's internal cost of capital. As a result, a host currency depreciation is predicted to have a positive effect on inbound FDI (IFDI), as it automatically increases the wealth of foreigners, allowing them to make higher bids for assets. A depreciation in the host country's currency relative to the home country's currency, increases the attractiveness of the home country to potential foreign investors; whilst an appreciation in the home country's currency reduces the attractiveness of the home country to foreign investors. Golberg (2006) opined that the country's wages and production costs are reduced relative to those of its foreign counterparts, leading to locational advantage. In contrast, the price of assets should not matter, but only their return on assets because if the price of the assets decreases, the nominal value of the return on assets would also decrease, and the real of the return would be held constant, and fluctuation in exchange rate would have no effect on FDI. However, Darby *et al.* (1999) is of the view that uncertainty caused by increasing exchange rate volatility could cause investment to increase or decrease depending on certain conditions which can be industry or economic specific; the exchange rate variations should be split into their misalignments which may be asymmetric depending on their sign and the impacts are non-linear. According to Rodrik (2008) a weak real exchange rate compensates for institutional weakness and market failures which lead to underinvestment in the traded goods sector.

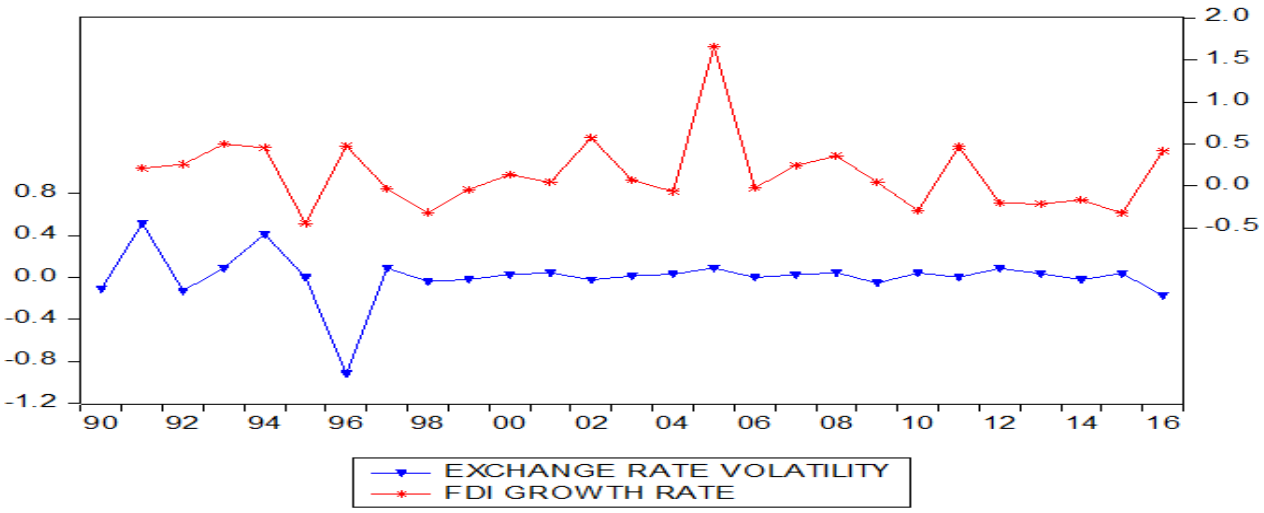


Figure-2. Exchange rate volatility and FDI growth rate in Nigeria (1990-2016)

Source: Data from World bank; Figure drawn by the authors with the aid of Eviews 9.0

Prior to 1985, Nigeria has been under a fixed exchange rate regime, where the exchange rate was fixed by the government regardless of the market equilibrium. In 1986, following the structural adjustment programme, the Second-tier Foreign Exchange Market (SFEM) was introduced and the country liberalized the foreign exchange market changing its policy to floating exchange rate; allowing for the exchange rate to be determined by the forces of demand and supply. Exchange rate dwindled by 45% and FDI in the period decreased by 60%. In 1987, the first and second tier market was merged into an enlarged foreign exchange market in 1987; exchange rate in following year experienced an increase of 1% and FDI increased rapidly by 216%. In 1990, exchange depreciated by 51% and FDI increased by 17.4%. Real exchange rate depreciated sharply in 1992 at 12.7% and in 1993, it appreciated by 9.1%. FDI grew at about 26% and 50% in 1992 and 1993 respectively. The Autonomous Foreign Exchange Market (AFEM) was introduced in 1995 as a result of market imperfections and sustained instability in the exchange rate. This allowed exchange rate stability in that year but FDI declined by 45%. However, exchange rate continued to fluctuate with -91%, 8%, and -3% in 1996, 1997 and 1998 respectively. The Interbank Foreign Exchange Market (IFEM) – a two-way system intended to diversify the supply of foreign exchange and assist the achievement of a realistic exchange rate; was set up in 1999 and volatility in exchange rate was a mere -1.8% in that year and about

2% in the following year. FDI declined by 4% in 1999 and grew by 13% in 2000. However, the year 2001 saw a depreciation of almost 5% with FDI growth of 4% and a two-way auction system in which both the CBN and the

by 2% in that year, 1.3% in the following year, and 3% in 2003. However, in 2005 volatility increased as high as 8.9% and the wholesale Dutch Auction System was introduced in 2006 which maintained the volatility of exchange rate at an average of 2.3% between 2006 and 2013. The Retail Dutch Auction system, Interbank Foreign Exchange Market alongside CBN intervention was re-introduced in 2013 stabilized exchange rate at an average of 2.8% while FDI declined at an average of 23.4% between 2013 and 2015.

The stock market may affect the economy in two ways; wealth effect on private consumption and cost of capital effect on corporate investment. The wealth effect relates to the fact that consumers may spend more of their current income if they perceive an increase in their financial and non-financial wealth and assume that it will be permanent. Araoye and Olusuyi (2018) posits that the stock exchange market can provide available information available on firm's prospect and and redistributing investible capital. The cost of capital effect hypothesizes that FDI inflows are opportunistic use of relatively low-cost financial capital in overvalued source country firms. According to Krugman (1998) in his book, he proposed the fire sale hypothesis where FDI reflects the purchase of undervalued host country assets, foreign investors would purchase companies that are experiencing liquidity problem and very low share price below their value. A more developed local financial market increases the ease of doing business by providing financial access to credit constrained entrepreneurs to start their own firm. Foreign direct investors would gain confidence in an economy that has stock market stability knowing that it is easier to exit and liquidate their business at will.

In the analysis of Malcom Baker and Fritz (2004) FDI inflows are strongly positively related to the market-equity-to-book-equity-value ratio of publicly traded firms in the source country and FDI inflows are unrelated to the host country's market to book rates, contrary to the fire sale hypothesis.

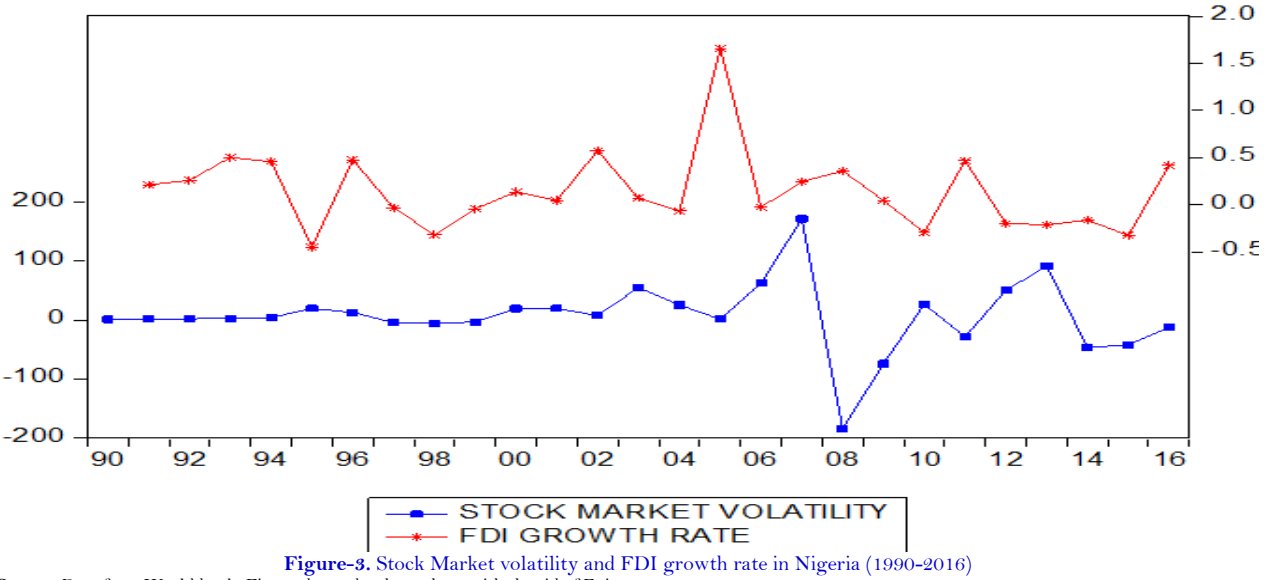


Figure-3. Stock Market volatility and FDI growth rate in Nigeria (1990-2016)

Source: Data from World bank; Figure drawn by the authors with the aid of Eviews 9.0

In the early 1990s, the stock market was relatively stable until 1995 when the federal government annulled the Exchange Control Act of 1962 and the NEPD in order to internationalize the capital market. Volatility in all share index increased to 20%, FDI saw a downtrend of 44.9%. All share index increased by 13% in 1996 probably as a result of the introduction of Percentage pricing system, and FDI grew by 32%. In 1997, the Central Securities Clearing System was introduced and the stock market fell by 3.8% while FDI fell by 47.6%. The stock market fell again by 5.3% with the commencement of trading rights in 1998 and in 1999, the stock exchange transited to Automated Trading System, the all share index dropped by 2.8% and FDI fell by 31.7% and 4% in the years

respectively . In 2000, when the trade guaranteed fund was introduced, the stock market recovered and grew by about 20% in each of the two years that followed. and FDI increase by 13.4% and 4.4% respectively. In 2002 the volatility in stock market was a mere 8.15% while FDI saw a tremendous growth of 57.4%. however in 2003, when stock market experienced a volatility of 55.5%, FDI grew by only 7%. In 2004, the stock exchange admitted the ₦150 billion first federal government bond to the official list; stock market volatility grew by 25.8% while FDI fell by 6.5%. In 2005, stock market volatility was a mere 1.7% and growth in FDI was 165%. In 2006, stock market volatility stood at 63.2% and FDI declined by 2.5%. In 2007, the stock market saw a growth of 172% while FDI grew by only 24%. The Nigeria stock market crashed drastically in 2008, the stock market fell by 184% and Foreign Direct Investment experienced a growth 35.8%. The All share index fell by 73.7% in 2009. Foreign Direct Investment experienced a growth 4.4%. In 2010, when the markets began to recover with a growth of 27%, FDI declined drastically by 29.6%. In 2011, the market further crashed by 28% and FDI saw a sharp increase of 46.7%. In 2012 and 2013, the stock market increased by 51% and 92% while FDI saw a decrease of 20% and 21.3% respectively. In 2014, the stock market fell by 46%, and FDI reduced by 16.4%. In 2015, the stock market fell by 41.7% and FDI declined by 32.6%. In 2016, the stock market reduced by 12.27% and FDI increased by 41.7%.

1.1 Problem Statement

Empirical literature has divergent views on the effect of volatility in the stock market and exchange rate on FDI inflows. The purpose of this paper is to examine the strength and the direction of the effect of fluctuations in the stock market and exchange rate on Foreign Direct Investment inflows in the short-run and long-run in Nigeria. This research paper aims to provide answers to the following questions:

(1) Is a stable exchange rate policy beneficial to FDI inflow?

(2) Does the Fire-sale hypothesis of Krugman apply to Nigeria?

(3) How does liquidity of the stock market affect Foreign Direct Investment into the country.

1.2. Objectives

(1) To determine the effect of exchange rate volatility on FDI inflow to Nigeria both in the long run and short run.

(2) To test the Krugman fire-sale hypothesis in Nigeria

(3) To check the effect of activities of the stock market of FDI inflow to Nigeria both in the long run and short run.

2. THEORETICAL ARGUMENTS AND LITERATURE REVIEW

2.1. Theoretical Arguments

FDI is a transfer of capital and hence can be interpreted in terms of comparison of expected return of alternative decisions of investment. Accordingly, the impact of exchange rates

The Harrod-Domar model explains an economic growth rate in terms of the level of savings and productivity of capital. It assumes that a country's output is a function of its capital stock. The growth in total output (g) is equal to the savings ratio (s) divided by the capital-output ratio (k)

$$g = \frac{s}{k}$$

The first hypothesis (model) suggests that for a developing country which is a price taker, an exogenous capital inflow will lead to exchange rate appreciation or depreciation depending on whether foreign exchange is used to finance domestic spending or capital accumulation in the traded and non-traded sector (Branson, 1977). Thus, causality runs from FDI to exchange rate volatility.

According to Keynes, investment decisions are taken by comparing the marginal efficiency of capital or break-even rate of return with the real interest rate. A company with a higher ratio of marginal efficiency of capital to real

interest rate will attract more investment. In contrast to the Keynesian theory of investment, the neo-classical theory posits that capital accumulation is determined by relative prices of the factors of production

The internalization theory advanced by Casson and Buckley in 1976 explains the growth of multinational corporations and their motivation. FDI is only attractive if the OLI (Ownership, Location, and Internalization) conditions are met i.e. multinationals must have an ownership advantage compared to local firms in the form of organizational, technical knowledge or government policies. According to Hymer (1976) FDI will only occur when the exploitation of firm specific advantage supersedes the relative costs of investing abroad. Thus, FDI is a strategic decision made at the firm level rather than a financial decision of the capital market.

The Tobin-q theory of investment was first introduced by Nicholas Kaldor in his work "Marginal Productivity and the Macro-economic Theories of Distribution". It relates fluctuations in investment to changes in stock prices. Firms base their investment decision on the ratio between the market value of all physical capital and its replacement costs. If the stock market values the company more than the market price of its physical assets, firms will invest and increase their capital stock.

$$q = {}^{market\ value\ of\ the\ firm}/_{replacement\ cost\ of\ capital}$$

The Fire Sale Hypothesis posited by Paul Krugman in his work 'Fire Sale FDI' in 1998, states that Foreign Direct Investment financial crises has been accompanied by FDI inflow. Falling assets prices made the insolvency of domestic firms visible and vulnerable to foreign firm acquisitions.

The financial theory of investment (also known as the cost of capital theory of investment) developed by James Duesenberry states that the amount of investment funds is mainly determined by the intersection of the marginal efficiency of investment (MEI) and marginal cost of fund (MCF) curves. However, cost of capital (market rate of interest) is one of the major determinants of investment funds. As the equity fund of a firm increases, the market price of equities decreases, the market rate of interest increases slightly, and firm yield would increase. Factors that influence the MEI includes rate of investment, technical change and level of capital stock while on the other hand, determinant of MCF are retained profit, depreciation, debt position of the firm and market interest rate.

2.2. Literature Review

Okafor *et al.* (2016) employed a factor analytical approach to study Foreign Direct Investment for sustainable economic growth in Nigeria. The study focused on identifying the factors that influenced the FDI contribution to economic growth and revealed that marginal efficiency of capital and public-sector investment.

Egwaikhide (2012) investigated the relationship between FDI and economic growth, he also examined the determinants of FDI in Nigeria. He concluded that Nigeria is yet to reap the benefits of FDI because the impact on the economy is very minimal. He recommends that all barriers to trade such as import and export duties, tariffs, should be reduced to the barest minimum. There should be a clear guideline in terms of priority sectors that require foreign direct investment.

Mohammad and Mahmoud (2014) found that adequate level of human capital, well developed financial markets and the open trade regimes play positive role in the FDI- Economic Growth relationship.

The existing literature has been split on the effect of exchange rate volatility on FDI. While some studies find a positive effect, others find a negative effect. A positive effect can be justified with a view that FDI is export substituting. Increases with exchange rate volatility between the headquarters and the host country induce a multinational to serve the host country via a local rather than exports thereby, insulating against the currency risk (Foad, 2005). According to Bénassy-Quéré *et al.* (2001) exchange rate volatility is detrimental to Foreign Direct Investment and that its impact compares with misalignments. In contrast, according to Olumuyiwa (2003) the results obtained using the parallel markets exchange rates volatility has a positive effect on the agricultural sector and a negative effect on the manufacturing sector. Osinubi *et al.* (2005) however suggest that exchange rate

volatility need not be a source of worry by foreign investors. Campa and Goldberg (1999) show that the effect of exchange rates on the firm's investment are inversely related to its markup ratio. Investments in highly competitive market with low markup ratios is more dependent on exchange rate movements. In their analysis, they found that exchange rates tend to have insignificant rates in high mark-up sectors across countries. However, investment responsiveness to exchange rates is strong in low mark-up sectors. Cristiano (2014) examined the impact of exchange rate uncertainty on investment under different exchange rates regimes and concluded that the larger the exchange rate volatility, the smaller the investment. By systematically lowering the relative wealth of domestic agents, a depreciation of the domestic currency can lead to foreign acquisitions of certain domestic assets (Froot and Stein, 1991; Amadi and Amadi, 2014; Anigbogu and Nduka, 2014).

Araoye and Olusuyi (2018) examined the relationship between stock market and economic growth in Nigeria and found that stock market development (market capitalization) contributes positively to economic growth and vice-versa. Batten and Vo (2009) confirmed a linkage between FDI and stock market development whereby FDI possessed a stronger effect on the economic growth in countries with higher levels in the development of the stock market. Okwuchukwu (2015) investigated the impact of exchange rate volatility and stock market performance on the inflow of FDI and found that exchange rate volatility has a negative and significant effect on the inflow of FDI to Nigeria in both the long run and the short run and a stable and well-developed stock market will attract FDI to Nigeria.

Asiedu (2002) posits that a higher return on investment and better infrastructure have a positive impact on FDI to non-sub Saharan African countries but have no significant impact on FDI to sub-Saharan African countries. According to Olatunji and Shahid (2015) macroeconomic and political stability is a necessary though not sufficient condition to ensure access to large FDI inflow in Africa.

3. RESEARCH METHODOLOGY

3.1. Theoretical Framework

3.1.1. Keynesian Model Extended

Extending the Keynesian aggregate demand model and the accelerator theory of investment as proposed by Adesete Ahmed Adefemi in this study, these are the few assumptions that would serve as the guideline for the extension:

Assumptions

(1) Total investment is divided into foreign direct investment and local investment

(2) Total export and import in the economy is majorly affected by exchange rate

(3) The major determinant of government expenditure are revenue from stock market, personal income tax and revenue from international trade with other countries.

(4) Investment is the result of capital accumulation over the years.

(5) Consumption is majorly determined by consumers disposable income.

(6) Revenue from stock market is a function of all share price index and revenue from international trade is a function of net export.

(7) Total expenditure equals total revenue

C------Consumption expenditure

I-------Investment expenditure

G------Government expenditure

X------Volume of Exports

M-----Volume of imports

Y------Gross domestic product

T------ Direct taxes(T)

K------Capital stock

FDI---Foreign direct investment

LI-----Local investment

E------All share index

ER----Exchange rate

From the Keynesian AD model:

$AD = Y$

$Y = C + I + G + (X - M)$

$C = c_0 + c_1(Y^d)$

$Y^d = Y - T$

$C = c_0 + c_1(Y - T)$

$C = c_0 + c_1Y - c_1T$

From the simple accelerator theory of investment;

$I = K_t - K_{t-1}$

$I = \Delta K$

$I = FDI + LI$

$FDI = \beta(\Delta K)$

β = proportion of total investment that is in form of foreign direct investment

$LI = \alpha(\Delta K)$

α = proportion of total investment in the form of local investment

$I = \beta(\Delta K) + \alpha(\Delta K)$

$I = (\beta + \alpha)\ \Delta K$

Note: $\beta + \alpha = 1$ for (I = FDI + LI) to hold

G = f(Stock market revenue(SMR), International trade revenue(ITR), Direct taxes(T))

$G = SMR + ITR + T$

SMR = f(All share index)

$SMR = r_0 + r_1E$

ITR = f(net export revenue(NER))

$ITR = d_0 + d_1(NER)$

$NER = (X - M)$

$X = x_0 + x_1ER$

$M = m_0 - m_1ER$

$NER = x_0 + x_1ER - (m_0 - m_1ER)$

$NER = x_0 + x_1ER - m_0 + m_1ER$

$NER = (x_0 - m_0) + x_1ER + m_1ER$

$NER = (x_0 - m_0) + (x_1 + m_1)\ ER$

$ITR = d_0 + d_1((x_0 - m_0) + (x_1 + m_1)\ ER)$

$ITR = d_0 + d_1(x_0 - m_0) + d_1\ (x_1 + m_1)\ ER$

$ITR = d_0 + d_1(x_0 - m_0) + d_1\ (x_1 + m_1)\ ER$

For most developing countries, $m_0 > x_0$, $m_1 > x_1$

$x_0 - m_0 = -ve$, $x_1 + m_1 = +ve$

$G = r_0 + r_1E + (d_0 - d_1(x_0 - m_0)) + d_1\ (x_1 + m_1)\ ER + T$

$G = (r_0 + d_0) - d_1(x_0 - m_0) + r_1E + d_1\ (x_1 + m_1)\ ER + T$

$G = (r_0 + d_0) + r_1E + d_1((x_1 + m_1) - (x_0 - m_0))ER + T$

Recall : NER = X - M

$NER = (x_0 - m_0) + (x_1 + m_1)\ ER$

Substituting C, I, G, NER in Y

$C = c_0 + c_1Y - c_1T$

$I = \beta(\Delta K) + \alpha(\Delta K)$

$G = (r_0 + d_0) + r_1E + d_1((x_1 + m_1) - (x_0 - m_0))ER + T$

$X - M = -(x_0 - m_0) + (x_1 + m_1)\ ER$

$Y = c_0 + c_1Y - c_1T + FDI + \alpha(\Delta K) + (r_0 + d_0) + r_1E + d_1((x_1 + m_1) - (x_0 - m_0))ER + T - (x_0 - m_0) + (x_1 + m_1)\ ER$

$FDI = Y - c_1Y - \alpha(\Delta K) + c_1T - T - r_1E - [d_1((x_1 + m_1) - (x_0 - m_0))ER] + (x_1 + m_1)\ ER - (r_0 + d_0) + (x_0 - m_0) - c_0$

$FDI = Y(1 - c_1) - \alpha(\Delta K) - (1 - c_1)T + (x_1 + m_1)\ ER - [d_1((x_1 + m_1) - (x_0 - m_0))ER] - r_1E + [(x_0 - m_0) - (r_0 + d_0) - c_0]$

$FDI = [(x_0 - m_0) - (r_0 + d_0) - c_0] + (1 - c_1)Y + [(x_1 + m_1) - d_1((x_1 + m_1) + d_1(x_0 - m_0)]\ ER - (1 - c_1)T - r_1E - \alpha(\Delta K)$

Let

$\psi = [(x_0 - m_0) - (r_0 + d_0) - c_0]$

$\lambda_1 = (1 - c_1)$

$\lambda_2 = [(x_1 + m_1) - d_1((x_1 + m_1) + d_1(x_0 - m_0)]$

$\lambda_3 = -(1 - c_1)$

$\lambda_4 = r_1$

$\lambda_5 = \alpha$ = proportion of total investment in the form of local investment

$FDI = \psi + \lambda_1Y + \lambda_2ER - \lambda_3T - \lambda_4E - \lambda_5(\Delta K)$

$\lambda_1 > 0, \lambda_2 > 0, \lambda_3 < 0, \lambda_4 < 0, \lambda_5 < 0$

If $\alpha = 0$, that is, if it is assumed that the foreign direct investment is the total investment in the economy,

$FDI = \psi + \lambda_1Y + \lambda_2ER - \lambda_3T - \lambda_4E$

Based on the objective and purpose of this study which is to investigate majorly, the effect of exchange rate volatility and stock market volatility on foreign direct investment in Nigeria:

FDI = f(economic growth, exchange rate volatility, stock market volatility)

3.2. Methodology

3.2.1. Data

All the data used in this study were sourced from the World bank.

3.2.2. Analytical Technique

In order to avoid a spurious regression using a time-series data, statistical properties of the series has to be examined. First step in examining the statistical properties of panel data(used in this study), is to identify the order of integration of the variables to be used by testing if the variables are stationary or not. That is by testing for unit root. If the variables are stationary at level(I(0)) or first difference(I(1)), the Second step is to determine if there is presence of cointegration amongst the variable.

The pre-estimation test that were included in this study includes unit root test, cointegration test and multicollinearity test. Phillips-Perron unit root test and the augmented dickey fuller(ADF) unit root test would be used to test for unit root while the Johansen cointegration test and the ARDL bound test for cointegration would be used to test for cointegration among the variables.

The autoregressive distributed lag(ARDL) estimation technique is used to estimate the long run and error correction model equation. The Schwarz information criteria(SIC) was used to check the optimal lag length structure of the variables used in this study. The ARCH/GARCH estimation technique was used to estimate the exchange rate volatility and stock market volatility values in which GARCH(1 , 1) was employed.

The post-estimation tests included in this study were serial correlation test, heteroscedasticity test, normal distribution test and the omitted variable bias test. The Correlogram of Standardized Residuals Squared Test for Autocorrelation was used to check for serial correlation in the ARCH/GARCH equation while Breusch-Godfrey Serial Correlation LM Test was used to check for autocorrelation in the residuals of the FDI ARDL equation. The Jarque-bera test was used to check for normal distribution in the residuals of the FDI ARDL equation. The ARCH effect test was used to test for heteroscedasticity in the residuals of the ARCH/GARCH equation while the Breusch-Pagan-Godfrey heteroscedasticity test was used to check for heteroscedasticity in the residuals of the FDI ARDL equation. The Ramsey RESET test was used to check for misspecification bias in the FDI ARDL equation. The pairwise granger causality test was used to check for the direction of relationship between FDI and (stock market volatility, exchange rate volatility) to investigate if there is a unidirectional or bi-directional relationship amongst these variables.

3.3. Model Specification

Based on the Keynesian Aggregate demand model , simple accelerator theory of investment and further extension to these theories as proposed the theoretical framework used in this study backed by some assumptions,

$FDI = \psi + \lambda_1 Y + \lambda_2 ER - \lambda_3 T - \lambda_4 E - \lambda_5(\Delta K)$

Based on the objective and purpose of this study which is to investigate majorly, the effect of exchange rate volatility and stock market volatility on foreign direct investment in Nigeria:

FDI = f(economic growth(GDP), exchange rate volatility(EXCHV), stock market volatility(STMV))

Economic growth of Nigeria proxy by the gross domestic product growth rate of Nigeria.

Exchange rate volatility proxy by the volatility in real effective exchange rate of Naira to US dollar.

Stock market volatility proxy by the volatility in all share price index(ASI) of Nigeria.

$FDI = \psi + \lambda_1(GDP) + \lambda_2(EXCHV) - \lambda_3(STMV)$

4. RESULTS AND DISCUSSION

4.1. Pre-Estimation Analysis

4.1.1. Description Statistics

Table-1. Descriptive statistics for FDI, GDP, STPV and EXCHV(1990-2016)

	FDI	GDP	STPV	EXCHV
Mean	3.42E+09	5.384261	6.832327	0.□04499
Median	1.96E+09	4.411065	3.029167	0.024692
Maximum	8.84E+09	33.73578	172.2285	0.515652
Minimum	5.88E+08	-1.541057	-184.3015	-0.917787
Std. Dev.	2.68E+09	6.590083	60.03978	0.230581
Skewness	0.722681	3.039046	-0.412778	-1.887316
Kurtosis	2.149428	13.89856	6.802006	11.59765
Jarque-Bera	3.164111	175.1870	17.02889	99.18842
Probability	0.205552	0.000000	0.000201	0.000000
Observations	27	27	27	27

Source: Computed by the authors

4.1.2. Unit Root Test

H_0 --------There is unit root(non-stationary time series)

H_1 --------There is no unit root(stationary time series)

Chosen level of significance: 5%

According to the augmented dickey fuller test result in Table 2, all variables are stationary both at level and first difference except foreign direct investment(FDI) data which was stationary only at first difference. The Phillips-Perron unit root test result in this study is consistent with the Augmented Dickey Fuller(ADF) unit root test result.

Table-2. Augmented Dickey Fuller (ADF) and Phillip perron test Result

	ADF		Phillip Perron Test	
VARIABLE	**Level**	**First Difference**	**Level**	**First Difference**
FDI	0.4418	0.0001	0.4494	0.0001
GDP	0.0031	0.0000	0.0030	0.0001
STPV	0.0002	0.0000	0.0000	0.0000
EXCHV	0.0001	0.0000	0.0001	0.0000

Source: Computed by the authors

4.1.3. Cointegration Test

H_0 (Null hypothesis)----------No cointegration

H_1 (Alternative Hypothesis)----------There is presence of cointegration

ARDL Bound Test for Cointegration

Table-3. ARDL Bound Test of Cointegration result

Test Statistic	**Value**	**K**
F-Statistic	7.561127	3
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	3.47	4.45
5%	4.01	5.07
2.5%	4.52	5.62
1%	5.17	6.36

Source: Computed by the authors

Decision Criterion: Do not reject null hypothesis(H_0) if F-statistic value is less than both I(0) and I(1) bound values at chosen level of significance. The test becomes inconclusive if the F-statistic value is between the I(0) and I(1) bound values at chosen level of significance

ARDL bound test is chosen as the test for cointegration because some of the variables are stationary both at level(I(0)) and at first difference(I(1)). Gross domestic product growth rate(GDP), stock market volatility(STMV) and exchange rate volatility(EXCHV) is stationary both at I(0) and I(1) while foreign direct investment(FDI) is stationary only at I(1). The null hypothesis would be rejected which indicates we conclude that there is presence of cointegration among foreign direct investment(FDI), gross domestic product growth rate(GDP), stock market volatility(STMV) and exchange rate volatility(EXCHV).

4.1.4. Test for Multicollinearity

Table-6. Correlation Matrix For Foreign Direct Investment, Gross Domestic Product Growth Rate, Stock Price Volatility And Exchange Rate Volatility

VARIABLES	**FDI**	**GDP**	**STPV**	**EXCHV**
FDI	1	0.076671	-0.08868	-0.00574
GDP	0.076671	1	0.114549	-0.08141
STPV	-0.08868	0.114549	1	0.007636
EXCHV	-0.00574	-0.08141	0.007636	1

Source: Computed by the authors

Decision Criterion: There is high degree of multicollinearity among variables if the degree of correlation among them is high(> 50%) There is no evidence of multicollinearity among variables if the degree of correlation among them is low(< 50%).

There is no evidence of multicollinearity between foreign direct investment(FDI) data and the data for (gross domestic product growth rate(GDP), stock market volatility(STMV) and exchange rate volatility(EXCHV)) because of their very low correlation coefficients which is lower than 50%.

4.1.5. Optimal Lag Length Criteria

Table-7. VAR Lag Order Selection Criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-227.1619	NA	6309.072	20.10103	20.29851	20.15070
1	-200.9264	41.06415	2664.276	19.21100	20.19838	19.45932
2	-188.146	15.55882	4087.655	19.49096	21.26825	19.93794
3	-165.5953	19.60929	3539.776	18.92133	21.48853	19.56698
4	-99.67982	34.39068*	134.9335*	14.58085*	17.93797*	15.42516*

Source: computed by the authors
* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

According to the sequential modified LR test statistic, Log-Likelihood, Final prediction error(FPE), Akaike information criterion(AIC), Schwarz information criterion(SIC) and Hannan-Quinn information criterion(HQ), the optimal lag length for foreign direct investment(FDI) data, gross domestic product growth rate(GDP) data, stock market volatility(STMV) data and exchange rate volatility(EXCHV) data is four(4) lag periods because the LR, FPE, SIC, AIC and HQ values are minimum at this lag length period. This alternatively implies that, the dependent and independent variables optimal lag length is 4 lag periods in the proposed ARDL equation for this study. The log-likelihood values also support this result because the lag period with the highest log-likelihood value is 4.

4.1.6. ARDL Optimal Model Lag Selection

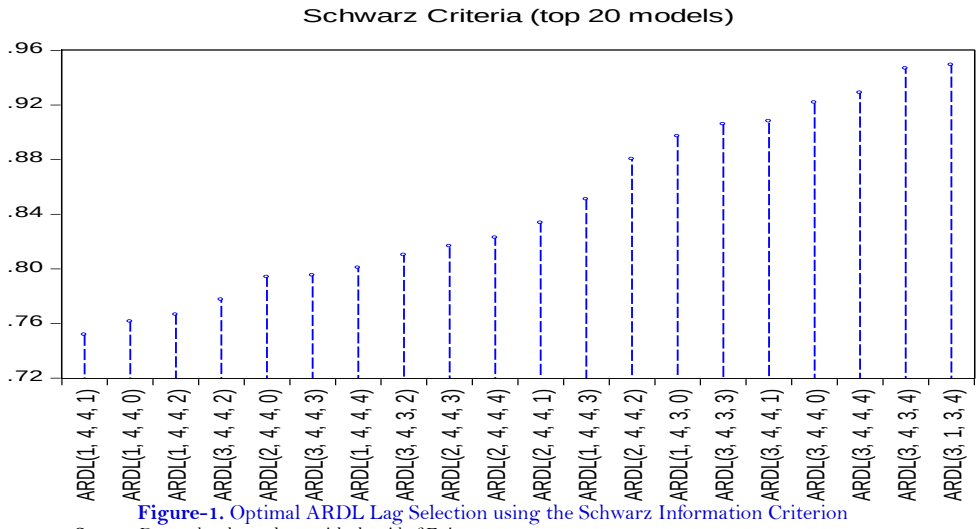


Figure-1. Optimal ARDL Lag Selection using the Schwarz Information Criterion
Source: Drawn by the authors with the aid of Eviews 9.0

Figure 1 shows the graphical representation of the combined optimal lag selection of variables used in this study. It shows the top 20 ranking ARDL models which has 4 as the optimal lag length for each variable.

According to Figure 1, ARDL model with combined lag lengths (1 , 4 , 4 , 1) is the best fit model because it has the lowest Schwarz information criterion(SIC) value. In other words, the best ARDL model is the model in which FDI has one(1) lag period, stock market volatility(STMV) has four(4) lag periods, gross domestic product(GDP) has four(4) lag periods and exchange rate volatility has one(1) lag period.

4.2. Estimation and Interpretation of Results

4.2.1. ARCH/GARCH Equation

Table-8. Exchange Rate ARCH/GARCH(1 , 1) Equation Result

MEAN EQUATION			
Variable	**Coefficient**	**Std. Error**	**Prob.**
C	0.183942	0.328701	0.5758
D(EXCH(-1))	0.127872	0.030466	0.0000
VARIANCE EQUATION			
C	68.92241	1.109901	0.0000
RESID(-1)^2	0.288024	0.132228	0.0294
GARCH(-1)	-0.08025	0.00323	0.0000
R-squared	**0.032205**	**Durbin-Watson stat**	**1.855478**
Adjusted R-squared	**0.029181**		

Source: Computed by the authors

The GARCH(1 , 1) model was used which signifies one arch term(RESID(-1)^2) and one garch term(GARCH). The first difference method was also used to specify the equation for this exchange rate arch/garch model. The first differencing method involves regressing exchange rate on the previous month value of exchange rate. In other words, the considered variable is a function of that same variable lagged by one(-1). The GARCH term represents the previous month volatility of exchange rate(GARCH(-1)) while the ARCH term(RESID(-1)^2) represents the previous month information about the exchange rate volatility. The mean equation shows the mean effect of previous month exchange rate on current month exchange rate while the variance equation shows the effect of previous month volatility of exchange rate(GARCH(-1)) and previous month information about the exchange rate volatility(RESID(-1)^2) on current month volatility of exchange rate(GARCH).

The mean equation indicates that, previous month exchange rate is a very important determinant of exchange rate in Nigeria. This is because the computed probability value of the previous month exchange rate is less than the chosen level of significance(0.0000 < 0.05).

The previous month volatility of exchange rate(GARCH(-1)) and previous month information about the exchange rate volatility(RESID(-1)^2) are major determinant of current month volatility of exchange rate(GARCH). There is a negative significant relationship between current month volatility of exchange rate(GARCH) and previous month volatility of exchange rate(GARCH(-1)) because the computed probability value is less than the chosen level of significance(0.0294 < 0.05). There is a positive significant relationship between current month volatility of exchange rate and previous month information about the exchange rate volatility(RESID(-1)^2) because the computed probability value is less than the chosen level of significance(0.0000 < 0.05).

The Durbin-Watson statistic value signifies that there is no evidence of autocorrelation in the GARCH(1 , 1) equation because the durbin watson stat value is in between 1.65 and 2.45.

Table-9. Stock price ARCH/GARCH Equation Result

MEAN EQUATION			
Variable	**Coefficient**	**Std. Error**	**Prob.**
C	16.45038	3.114772	0
D(STP(-1))	0.413665	0.061697	0
VARIANCE EQUATION			
C	37.4261	36.571	0.3061
RESID(-1)^2	0.503105	0.064368	0
GARCH(-1)	0.698405	0.031526	0
R-squared	**-0.072730**	**Durbin-Watson stat**	**2.655792**
Adjusted R-squared	**-0.076083**		

Source: Computed by the authors

The GARCH(1 , 1) model was used which signifies one arch term(RESID(-1)^2) and one garch term(GARCH). The first difference method was also used to specify the equation for this stock price arch/garch model. The first differencing method involves regressing stock price of the previous month value of stock price. Table 9 shows the mean and variance equation of the garch(1 , 1) model. In Table 9, the GARCH term represents the previous month volatility of stock price (GARCH(-1)) while the ARCH term(RESID(-1)^2) represents the previous month information about the stock price volatility. The mean equation shows the mean effect of previous month stock price on current month stock price while the variance equation shows the effect of previous month volatility of stock price (GARCH(-1)) and previous month information about the stock price volatility(RESID(-1)^2) on current month volatility of stock price (GARCH).

Since the ARCH and GARCH terms are statistically significant factors that influences the stock price volatility, we can proceed to use the stock price volatility values generated with the aid of the GARCH(1 , 1) equation for further analysis.

4.2.2. FDI Long and Short Run Equation

Table-10. FDI ARDL(1, 4, 4, 1) Model Result

Variables	Coefficient	Standard Error	Z-value	Prob value
LONG RUN EQUATION				
GDP	0.165579	0.045457	3.642516	0.0066*
STMV	0.009003	0.013094	0.687556	0.5112
EXCHV	-2.194486	1.058492	-2.07322	0.0719**
C	19.912609	0.363710	54.748645	0.0000
@TREND	0.060446	0.021568	2.802643	0.0231*
SHORT RUN EQUATION				
D(GDP)	-0.008236	0.007420	-1.10993	0.2993
D(GDP(-1))	-0.010573	0.008134	-1.299846	0.2299
D(GDP(-2))	0.026536	0.020644	1.285387	0.2346
D(GDP(-3))	-0.072802	0.017997	-4.045125	0.0037*
D(STMV)	0.005706	0.002665	2.140923	0.0647**
D(STMV(-1))	-0.001874	0.001465	-1.279073	0.2367
D(STMV(-2))	0.002232	0.000904	2.470099	0.0387*
D(STMV(-3))	-0.002708	0.001453	-1.863508	0.0994**
D(EXCHV)	-0.768622	0.256663	-2.994673	0.0172*
D(@TREND)	0.027965	0.012715	2.199277	0.0591**
ECT	-0.462636	0.139051	-3.327091	0.0104*
Dependent Variable = D(FDI)				

Source: Computed by the authors

Table 10 shows the ARDL model result indicating the short run and long run equations. The chosen level of significance is 5% and 10%. The optimal lag for this model was selected using the Schwartz Bayesian Information Criterion(SBIC). The optimal lag selected based on the minimum Schwartz Bayesian Information Criterion of all

variables used in this study is four(4) for the dependent variable and explanatory variables. It should also be noted that FDI is in log terms. * signifies variables stationary at 5% and 10% while ** signifies variables stationary at 10% only.

Long Run Equation Interpretation

Gross domestic product growth rate(GDP) and time trend were statistically significant both at significance levels 5% and 10% while exchange rate volatility(EXCHV) was statistically significant at significance level 10% in the long run.

There is a positive significant relationship between foreign direct investment(FDI) and gross domestic product growth rate(GDP) in the long run equation. i.e. if there is an increase in gross domestic product growth rate(GDP) in the long run, there would be an increase in foreign direct investment(FDI) in the long run and vice-versa. The computed probability value for gross domestic product growth rate(GDP) which is 0.0066, is less than the chosen level of significance which is 0.05 (0.0066 < 0.05). This supports the apriori expectation of the relationship between gross domestic product growth rate(GDP) and foreign direct investment(FDI).

The stock market volatility (STMV) has an insignificant positive effect on foreign direct investment(FDI) in the long run. The positive relationship between stock market volatility(STMV) and foreign direct investment(FDI) is statistically insignificant because the computed probability value of the coefficient of stock market volatility(STMV) is greater than the chosen levels of significance(0.5112 > 0.05). The standard error test of significance also supports this argument because the standard error of stock market volatility(STMV) coefficient is greater than the coefficient of stock market volatility(STMV) divided by two(0.013094 > 0.004502). This result indicates that periods high or low of positive/negative stock market volatility (STMV) has no significant effect on foreign direct investment(FDI) decisions in Nigeria in the long run. That is, even if stock price is highly volatile or with low volatility, it does not have a significant effect on foreign investors decisions regarding investment inflow into Nigeria in the long run. Conclusively, according to this study, stock market activities does not have a significant effect on foreign direct investment (FDI) of Nigeria in the long run.

In the long run at Nigeria, there is a negative relationship between exchange rate volatility (EXCHV) and foreign direct investment (FDI). The effect of exchange rate volatility (EXCHV) on foreign direct investment (FDI) is considered a significant effect at 10% level of significance. We can conclude that during the period of negative exchange rate volatility, there is a boost in foreign direct investment while during the period of positive high volatility, there is a decrease in foreign direct investment in the long run.

Time trend is also a very important significant determinant of foreign direct investment in Nigeria. This means that time factor is a very important factor that should be considered in making foreign direct investment decisions.

Short Run Equation Discussion

The second part of Table 10 reveals the short run equation. One important variable that majorly differentiate it from the long run equation is the error correction term(ECT). The chosen level of significance here too is 5% and 10%. In the short run according to estimation result shown in Table 10, current year stock market volatility(STMV) has a significant effect on foreign direct investment(FDI) at 10% significance level in Nigeria while the current year exchange rate volatility(EXCHV) too has a significant effect on foreign direct investment(FDI) at 5% and 10% significance levels in Nigeria.. Also note that all the variables in the short run equation are differenced of first order(I(1)).

Current year economic growth(GDP), previous one year economic growth(GDP(-1)), previous two years economic growth(GDP(-2)) and previous three years economic growth(GDP(-3)) of Nigeria does not have a significant positive effect on foreign direct investment(FDI) of Nigeria because their computed probability values are greater than the chosen levels of significance

It is also observed that current year stock market volatility(STMV) is statistically significant in the short run that is there is a positive statistically significant relationship between current year stock market volatility(STMV) and current year foreign direct investment(FDI) in the short run. Previous two years stock market volatility(STMV(-2)) is also another significant factor that determines foreign direct investment(FDI) in the short run at 5% and 10% significance levels because the computed probability value for coefficient of STMV(-2) is less than the chosen levels of significance(0.0387 < 0.05, 0.0387 < 0.10). i.e., if stock price is highly volatile or with low volatility, it does have a significant effect on foreign investors decisions regarding investment inflow into Nigeria in the short run. Conclusively, according to this study, stock market activities have a significant effect on foreign direct investment(FDI) of Nigeria in the short run.

Exchange rate volatility(EXCHV) has a negative significant effect on foreign direct investment(FDI) of Nigeria. This means that exchange rate dynamics is a major determinant of foreign direct investment of Nigeria in the short run. That is, during the period of negative exchange rate volatility, there is a boost in foreign direct investment while during the period of positive high volatility, there is a decrease in foreign direct investment in the short run. A reduction in exchange rate in Nigeria motivates the foreign direct investors to increase their investment in Nigeria.

Time trend is also a very important significant determinant of foreign direct investment in Nigeria in the short run because the computed probability value for trend is less than 10% which is part of the chosen level of significance(0.0591 < 0.10). This means that time factor is a very important factor that should be considered in making foreign direct investment decisions in the short run. The short run equation can be used to almost perfectly forecast the future values of foreign direct investment in the short run. It also indicates that, during the sample period,, foreign direct investment grows by an average of 0.027965% per year. This means that as the time frame increases from one year to another year, foreign direct investment increases by 0.027965% in the short run.

Examining and checking the Error Correction Term in the Short run equation to confirm if the conventional three conditions of Error Correction Term exists:

(1) The error correction term(-0.462636) in the short run equation in Table 10 is statistically significant because probability value of the error correction term is less than the chosen levels of significance(0.0104 < 0.05, 0.0104 < 0.10)

(2) The error correction term(-0.462636) is negative.

(3) T he absolute value of the error correction term(|-0.462636| = 0.462636) is less than one.

Ascertaining that the error correction term(ECT) meets the three condition, the coefficient of the error correction term indicates that about 46.26% of disequilibrium was corrected within one year in Nigeria. That is, the rate or speed of adjustment from short-run disequilibrium to long run equilibrium is 46.26%. Thus, it would take the system approximately 26 months to adjust from short run disequilibrium to long run equilibrium and be steady state once again in Nigeria.

4.2.3. Pairwise Granger Causality Test

H_0 ----------First variable does not granger cause the second variable.

H_1 ----------First variable granger causes the second variable.

Table-11. Pairwise Granger Causality Test Result

Null Hypothesis	Observations	F-Statistic	Prob.	Decision
STMV does not Granger Cause FDI	25	0.50519	0.6109	Accept Null Hypothesis
FDI does not Granger Cause STMV	25	0.39517	0.6787	Accept Null Hypothesis
EXCHV does not Granger Cause FDI	25	0.82638	0.4520	Accept Null Hypothesis
FDI does not Granger Cause EXCHV	25	3.47817	0.0505**	Reject Null Hypothesis

Source: Computed by the authors

Decision criterion: Do not reject null hypothsis(H_0) if the computed probability value from the F-statistic is greater than the chosen level of significance, otherwise, reject null hypothesis(H_0) if computed probability value from the F-statistic is less than the chosen level of significance.

Chosen level of significance = 5%, 10%

4.3. Post Estimation Analysis

4.3.1. Exchange Rate ARCH/GARCH Equation Post Estimation Results

Table-12. Exchange Rate ARCH Effect Test/ Heteroskedasticity Test

F-statistic	0.014503	Prob. F(1,319)	0.9042
Obs*R-squared	0.014593	Prob. Chi-Square(1)	0.9038

Source: Computed by the authors

H_0 ----------No ARCH Effect

H_1 ----------There is ARCH Effect

Decision Criterion: Do not reject null hypothsis(H_0) if the computed probability value is greater than the chosen level of significance while the null hypothsis(H_0) is rejected, if the computed probability value is less than the chosen level of significance.

Chosen level of significance = 5%, 10%

The null hypothesis is not rejected because the computed probability values from the F-statistic and the observed R squared is greater than the chosen level of significance(0.9042 > 0.05, 0.9042 > 0.10)(0.9038 > 0.05, 0.9038 > 0.10). Thus, there is no evidence of heteroscedasticity in the exchange rate volatility values.

Table-13. EXCHV Correlogram of Standardized Residuals Squared Test for Autocorrelation Result.

Sample: 1990M01 2016M12						
Included observations: 322						
Autocorrelation	**Partial Correlation**		**AC**	**PAC**	**Q-Stat**	**Prob***
.|. |	.|. |	1	-0.007	-0.007	0.0148	0.903
.|. |	.|. |	2	0.007	0.007	0.0297	0.985
.|. |	.|. |	3	-0.010	-0.010	0.0631	0.996
.|. |	.|. |	4	-0.011	-0.011	0.1030	0.999
.|. |	.|. |	5	-0.011	-0.011	0.1463	1.000
.|. |	.|. |	6	-0.007	-0.007	0.1605	1.000
.|. |	.|. |	7	-0.011	-0.012	0.2034	1.000
.|. |	.|. |	8	0.002	0.002	0.2049	1.000
.|. |	.|. |	9	-0.012	-0.012	0.2490	1.000
.|. |	.|. |	10	-0.008	-0.009	0.2725	1.000
.|. |	.|. |	11	-0.008	-0.008	0.2924	1.000
.|. |	.|. |	12	-0.006	-0.006	0.3033	1.000
.|. |	.|. |	13	-0.006	-0.006	0.3144	1.000
.|. |	.|. |	14	0.033	0.032	0.6778	1.000
.|. |	.|. |	15	-0.007	-0.007	0.6950	1.000
.|. |	.|. |	16	-0.009	-0.010	0.7197	1.000
.|. |	.|. |	17	-0.007	-0.007	0.7375	1.000
.|. |	.|. |	18	-0.009	-0.009	0.7648	1.000
.|. |	.|. |	19	-0.008	-0.008	0.7874	1.000
.|. |	.|. |	20	-0.005	-0.005	0.7945	1.000
.|. |	.|. |	21	-0.008	-0.008	0.8161	1.000
.|. |	.|. |	22	0.020	0.019	0.9588	1.000
.|. |	.|. |	23	-0.007	-0.007	0.9760	1.000
.|. |	.|. |	24	-0.008	-0.009	0.9986	1.000
.|. |	.|. |	25	-0.002	-0.003	1.0006	1.000
.|. |	.|. |	26	-0.002	-0.002	1.0025	1.000

. |**	. |**	27	0.251	0.252	23.333	0.667
. |.	. |.	28	0.009	0.011	23.363	0.715
. |.	. |.	29	-0.004	-0.008	23.368	0.759
. |.	. |.	30	-0.006	-0.002	23.382	0.799
. |.	. |.	31	-0.008	-0.003	23.405	0.834
. |.	. |.	32	-0.008	-0.001	23.430	0.864
. |.	. |.	33	-0.008	-0.005	23.454	0.890
. |.	. |.	34	0.003	0.008	23.457	0.913
. |.	. |.	35	0.012	0.012	23.513	0.930
. |*	. |*	36	0.157	0.171	32.454	0.638

*Probabilities may not be valid for this equation specification.

H_0 ----------No serial correlation

H_1 ----------There is serial correlation

Decision Criterion: Do not reject null hypothsis(H_0) if the computed probability value is greater than the chosen level of significance while the null hypothsis(H_0) is rejected, if the computed probability value is less than the chosen level of significance.

Chosen level of significance = 5%, 10%

For all the included 36 lags, the null hypothesis is not rejected because the computed probability values of all the 36 lags is greater than the chosen level of significance. This indicates that there is no evidence of serial correlation in the residuals of the exchange rate ARCH/GARCH equation.

4.3.2. Stock Market ARCH/GARCH Equation Post Estimation Results

Table-14. Stock market ARCH Effect Test

F-statistic	0.715035	Prob. F(1,319)	0.3984
Obs*R-squared	0.717909	Prob. Chi-Square(1)	0.3968

Source: Computed by the authors

H_0 ----------No ARCH Effect

H_1 ----------There is ARCH Effect

Decision Criterion: Do not reject null hypothsis(H_0) if the computed probability value is greater than the chosen level of significance while the null hypothsis(H_0) is rejected, if the computed probability value is less than the chosen level of significance.

Chosen level of significance = 5%, 10%

The null hypothesis is not rejected because the computed probability values from the F-statistic and the observed R squared is greater than the chosen level of significance(0.3984 > 0.05, 0.3984 > 0.10)(0.3968 > 0.05, 0.3968 > 0.10. Thus, there is no evidence of heteroscedasticity in the stock market volatility values.

Table-15. STMV Correlogram of Standardized Residuals Squared Test for Autocorrelation Result

Sample: 1990M01 2016M12						
Included observations: *322*						
Autocorrelation	**Partial Correlation**		**AC**	**PAC**	**Q-Stat**	**Prob***
.|. |	.|. |	1	0.047	0.047	0.7268	0.394
*|. |	*|. |	2	-0.066	-0.069	2.1642	0.339
.|. |	.|. |	3	0.026	0.033	2.3833	0.497
.|. |	.|. |	4	-0.044	-0.052	3.0121	0.556
.|. |	.|. |	5	0.036	0.046	3.4486	0.631
.|. |	.|. |	6	-0.026	-0.038	3.6651	0.722
.|. |	.|. |	7	-0.061	-0.050	4.9158	0.670
.|. |	.|. |	8	-0.060	-0.065	6.1241	0.633
.|. |	.|. |	9	-0.061	-0.057	7.3518	0.601
.|. |	.|. |	10	-0.048	-0.054	8.1378	0.615
.|. |	*|. |	11	-0.061	-0.066	9.3803	0.587
.|. |	.|. |	12	-0.006	-0.008	9.3933	0.669
*|. |	*|. |	13	-0.080	-0.094	11.557	0.564
.|. |	.|. |	14	0.048	0.052	12.329	0.580
.|. |	.|. |	15	-0.005	-0.040	12.338	0.653
.|. |	.|. |	16	-0.048	-0.044	13.126	0.664
.|* |	.|. |	17	0.085	0.059	15.619	0.551
.|* |	.|* |	18	0.153	0.140	23.667	0.166
*|. |	*|. |	19	-0.070	-0.101	25.344	0.150
.|. |	.|. |	20	-0.011	-0.003	25.383	0.187
.|. |	.|. |	21	0.015	-0.005	25.463	0.228
.|. |	.|. |	22	-0.031	-0.035	25.787	0.261
.|. |	.|. |	23	-0.034	-0.060	26.184	0.292
.|. |	.|. |	24	-0.012	-0.003	26.232	0.341
.|. |	.|. |	25	-0.022	-0.010	26.406	0.386
.|. |	*|. |	26	-0.061	-0.068	27.714	0.373
.|. |	.|. |	27	0.043	0.068	28.365	0.392
.|. |	.|. |	28	0.067	0.063	29.954	0.365
.|. |	.|. |	29	-0.002	0.000	29.956	0.416
.|. |	.|. |	30	-0.055	-0.061	31.025	0.414
.|. |	.|. |	31	0.032	0.062	31.393	0.447
.|. |	*|. |	32	-0.008	-0.070	31.417	0.496
.|. |	.|. |	33	0.024	0.039	31.630	0.535
.|. |	.|. |	34	0.025	0.011	31.849	0.573
.|. |	.|. |	35	-0.018	-0.038	31.966	0.615
.|. |	.|. |	36	0.028	0.007	32.245	0.648

*Probabilities may not be valid for this equation specification.

H_0 ----------No serial correlation

H_1 ----------There is serial correlation

Decision Criterion: Do not reject null hypothsis(H_0) if the computed probability value is greater than the chosen level of significance while the null hypothsis(H_0) is rejected, if the computed probability value is less than the chosen level of significance.

Chosen level of significance = 5%, 10%

Table 15 shows the results to the correlogram of standardized residuals squared which is used to test for autocorrelation in the values of the stock market volatility(EXCHV). Table 15 reveals that, for all the included 36 lags, the null hypothesis is not rejected because the computed probability values of all the 36 lags is greater than the chosen level of significance. This indicates that there is no evidence of serial correlation in the residuals of the stock market ARCH/GARCH equation and there is no evidence of autocorrelation in the values of the stock market volatility.

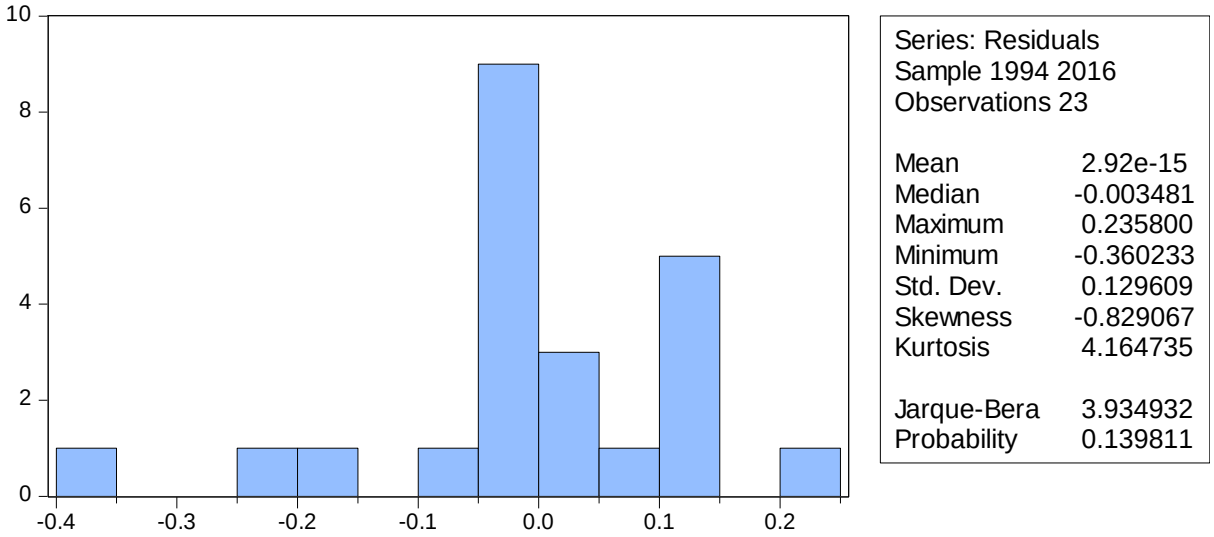
4.3.3. FDI ARDL Equation Post Estimation Results

Decision Criterion: Do not reject null hypothsis(H_0) if the computed probability value is greater than the chosen level of significance while the null hypothsis(H_0) is rejected, if the computed probability value is less than the chosen level of significance.

Chosen level of significance = 5%, 10%

Normal Distribution Test

Figure:



H_0 ----------Residuals are normally distributed

H_1 ---------- Residuals are not normally distributed

The normal distribution test from the FDI ARDL equation indicates that, the residuals from the FDI ARDL equation are normally distributed.

Serial Correlation Test

H_0 ----------Residuals are not serially correlated; H_1 --------- Residuals are serially correlated

Table-16. Breusch-Godfrey Serial Correlation LM Test Result

F-statistic	**2.037852**	**Prob. F(2,6)**	**0.2112**
Obs*R-squared	9.303686	Prob. Chi-Square(2)	0.0095

Source: Computed by the authors

The null hypothesis is not rejected because the computed probability values from the F-statistic is greater than the chosen level of significance(0.2112 > 0.05, 0.2112 > 0.10). Thus, there is no evidence of serial correlation in the residuals of the FDI ADRL equation.

Heteroscedasticity Test

H_0 ----------There is no evidence of heteroscedasticity in residuals

H_1 ---------- There is evidence of heteroscedasticity in residuals

Table-17. Breusch-Pagan-Godfrey Heteroscedasticity Test

F-statistic	0.549325	Prob. F(14,8)	0.8438
Obs*R-squared	11.2732	Prob. Chi-Square(14)	0.6645
Scaled explained SS	2.158136	Prob. Chi-Square(14)	0.9999

Source: Computed by the authors

Table 17 reveals that, the null hypothesis is not rejected because the computed probability values from the F-statistic, observed R squared and scaled explained SS, is greater than the chosen level of significance(0.8438 > 0.05, 0.8438 > 0.10) (0.6645 > 0.05, 0.6645 > 0.10) (0.9999 > 0.05, 0.9999 > 0.10).

Mis-Specification Bias Test

H_0 ----------There is no evidence of misspecification bias

H_1 ----------There is evidence of misspecification bias

Table-18. Ramsey RESET Test Result

	Value	Df	Probability
t-statistic	0.054044	7	0.9584
F-statistic	0.002921	(1, 7)	0.9584

Source: Computed by the authors

The probability values of the t-statistic and F-statistic is greater than the chosen level of significance in this study (0.9584 > 0.05, 0.9584 > 0.10). This also means there is no evidence of misspecification bias in the functional model adopted for this study and the linear functional specification form of STMV, EXCHV, GDP in the model adopted in this study is appropriate for explaining FDI in this study.

5. CONCLUSION AND RECOMMENDATION

The study reveals that stock market volatility has a positive effect on Foreign Direct Investment but is not significant and there is no causal relationship between stock market volatility and Foreign Direct Investment. While Krugman's fire-sale hypothesis is applicable in Nigeria, we see FDI inflow increase at very low level of All share index for example during the stock market crash in 2008, the effect is not significant enough to cause FDI inflow. Liquidity in the stock market which is a derivative of a highly volatile market seem not be responsive to attracting direct investment from foreign entities.

Exchange rate volatility has a negative and significant effect on Foreign Direct Investment. Exchange rate volatility has a causal effect on Foreign Direct investment. A stable exchange rate would be beneficial to attracting Foreign Direct Investment into the economy. This is in contrast with earlier studies of Froot and Stein (1991), Blonigen (1997) and Golberg (2006).

This study recommends that a stable exchange rate policy should be adopted in order to increase FDI inflow into the economy. However, since the stock market volatility does not have a causal effect on Foreign Direct Investment inflow, government should rather focus on policies that would ensure a stable exchange rate and higher economic growth rate that would boost Foreign Direct Investment inflow in the long-run.

Government should increase expenditure on capital projects that would attract foreign investors, increase per capita income, savings and investment levels which would in turn increase economic growth and thus Foreign Direct Investment.

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