Adebayo, Tomiwa; Akinsola, Gbenga Daniel; Olkushola Olanrewaju, Victoria et al.

Article

Does inflation asymmetrically afect foreign direct investment in an emerging market? : an application of the non-linear autoregressive distributed lag (NARDL) model

EuroEconomica

Provided in Cooperation with:
Danubius University of Galati

Reference: Adebayo, Tomiwa/Akinsola, Gbenga Daniel et. al. (2020). Does inflation asymmetrically afect foreign direct investment in an emerging market? : an application of the non-linear autoregressive distributed lag (NARDL) model. In: EuroEconomica 39 (3), S. 82 - 98. https://dj.univ-danubius.ro/index.php/EE/article/view/531/712.

E u r o E c o n o m i c a

Issue 3(39)/2020 *ISSN: 1582-8859*

Does Inflation Asymmetrically Affect Foreign Direct Investment in an Emerging Market? An Application of the Non-Linear Autoregressive Distributed Lag (Nardl) Model

Tomiwa Sunday Adebayo[1], **Gbenga Daniel Akinsola**[2], **Victoria Olushola Olanrewaju**[3], **Abisoye Abolaji**[4]

Abstract: In the last two decades, Nigeria has observed sporadic FDI inflows. The goal of this analysis is to examine the asymmetrical effect of inflation on FDI inflows in Nigeria. Utilizing the ARDL and non-linear ARDL frameworks, the research discusses the impact of inflation and the exchange rate on FDI inflows in Nigeria between 1981 and 2018. The results of the study affirm the asymmetric linkage between inflation and FDI inflows during the study period. The result has established that the exchange rate plays a substantial role in increasing inflows of FDI in Nigeria. Moreover, the downside and upward trends of inflation decrease FDI inflows in the long and short term. Past studies have identified the aggregate effect of inflation, which can include limited knowledge on the phenomenon, in order to assess FDI inflows. The nonlinear method adopted points out that all forms of variations (i.e., upside and downside) of independent variables may have a significant and different effect on FDI inflows. The non-linear linkage between FDI and inflation may be critical in constructing a long-term strategy.

Keywords: FDI Inflows; Inflation Rate; exchange rate; ARDL; NARDL

JEL Classification: G17

1. Introduction

The past 3 decades have shown a significant rise in foreign direct investment (FDI) due to prospective benefits for host and home nations (OECD, 2017). FDI inflows are an integral part of a nation's economic advancement objectives. Throughout the period covered in this study, there is significant growth in FDI inflows to emerging economies (Xiao & Park, 2018). The crucial benefits of FDI include advancement in technology, managerial skills, employment and production capacity increment, and capital flows (Uddin et al., 2019). Due to improvements in technology, cheap, and fast transportation, and economic liberalization policies globally, there has been an increase in market competition between countries for FDI opportunities. From the home nation's perspective, the benefits expected from having FDIs via multinational enterprises (MNEs) include; growth in GDP, lower unemployment rate, new business skills, and technology advancement (Dunning and Lundan 2008; Bailey & Warby, 2019; Adebayo & Kalmaz, 2020). MNEs invest in another country due to the extra revenue they earn in host nations, which they don't make in their home nations (Gokmenoglu et al.,

[1] Department of Business Administration, Cyprus International University, Cyprus, Corresponding author: twaikline@gmail.com.
[2] Girne American University, Department of Business Management, Cyprus, E-mail: gbengadan@yahoo.com.
[3] Department of Business Administration, Cyprus International University, Cyprus, E-mail: olanrewajuvictoria8@gmail.com.
[4] Girne American University, Department of Business Management, Cyprus, E-mail: yungsaint02@gnmail.com.

2019). As Dunning (1980) noted, benefits attached to engagement in FDI by MNEs include efficient supply in a new location, lower cost of production, strategic assets control, and dominance in the global market. Nevertheless, when MNEs earn profit through investment abroad, they are prone to macroeconomic instability in the host countries. Examples of factors that may have a severe impact on host nations' investment are interest rate and inflation rate. It is due to constant fluctuations of these macroeconomic variables in developing economies compared to developed economies. This study is based on Nigeria since it has witnessed sporadic foreign investment inflow over the past 2 decades. Therefore, it is necessary to look at the relationships between FDI and exchange and inflation rate in Nigeria. In contrast to other capital inflow, FDI involves the movement of real assets into the host nation. After the completion of the FDI process, the next thing is MNEs' business practices, which depend mainly on the economic condition of the host nation. Based on the logic, as mentioned above as a yardstick, it is safe to say that FDI, inflation rates, and interest rates are linked together. Inflation is a persistent rise in the general price of goods and services (Tobin, 1965). One of the primary concerns of MNEs is inflation. An increase in the inflation rate would result in a fall in the purchasing power, i.e., consumers will buy less due to the price increase, which demonstrates real value loss in the economy in terms of exchange rate unit of account (Ball et al., 2005).

When inflation is high, it will affect local currency, leading to foreign investors and firms' foreign exchange risks. Inflation is most probable to have a profound negative instead of a significant positive impact on the valuation of the currency and the foreign exchange rate. A relatively low inflation rate does not guarantee a better rate of exchange for a nation. However, an exceptionally high inflation rate is likely to have a detrimental impact on the nation's exchange rate with other nations. Comprehensively, MNEs need to consider the inflation and exchange rate before making decisions about FDIs location. However, there are many risk MNEs faced in host nations. This paper focused only on inflation and the exchange rate. Investing companies may find it challenging to attain the expected return from their investments because they often share the problems faced by host countries such as balancing the current account, the question of debt repayment, and exchange rate stabilization (Gokmenoglu et al., 2019; Adebayo, 2020a). Though inflation and exchange rate can deter MNEs from investing in a foreign nation, profit earned may surpass the possible loss incurred. Oil discovery in large quantities in the 1970s and the commendable structural adjustment program (SAP) policy implementation, which is engineered to stimulate speculative activities and trade, is the primary driving force that encouraged the inflow of FDI into Nigeria.

Though foreign investment increased during this period, fluctuations emerged recently due to macroeconomic instability and political unrest. The 1989 FDI inflow surge in Nigeria contributed to 4.28% to the real GDP (World Bank, 2020). SAP initiated during this period, which was aim at attracting investors to boost the economy (Adebayo et al 2020b). Furthermore, between 2012 and 2018, FDIs contribute merely an average of 0.82% to GDP in Nigeria (World Bank, 2020). During this period, Nigeria's economy stumbles due to the high political instability, Boko Haram insurgency in the northern part of the country and militant attacks in the southern part of the nation crippled the country. Thus, paving the way for the recession in 2016 coupled with the decline in crude oil price. Nigeria's economy is the biggest in Africa, with GDP and GDP per capita amounting to US$397.3 billion and US$2,028 in 2018 (world Bank, 2020). Poor fiscal and monetary policies management, stagnant economic growth, a constant increase in budget deficits, and double-digit inflation were several financial problems confronting its economy (Nyoni & Bonga, 2018; Adebayo & Kalmaz, 2020).

Looking at the historical trends of FDI and recent issues confronting Nigeria's economy, it would hold high significance to look at how the relationship between inflation, exchange, and FDI inflows unfold. Due to the explosive nature of developing countries' economies, inflation and exchange rate are some of the essential indicators that determine the destinations of MNEs. Based on inconclusiveness in prior studies, it is crucial to conduct a robust analysis. The research seeks to answer a series of questions, including whether the exchange rate has a significant impact on FDI inflows into Nigeria? Does inflation have an asymmetrical effect on FDI inflows? Which regulatory ramifications should be followed to enhance FDI inflows in Nigeria? Thus, to ascertain the interaction between FDI inflows, exchange rate, and inflation rate, the ARDL, and the recent NARDL were applied. This paper starts by utilizing the ARDL technique proposed by Peseran (2001) and the effective NARDL proposed by Shin et al. (2014). The benefit of NARDL over ARDL is that it enables the probability of asymmetrical results with positive and negative shifts in the explanatory variables on the dependent variable to be implemented, as compared to the case with ARDL, wherein the potential influence of the independent variable stays the same. Several authors have explored the interaction between FDI, exchange, and inflation in Nigeria using the ARDL technique. To the author's understanding, no prior studies on Nigeria have used the non-linear ARDL to examine the asymmetric impact of inflation on FDI inflows between the period of study. The remaining section of this study is as follows. The second section entails the recent views of related research. The data utilized and the methodology are discussed in the third section. The empirical findings are conducted in the fourth section and section five concludes the paper.

2. Theoretical Grasp and Empirical Review

2.1. Exchange Rate and FDI Relationship

According to Sahoo et al. (2019), in terms of international placement of a nation's currency, the exchange rate will be a critical element if the amount of exports and imports is price elastic. As Sahoo & Dash (2014) stated, in the absence of market elasticity of trade, the position of exchange rate volatility may become negligible. Given the environment, the number of foreign transactions and market prospects in imports and exports or FDI does not shift significantly. Besides, the decreasing currency value of the host nation increasing offset the positive effects of increased FDI inflows since the value of nominal returns in other currencies reduced. Subsequently, its influence on FDI may turn out to be indecisive (Gokmenoglu et al. 2019; Adebayo, 2020b). Hence, emerging nations policymakers have consistently modified their exchange-rate strategies to shield national producers from international investors and increase their foreign reserves. In the study of Vijayakumar et al. (2010) on BRICS, the authors deployed a yearly panel dataset between 1975 and 2007 to analyze this linkage exchange rate and FDI inflows. The finding shows that exchange rate and inflation are the major determinants of FDI inflows in BRICS economies, while insignificant interconnection exists between trade openness and FDI inflows. With the motive to explore FDI inflows determinants in Malaysia, Yol & Teng (2012) utilized the dataset between 1975 and 2006. Finding from this study revealed evidence of cointegration amongst the variables deployed and negative interaction between exchange rate and FDI inflows. Using China and India as a case study, Khandare (2016) investigated the connection between FDI and exchange rate from 1991 to 2014 and utilizing both regression and correlation techniques to analyze this interaction. The investigator found a positive interconnection

between FDI inflows and exchange rate in India whereas the exchange rate and FDI inflows in China are negatively correlated. A positive linkage was found between the exchange rate and FDI inflows in India, while there was no significant interconnection between the exchange rate and FDI inflows in China. Utilizing similar techniques with Khandare (2016) to investigate the link between FDI and exchange rate in Nigeria, Zakari (2017) found positive interaction between exchange rate and FDI inflows. A weak connection surfaced between FDI inflows and real GDP. Utilizing data between 1990 and 20012, Dal Bianco & Loan (2017) examined the interaction amongst price, exchange rate, and FDI inflows in 10 Latin America and Caribbean nations. By employing Fixed Effects estimator, the authors found a negative link between exchange rate and FDI inflows, while positive interconnection surfaced between price volatility and FDI inflows. The investigators refer to the significance of stability strategies and also the approach of government legitimacy in fostering economic transparency and human capital formation. Employing the ARDL and NARDL, Yi et al. (2020) investigated the FDI inflows determinants in 5-ASEAN economies. The NARDL framework was used to analyze the asymmetric impact exchange rate has on FDI inflows. The study found that the exchange rate influence FDI inflows positively in the ASEAN economies, while no significant evidence was found between negative exchange rate and FDI inflows. Factors connected with FDI to the MENA area was explored by Khatabi et al. (2020) between 2002 and 2016 using two-stage least squares (2SLS). Findings revealed a positive link between exchange rate and FDI inflows, whereas real GDP, trade and governance have a significant influence on FDI inflows. Eregha (2020) explored the linkage between Exchange Rate Regimes and FDI inFlows in west African economies using panel data between 1980–2016. Findings revealed that exchange has a detrimental impact on FDI inflows. Furthermore, the study advises that monetary authorities should be careful in regulating their exchange rates, particularly during periods of depreciation of foreign reserves and contraction of the current account, so that it doesn't impede the much-needed inflow of FDI. Using quarterly data between 1974Q1 to 2016Q4, Qamruzzaman et al. (2019) examined the interconnection between FDI inflows, fiscal policy, monetary policy, and exchange rate in Bangladesh. The NARDL results revealed the existence of a long-term asymmetric interaction. In the long term, a positive shift in the exchange rate decreases FDI inflows and negative shocks, resulting in an adverse FDI inflow. Still, positive shocks yield a higher intensity than negative shocks in the exchange rate. Also, long-run bidirectional causality was found between FDI and the exchange rate.

2.2. Inflation and FDI relationship

As Erramilli et al. (1995) stated, economic uncertainty in the emerging economy may be a significant restriction on FDI inflows. They find that any volatility level creates a level of ambiguity that disrupts investors' view of the nation's potential profitability. Besides, Ajayi (2006) claimed that "low" inflation is a symbol of internal economic stability in the host nation. On the opposite, "strong" inflation suggested the government's unwillingness to fund its budget and the reluctance of the central bank to follow adequate monetary policy. According to Ahn et al. (1998), inflation may be seen as a measure of the developing nation's economic and political environment. However, the distinctions between "strong" inflation and "weak" inflation are not visible. Several studies depict differences on the inflation rate and FDI inflows interconnection. For instance, in India, Singhania & Gupta (2011) analyzed the determining factors of FDI inflows using data between 1995 and 1997 and deploying the

ARIMA model to investigate these interconnections. Findings revealed that only inflation and GDP impact FDI inflows positively. The result of Singhania & Gupta (2011) does not comply with Valli & Masih (2014), who examined the linkage between inflation and FDI inflows in South Africa using the time series dataset from 1970 to 2012. Findings suggest a long-term adverse linkage between inflation and FDI inflows in South Africa, suggesting that an increase in inflation will have a detrimental effect on the volume of FDI earned by South Africa. Furthermore, a one-way causal link exists from inflation to FDI inflows. In a bid to verify the causality associations among FDI determinants in Jordan, Bekhet & Al-Smadi (2014) used yearly data stretching between 1980 and 2011. The Johansen and Juselious cointegration test confirm the existence of long-run cointegration amongst the variables deployed. Furthermore, there is unidirectional causality from inflation to FDI, which indicates that inflation is a strong predictor of FDI in South-Africa. Asmae & Ahmed (2019) the link between inflation and FDI in Morroco and Turkey deploying time series data between 1990-2017. The outcome of the study revealed greater volatility of inflation might cause higher marginal profitability of capital and increase investment in Morroco. At the same time, FDI inflows are found more elastic to domestic price fluctuations in Turkey. Also, an insignificant exchange rate and FDI inflows exist in Turkey, whereas the exchange rate and FDI inflows are positively linked in Turkey. Furthermore, institution quality, infrastructure and market size rate are determining factors in FDI inflows in Morroco and Turkey. In Iran, utilizing the dataset between 1970 and 2016, Safarzadeh & Khodavaisi (2020) examined the influence of Inflation on FDI inflows using NARDL. In the short and long term, the rising and diminishing impacts of inflation have adverse and positive effects on enticing FDI. Furthermore, decreasing inflation shocks on increasing foreign direct investment attractions have more effects of rising inflation shocks on growing the attractiveness of FDI. In Nigeria, Babajide & Lawal, (2016) empirically analyzed the influence of Macroeconomic variables on FDI inflows from 1981 to 2014 using the ARDL techniques. Empirical findings from the ARDL calculations reveal remarkable trends. For example, it can be inferred that there is no noticeable long-term and short-term interaction between the FDInflows and the real GDP. The finding also indicates that, in the long term, exchange rate, inflation, and trade do not significantly impact FDI inflows. At the same time, in the short-run, there is evidence of the interconnection between FDI inflows and the other exogenous variables. Moreover, it can be shown from the outcome there is a clear interconnection between inflation and FDI inflows in the short run and long run, as well as between public spending and FDI inflows.

Table 1. Studies Summary

Investigators	Timeframe	Country (s)	Technique (s)	Findings
Exchange rate and FDI Relationship				
Vijayakumar et al. (2010)	1975-2007	BRICS	OLS	EXC→ FDI (+) INF→ FDI (+)
Yol & Teng (2012)	1975-2006	Malaysia	ARDL	EXC→ FDI (-)
, Khandare (2016)	1991-2014	China & India	Regression & correlation	Differing outcomes
Zakari (2017)	1991-2014	Nigeria	regression & correlation	EXC→ FDI (+) GDP→ FDI (+)
Yi et al. (2020)	1990-2017	5-ASEAN economies	ARDL & NARDL,	EXC→ FDI (+)
Khatabi et al.	2002-2016	MENA area	2SLS	EXC→ FDI (+)

(2020)				TO → FDI (+) GDP → FDI (+) GOV → FDI (+)
Eregha (2020)	1980–2016	west African economies	ARDL PMG	EXC → FDI (-)
Qamruzzaman et al. (2019)	1974Q1-2016Q4	Bangladesh	NARDL	EXC^{+} → FDI (-) EXC^{-} → FDI (-)
Inflation and FDI relationship				
Singhania & Gupta (2011)	1985-1997	India	ARIMA	INF → FDI (+) GDP → FDI (+)
Valli & Masih (2014)	1970-2012	South Africa	ARDL	INF → FDI (-) INF → FDI
Bekhet & Al-Smadi (2014)	1980-2011	Jordan	VECM	INF → FDI
Babajide & Lawal (2016)	1981-2014	Nigeria	ARDL	In the short run INF → FDI (+) GDP → FDI (+)
Asmae & Ahmed (2019)	1990-2017	Morocco & Turkey	Granger Causality.	Differing result
Dal Bianco & Loan (2017)	1990-2012	10 Latin America & Caribbean nations	Employing Fixed Effects estimator	EXC → FDI (-) INF → FDI (+)
Safarzadeh & Khodavaisi (2020)	1970-2016	Iran	NARDL	EXC^{+} → FDI (+) EXC^{-} → FDI (+)
INF: inflation, EXC: Exchange rate, GDP: real growth, FDI: Foreign direct investment, TO: trade openness, GOV: governance				

Source: Authors Collation

Prior studies have found the overall effect of the possible determinants of FDI inflows, which could comprise constrained knowledge on the occurrence. The NARDL method adopted reveals all forms of variations (i.e., positive and negative impacts) in inflation may have a significant and vital effect on FDI inflows. NARDL's interconnection between FDI and inflation may be crucial in constructing a strategy in the long-term.

3. Data and Methodology

3.1. Data Description

In this empirical analysis, the variables utilized are FDI inflows, inflation (CPI), and exchange rate. The variables consist of yearly data covering 37 years' period (1981 and 2018) and 38 observations. The data utilized in this analysis (exchange, Inflation, and FDI inflows) are acquired from the database of world bank (2020). The summary of the indicators deployed is illustrated in table 2, while Figures 1, 2, and 3 mirrors the trends in inflation, FDI inflows and exchange rate in Nigeria between 1981 and 2018.

Table 2. Descriptive Statistics

Data Name	**FDI Inflow**	**Inflation**	**Exchange Rate**
Source	World Bank	The Central Bank of Nigeria	The Central Bank of Nigeria
Code	FDI	INF	EXC
Mean	2.61E+09	19.35040	88.54405
Median	1.61E+09	12.71577	97.01772
Maximum	8.84E+09	72.83550	306.0837
Minimum	1.89E+08	5.388008	0.617708
Std. Dev.	2.64E+09	17.24364	87.13742
Skewness	1.042404	1.741920	0.802967
Kurtosis	2.822451	4.838732	2.974342
Jarque-Bera	6.931745	24.57028	4.084502
Probability	0.031246	0.000005	0.129736
Observations	38	38	38
FDI	1		
INF	-0.176941	1	
EXC	0.79763	-0.1717	1

Source: Authors Collation with EViews 10

Table 2 demonstrates a summary of indicators and the correlation amongst them. We note that foreign direct investment and inflation are more volatile than the exchange rate. The exchange rate has the lowest vulnerability, suggesting that the exchange rate was steady in Nigeria between 1981 and 2018. The results display the asymmetric distribution, as indicated by the skewness. As for the distribution of the sequence, we cannot support the bell shape. The Jarque-Bera statistics show the non-normal distribution of the series. These critical features of the series illustrate the need to focus on asymmetric approaches, as we have done in this analysis. Furthermore, a correlation study indicates a strong connection between the exchange rate and foreign direct investment, a weak and negative correlation between foreign direct investment and inflation and exchange rate and inflation are negatively correlated.

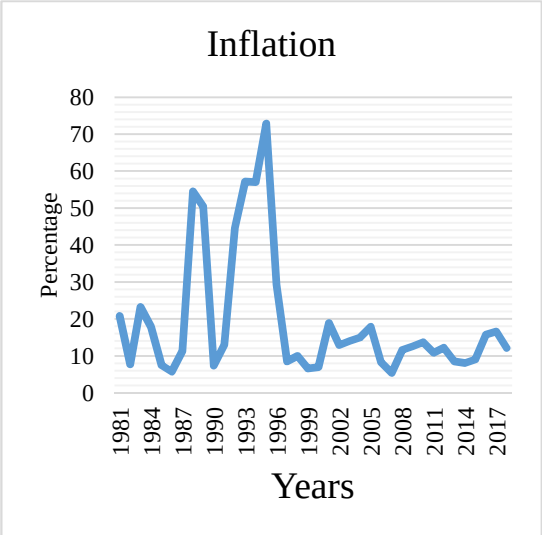


Figure 1. Exchange Rate Trend (1981-2018)

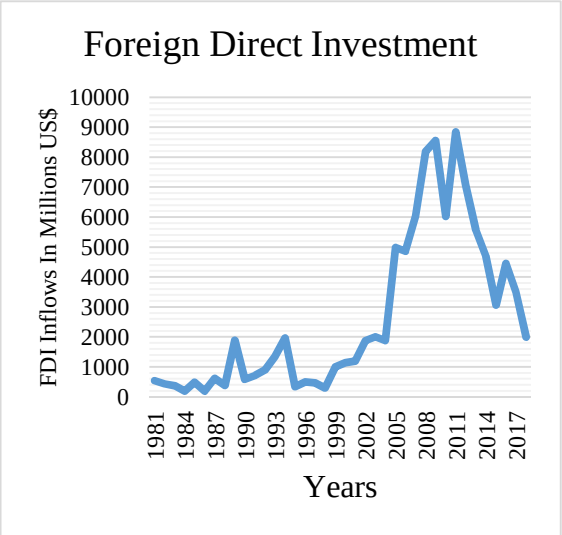


Figure 2. Exchange Rate Trend (1981-2018)

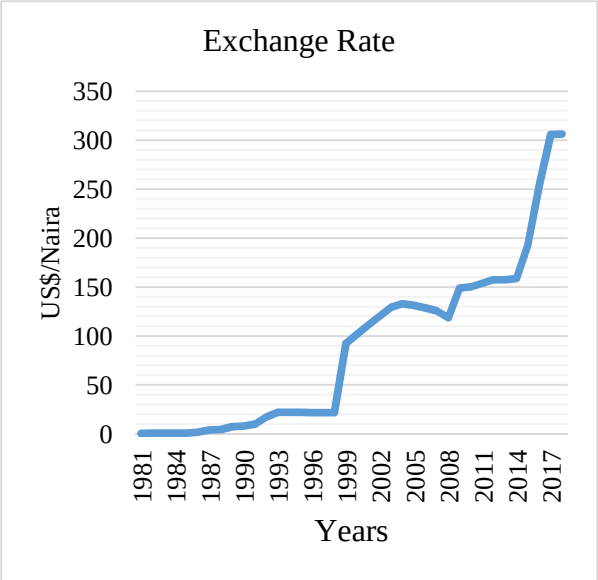


Figure 3. Exchange Rate Trend (1981-2018)

3.2. Methodology

In past studies, foreign direct investment – Inflation interaction is usually studied utilizing standard time-series methods of the Autoregressive Distributive Lag Model (ARDL) co-integration study, followed by ECM and causality methods. Nonetheless, econometric methods make it feasible to assess the existence of long-term interconnections accompanied by short-term relations, allowing the interconnection between foreign direct investment and inflation asymmetrical. Nevertheless, they are not sufficient to obtain conceivable asymmetries amongst indicators. Work carried out by Pesaran et al. (2001) expanded the ARDL system based on a further review by Pesaran et al. (1999) asymmetric adjustment of the non-linear ARDL co-integration approach (NARDL) to achieve long and short-term asymmetries in the target variables. The modeling approach is used in this research. The NARDL approach was deployed to investigate the connection between oil prices and prices of food in Malaysia (Ibrahim, 2015); the linkage between financial development and real growth in Bangladesh was investigated by Qamruzzaman et al. (2019); and corruption and FDI inflows to Nigeria by Zangina & Hassan, (2020). Before displaying the complete NARDL framework, the linkages between the exchange rate, inflation, and foreign direct investment is seen in the preceding asymmetrical regression in the long-run.

The economic function, economic model, and econometric model is depicted by equation 1, 2 and 3 correspondingly as follows;

$$FDI = f(EXC, INF^{+} INF^{-}) \quad (1)$$

$$FDI_t = \theta_0 + \theta_1 EXC_t + \theta_2^{+} INF_t^{+} + \theta_3^{-} INF_t^{-} \quad (2)$$

$$FDI_t = \theta_0 + \theta_1 EXC_t + \theta_2^{+} INF_t^{+} + \theta_3^{-} INF_t^{-} + \varepsilon_t \quad (3)$$

where FDI depicts foreign direct investment, EXC stand for exchange rate, INF depicts inflation, , and $\theta = \theta_0, \theta_1, \theta_2^{+}, \theta_3^{-}$ depicts the unknown vector parameters. Also, $INF_t = INF_0 + INF_t^{+} +$

INF_t^-,where $INF_t^+ + INF_t^-$ are the partial sum process of variation which are positive and negative in INF

$$INF_t^+ = \sum_{j=1}^{s} \Delta INF_j^+ = \sum_{k=1}^{s} max\left(\Delta INF_j, 0\right), INF_t^- = \sum_{k=1}^{s} min\left(\Delta INF_j, 0\right) + \varepsilon_t \quad .(4)$$

The equations above focused on the decomposition of the partial concept of asymmetric cointegration has been utilized in the nonlinear context of Schorderet (2003) to explore the relationship between unemployment and growth and to evaluate the nonlinear connection between unemployment and real growth. Regarding this analysis, equation (3) can be configured as follows in the framework of Pesaran et al. (2001) and Pesaran & Shin (1998) contexts of the ARDL;

$$\Delta FDI_t = \delta_0 + \theta_1 FDI_{t-1} + \theta_2 EXC_{t-1} + \theta_3^+ INF_{t-1}^+ + \theta_4^- INF_{t-1}^- + \sum_{i=1}^{p} \emptyset_i \Delta FDI_{t-1} + \sum_{i=1}^{a} \varphi_i \Delta EXC_{t-1} + \sum_{i=0}^{t} (\pi_i^+ \Delta INF_{t-1}^+ + \pi_i^- \Delta INF_{t-1}^-) + \varepsilon_t \quad (5)$$

Where the lag orders are a and t, the concealed co-integration question occurs in the calculated equation 3 in such a way that it cannot offer a valid explanation of the calculated asymmetric coefficients. Thus, a constraint is placed on equation 3 coefficients such as $\theta_2^+ = \frac{-\theta_3^+}{\theta_1}$ and $\theta_3^- = \frac{-\theta_4^-}{\theta_1}$ as suggested by Granger & Yoon (2002) and Lardic & Mignon (2008). $\sum_{i=0}^{t} \pi_i^+$ calculates the potential short-term effect of an increase in inflation on foreign direct investment, whereas $\sum_{i=0}^{t} \pi_i^-$ calculates the short-term impact of a reduction of inflation on foreign direct investment. Therefore, the short-term asymmetrical effect of inflation fluctuations on foreign direct investment is often identified in this system, together with the long-term asymmetrical interconnection. The Error Correction Model (ECM) of equation 5 is shown as follows;

$$\Delta FDI_t = \sum_{i=1}^{p} V_i \Delta FDI_{t-1} + \sum_{i=1}^{a} I_i \Delta EXC_{t-1} + \sum_{i=0}^{t} (K_i^+ \Delta INF_{t-1}^+ + K_i^- \Delta INF_{t-1}^-) + R_i ECT_{t-1} + \mu_t \quad (6)$$

Where V_i, I_i stand for coefficients in the short-run and K_i^+, K_i^- portrays adjustment symmetry in the short-run, whereas R_i Specifies the coefficient of error correction term. The calculation of the NARDL methodology requires the following procedures. Firstly, the ARDL method is accurate irrespective of whether all indicators are integrated of I(0) or I(1) or I(0) and I(1). It is quite essential to implement the unit-root test to ensure that no series is integrated of I(2) since the presence of the I(2) component makes null and void the predicted F-stat for evaluating cointegration (Guraji, 1995; Adebayo et al. 2020a; Adebayo et al. 2020b). To eradicate this issue, the widely utilized ADF), PP, and GLS(ERS) root tests were utilized to evaluate the integration order.

Furthermore, the Zivot-Andrew unit root tests were deployed to capture the existence of a structural break. Next, equation 3 is calculated using the Ordinary Least Squares (OLS) standard method. The overall-to-specific approach was introduced to boost the final condition of the NARDL framework by

reducing negligible lags (Katrakilidis & Trachanas, 2012). After calculating NARDL, a check for the existence of long-term interaction between the indicators in the model is performed by utilizing a bounds testing proposed by Pesaran et al. (2001) and Shin et al. (2014). It encompasses the Wald F-test of the null hypothesis, $H_o: \theta_1 = \theta_2 = \theta_3^+ = +\theta_4^- = 0$ against $H_o: \theta_1 \neq \theta_2 \neq \theta_3^+ \neq +\theta_4^- \neq 0$. Ultimately, with the advent of cointegration, an analysis of long and short-term asymmetries in the interconnection between inflation and foreign direct investment is performed and conclusions were made. Additionally, asymmetric cumulative dynamic multiplier impacts of 1% discrepancy in $INF_{t-1}^+ and\ INF_{t-1}^-$ correspondingly were calculated in equation 7;

$$B_a^+ = \sum_{j=0}^{a} \frac{\rho FDI_{t+j}}{\rho INF_{t-1}^+}, B_a^- = \sum_{j=0}^{a} \frac{\rho FDI_{t+j}}{\rho INF_{t-1}^-}, a = 1,2 \quad (7)$$

It is worth remembering that as a $\rightarrow \infty, B_a^+ \rightarrow \theta_1^+, B_a^- \rightarrow \theta_2^-$

4. Empirical Findings

4.1. Unit Root Test

It is essential to check each variable for stationarity before conducting cointegration checks. The regression analysis will yield false findings if the data set is not stationary (Gujarati & Porter. 1999). One requirement of the bounds testing approach is that no single indicator must be I(2), though mixed of I(1) or I(0) or mixed of I(I) and I(0) integration order is accepted. Tables 3 and 4 portray the outcomes of these tests at the trend and intercept. The Schwarz Information Criterion (SIC) for optimum lag order is used to test the ADF. The tests signify that inflation, FDI inflows, and exchange rates have a mixed integration order, like I(1) and I(0) respectively, therefore, the bound test procedures are next. After unit root testing was conducted, SIC is utilized to verify the optimal lag order for the framework utilizing a vector autoregressive (VAR) method. The NARDL method starts to distinguish between negative and positive variables of the inflation indicator. Figures 4 and 5 illustrate the negative and positive components of inflation. The NARDL and ARDL versions have been calculated to suit the two factors. The lag configuration of the ARDL framework is shown in Table 5. Therefore, the ARDL definition with a lag of 1, 0, 0 is chosen based on the Akaike Knowledge Criteria (AIC).

Table 3. Conventional Unit-Roots

	INF	Decision	FDI	Decision	EXC	Decision
ADF	-4.39[t]	1(0)	-9.82[t]	1(1)	-5.52[t]	1(1)
PP	-9.773 [t]	1(1)	-3.20[m]	1(0)	-5.71[t]	1(1)
DF-GLS	-3.54[o]	1(0)	-3.09[m]	1(0)	-5.55[t]	1(1)
Note: t, o, and m signifies significance level of 1%, 2% and 10% correspondingly						

Source. Authors Collation with EViews 10

Table 4. Structural-Break Unit-Root

Variables	ZA	Decision	Break-Year
FDI	-11.21[t]	I(1)	1999
INF	- 6.41[t]	I(0)	1997
EXC	-5.79[t]	I(1)	2001
Note: t, signifies significance level of 1%			

Source: Authors Collation with EViews 10

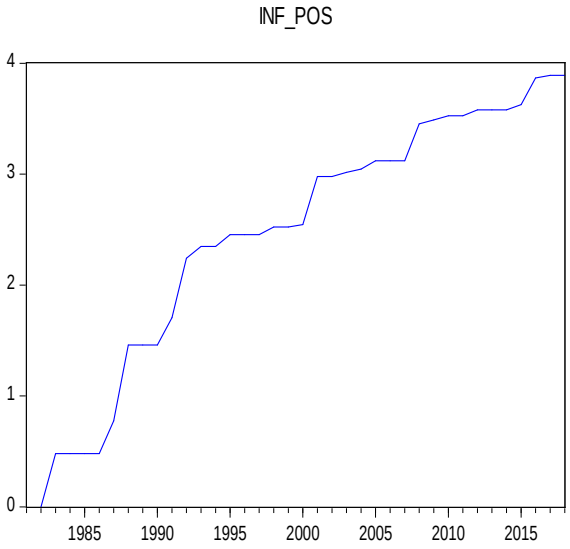


Figure 4. Inflation (+) 1981-2018

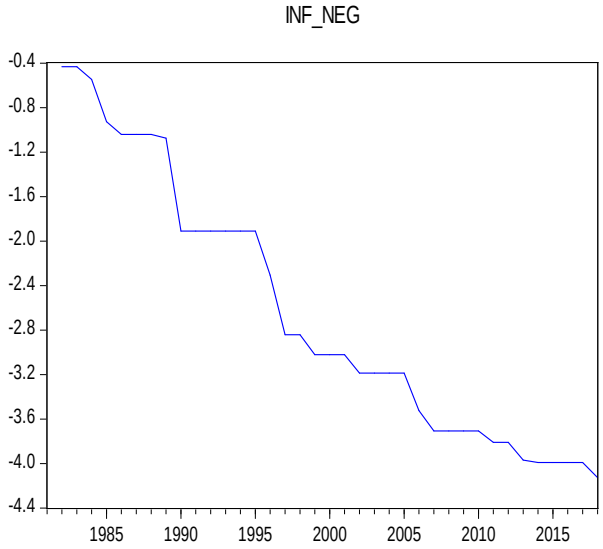


Figure 5. Inflation (-) 1981-2018

Table 5. Criteria Table

Model	LogL	AIC*	BIC	HQ	Adj. R^2	Specification
4	0.4889	0.1897	0.3639	0.2511	0.7529	ARDL(1, 0, 0)
2	1.3843	0.1954	0.4131	0.2721	0.7572	ARDL(1, 1, 0)
3	0.6512	0.2350	0.4527	0.3118	0.7474	ARDL(1, 0, 1)
1	1.4228	0.2474	0.5086	0.3395	0.7499	ARDL(1, 1, 1)
HQ illustrates Hannan-Quinn, AIC denotes Akaike information criterion, BIC portrays Bayesian information criterion; AdjR^2 stands for Adjusted R-squared						

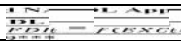
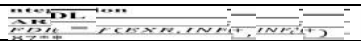
Source: Authors Collation with EViews 10

4.2. Cointegration Results

Table 6 portrays the result of the ARDL and NARDL. The R^2 for the ARDL and the NARDL are 0.81(81%) and 0.77 (77%) correspondingly, which depicts that exchange rate and inflation can explain 81% and 77% variation in foreign direct investment in the two frameworks. In comparison, the remaining 19% and 23% in ARDL and NARDL are due to error terms. The Durbin Watson (DW) statistics are 2.396 and 2.5024 for the ARDL and NARDL framework, showing no evidence of autocorrelation in the models. The absence of heteroscedasticity and serial correlation was noticed in the two models. Furthermore, residuals are normally distributed in the ARDL and NARDL models. Lastly, the Ramsey test provides evidence of no misspecification in the two models. These findings indicate that the 2 models are reliable and consistent. In the ARDL model, at a 10% significance level, the F-stat (4.19) is greater than the upper and lower bound, which portrays evidence of cointegration amongst series deployed. Also, in the NARDL model, at a 5% significance level, the F-stat (4.87) is

greater than the upper and lower bound which portrays evidence of cointegration amongst the series deployed. The Wald tests demonstrate the importance of asymmetry for both the long term and the short term, which suggests that non-linearity and asymmetry are essential when analyzing the linkage between inflation and foreign direct investment. This observation illustrates the significance of considering asymmetry while examining the interaction between such indicators. More comprehensive findings are given below.

Table 6. ARDL and NARDL Approaches to Cointegration

	ARDL	NARDL
Model specification		
F-statistic	4.19***	4.87**
Lower and Upper Bound	3.17 and 4.14	3.23 and 4.35
Inference	(1, 0, 0)	(1, 0, 0, 0)
Cointegration	Yes	Yes
χ^2 Normality	0.73(0.69)	0.24(0.88)
χ^2 LM	1.73(0.17)	17.31 (0.36)
χ^2 Heteroscedasticity	1.80(0.16)	1.19(0.274)
χ^2 Ramsey	1.37(0.17)	0.766(0.527)
R^2	0.81	0.77
Adj R^2	0.80	0.76
F-Statistic	33.63	27.76
Prob (F-Stat)	0.000	0.000

Source: Author Collation with EViews 10

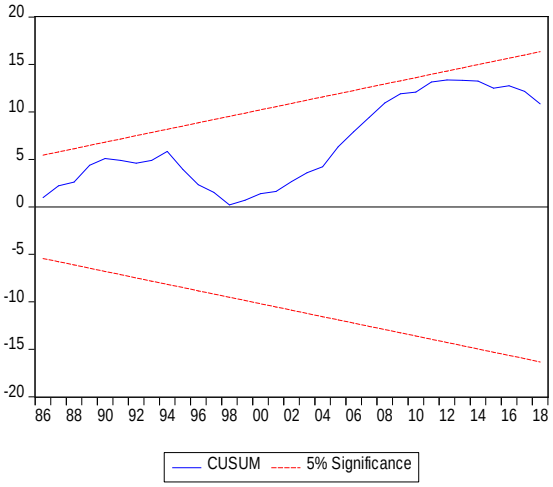


Figure 6a. CUSUM

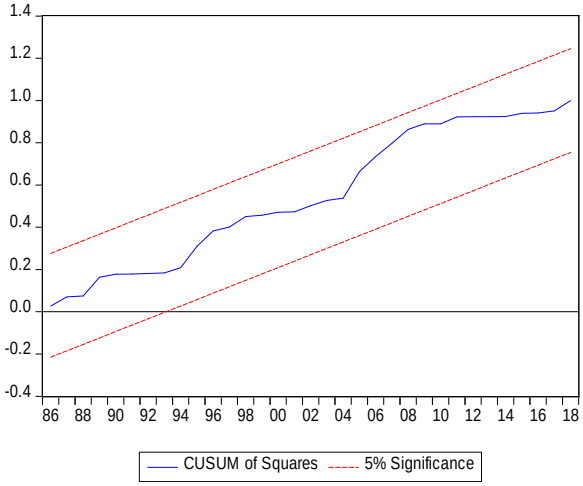


Figure 6b. CUSUM Sq

Table 7. Long and Short Run Asymmetric

	F-statistics	P-value
Long-run	15.88234	0.0005
Short-run	3.492344	0.0725

Source: Author Collation with Stata 15

4.3. ARDL Long-Run and Short-Run Estimate

Bearing in mind the existence of long-run linkages between variables deployed, we explored the dynamic influence of exchange rate and inflation on FDI inflows in Nigeria. The estimated outcomes are reported in table 5. Findings indicate; (i) exchange rate exert positive and significant influence on FDI inflows. This denotes that a 1% increase in the exchange rate will exert a 0.23% increase in FDI inflows. This outcome complies with past studies (Vijayakumar et al. 2010; Yol & Teng, 2012; Khandare, 2016; Zakari, 2017; Yi et al. 2020; Khatabi et al. 2020). (ii) No significant linkage between inflation and FDI inflows. This outcome complies with the findings of Babajide & Lawal (2016) and Asmae & Ahmed (2019). (iii) The ECM is significant, statistically indicating a quicker return to equilibrium in the event of an imbalance. (iv) there is evidence of interaction between inflation and FDI inflows in the short run.

Table 8. ARDL Short-Run and Long-Run Estimate

Long-Run Estimate			
Regressors	Coefficient	T-Statistic	Probability
EXC	0.234	2.934	0.006
INF	-0.020	-0.147	0.883
C	3.816	3.429	0.001
Short-Run Estimate			
	Coefficient	T-Statistic	Probability
ECM(-1)	-0.35	-2.953	0.006
ΔINF	-0.381	-2.976	0.005
Note: *, **, signifies significance level of 1% & 5%, respectively.			

Source: Author Collation with Eviews 10

4.4. NARDL Long-Run and Short-Run Estimate

In the long run, positive inflation shock has a detrimental and significant impact on foreign direct investment (-0,394), suggesting that any positive inflation shock hinders FDI inflows in Nigeria. Also, inflation had a detrimental impact on FDI, which corroborate with Sayek (2009), who clarified that higher inflation in the developing nation decreases FDI inflows. It lowers the profitability of income generated by international companies. Likewise, adverse inflation shocks have a strong and insignificant impact on foreign direct investment in Nigeria. In addition, there is a favorable relationship between the exchange rate and foreign direct investment as shown by the coefficient (4.384). It is generally accepted that the exchange rate downturn promotes foreign direct investment by reducing the cost of foreign investment and raising the return on foreign investment compared to exports. Therefore, the exchange rate, described as the domestic currency price of foreign currency, is essential in terms of its degree and its volatility. Exchange rates will affect the overall sum of foreign direct investment produced and the distribution of these investment expenditures among a variety of nations. In the context of Nigeria, the exchange rate has a positive impact on foreign investment. In the short run, The positive inflation shock is adversely linked to foreign direct investment, as seen by the coefficient (-0.522), which suggests that, in the short term, the positive inflation shock deteriorates FDI inflows in Nigeria. The negative inflation shock is also adversely influenced by foreign direct investment, as illustrated by the 5 percent importance point coefficient (-0.520).

Table 9. NARDL Estimates

Long-Run Estimate			
Regressors	Coefficient	T-Statistic	Probability
EXC	4.384	3.656	0.001
INF	-0.394	-2.115	0.042
INF	0.218	1.288	0.207
C	3.530	2.986	0.005
Short-Run Estimate			
	Coefficient	T-Statistic	Probability
ECM(-1)	-0.410	-3.735	0.000
ΔINF	-0.522	-3.336	0.002
ΔINF	-0.520	-2.101	0.044
Δ	-0.788	-2.528	0.018
Note: *, **, signifies significance level of 1% & 5%, respectively. The F-stat is			

Source: Author Collation with EViews 10

4.5. Dynamic Multiplier

Figure 7 illustrate Dynamic multiplier. The Positive and negative shift curves provide signs of asymmetrical modification of foreign direct investment to negative and positive inflation shocks over an established period. The dynamic multiplier graph shows that positive inflation shocks have a long-term impact on foreign direct investment in contrast to adverse inflation shocks, displaying the existence of positive asymmetry over the long term, although not substantial. Equilibrium is achieved in the long-run in 8 years.

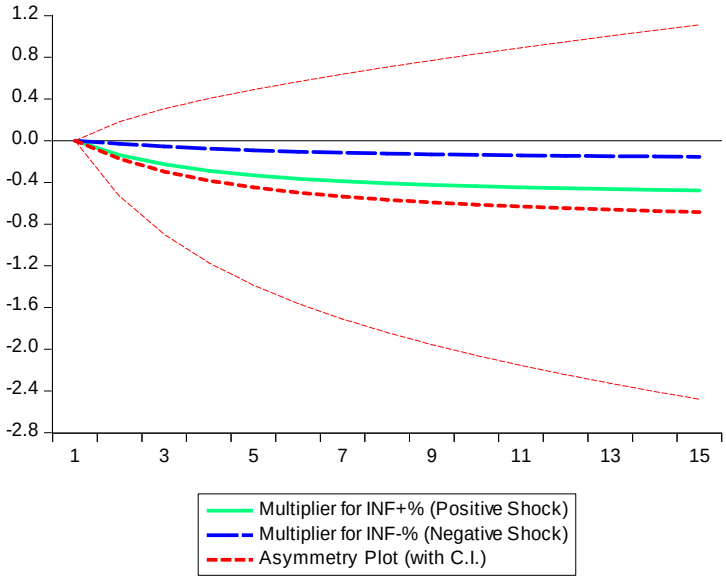


Figure 7. Dynamic Multiplier
Source: Author Collation with EViews 10

5. Conclusion and Policy Direction

As a developing nation, Nigeria experienced the FDI inflows in infrastructural development, industrialization, and capital market development over the past decades. Therefore, maintaining the flow of FDI, the regulatory authority initiated several financial reforms activities like financial market deregulation, corporate governance on banking sectors, monetary and fiscal policy formulation based on evaluating the macroeconomic situation, and many more. This study aims to gauge the dynamic asymmetric impact of inflation on FDI inflows in Nigeria between 1981 and 2018. To investigate the linear relationship, the investigator used the ARDL bound testing approach proposed by Pesaran et al. (2001) and to assess non-linearity by using NARDL proposed by Shin et al. (2014). The long-term model estimation outcomes utilizing the ARDL bounds testing technique and the NARDL established the validity of long-term cointegration between FDI inflows, inflation, and exchange rates. Findings from the long-term ARDL estimate provide signs of a positive and significant association between the FDI inflow and the exchange rate. It means that the real weakening of the naira against the US$ stimulates FDI inflows. This finding corroborates the outcome of Zakari (2017), Yi et al. (2020), and Khatabi et al. (2020). Furthermore, a negative and insignificant link exists between inflation and FDI inflows. This finding aligns with past studies (Babajide & Lawal, 2016 and Asmae & Ahmed (2019). Results based on the NARDL revealed an asymmetric relationship between inflation and inflows of FDI in Nigeria between 1981 and 2018. Findings revealed a positive change in inflation adversely impact on FDI inflows. Also, negative changes in inflation negatively affect FDI inflows in Nigeria. Dynamic multipliers also revealed positive and negative shift curves that provide signs of asymmetrical modification of foreign direct investment to negative and positive inflation shocks over an established period. Besides, positive inflation shocks have a longer-term impact on foreign direct investment than negative inflation shocks, displaying the existence of positive asymmetry over the long term, although not substantially. Since emerging economies such as Nigeria need FDI inflows because FDI inflows in the economy ensure a continuous flow of long-term capital, technological transfer, and international competitiveness. The weakening of Nigeria's currency (Naira) will induce additional foreign direct investment, thus preventing the import of luxury products. Therefore, the policymakers should maintain its monetary policy based on this finding. Furthermore, for macroeconomic stability, stable inflation is the key to inflows of FDI in the economy, as we found asymmetric relationships both in the long-run and short-run. Also, collaborative work, socio-political relations with other nations need to be bolstered in the long term, as these reforms may boost the nation's competitiveness in global markets. Better international positioning with a stable economic climate will potentially draw international investors, which will be attractive for a developing market like Nigeria. Although this analysis allows for robust empirical findings and fills holes in research using ARDL and more recent NARDL techniques, an additional study should be considered in future studies to evaluate this relation in the numerous advanced and emerging countries to expand the existing works.

References

Adebayo, T. S. & Beton Kalmaz, D. (2020). Ongoing Debate between Foreign Aid and Economic Growth in Nigeria: A Wavelet Analysis. *Social Science Quarterly*. https://doi.org/10.1111/ssqu.12841

Adebayo, T. S.; Awosusi, A. A. & Eminer, F. (2020a). Stock Market-Growth Relationship in an Emerging Economy: Empirical Finding from ARDL-Based Bounds and Causality Approaches. *Journal of Economics and Business*, 3(2), pp. 903-916.

Adebayo, T. S.; Awosusi, A. A., & Adeshola, I. (2020b). Determinants of CO2 Emissions in Emerging Markets: An Empirical Evidence from MINT Economies. *International Journal of Renewable Energy Development*, 9(3), pp. 411-422.

Adebayo, T. S. (2020a). Dynamic Relationship between Oil Price and Inflation in Oil Exporting Economy: Empirical Evidence from Wavelet Coherence Technique. *Energy Economics Letters*, 7(1), pp. 12-22.

Adebayo, T. S. (2020b). Does the Oil Price Influence the Exchange Rates in Nigeria? Empirical Evidence from Wavelet and Causality Approaches. *Asian Journal of Economics and Empirical Research*, 7(2), pp. 126-135

Ahn, Y. S.; Adji, S. S. & Willett, T. D. (1998). The effects of inflation and exchange rate policies on direct investment to developing countries. *International Economic Journal*, 12(1), pp. 95-104.

Ajayi, S. I. (2008). *Foreign direct investment in sub-Saharan Africa: origins, targets, impact and potential*.

Asmae, A. & Ahmed, B. (2019). Impact of the Exchange Rate and Price Volatility on FDI Inflows: Case of Morocco and Turkey. *Applied Economics and Finance*, 6(3), pp. 87-104.

Babajide, A. A. & Lawal, A. I. (2016). Macroeconomic behaviour and FDI inflows in Nigeria: An application of the ARDL model. *British Journal of Economics, Finance and Management Sciences*, 11(1), pp. 84-107.

Ball, L.; Mankiw, N. G. & Reis, R. (2005). Monetary policy for inattentive economies. *Journal of monetary economics*, 52(4), pp. 703-725.

Bekhet, H. A. & Al-Smadi, R. W. (2014). Determining the causality relationships among FDI determinants: evidence from Jordan. *International Journal of Sustainable Economy*, 6(3), pp. 261-274

Boateng, A.; Hua, X.; Nisar, S. & Wu, J. (2015). Examining the determinants of inward FDI: Evidence from Norway. *Economic Modelling*, 47, pp. 118-127.

Dal Bianco, S. & Loan, N. C. T. (2017). FDI inflows, price and exchange rate volatility: New empirical evidence from Latin America. *International Journal of Financial Studies*, 5(1), p. 6.

Dunning, J. H. (1980). Toward an eclectic theory of international production: Some empirical tests. *Journal of international business studies*, 11(1), pp. 9-31.

Dunning, J. H., & Lundan, S. M. (2008). Institutions and the OLI paradigm of the multinational enterprise. *Asia Pacific Journal of Management*, *25*(4), 573-593.

Erramilli, M. Krishna, & Derrick E. D. (1995). Uncertainty and foreign direct investment: the role of moderators. *International Marketing Review*.

Eregha, P. B. (2020). Exchange Rate Regimes and Foreign Direct Investment Flow in West African Monetary Zone (WAMZ). *International Economic Journal*, 34(1), pp. 85-99.

Gokmenoglu, K.; Kirikkaleli, D. & Eren, B. M. (2019). Time and frequency domain causality Testing: The causal linkage between FDI and economic risk for the case of Turkey. *The Journal of International Trade & Economic Development*, 28(6), pp. 649-667.

Granger, C. W. J. & Yoon, G. (2002). Hidden Cointegration. Department of Economics *Discussion Paper 2002-02*. University of California, San Diego.

Gujarati, D.N. & D.C. Porter. (1999). *Essentials of econo-metrics*. New York: McGraw Hill 2010.

Ibrahim, M. H. (2015). Oil and food prices in Malaysia: a nonlinear ARDL analysis. *Agricultural and Food Economics*, 3(1), pp. 1-14.

Khandare, V. B. (2016). Impact of exchange rate on FDI: A comparative study of India and China. *International Journal of Applied Research*, 2(3), pp. 599-602.

Khatabi, S.; Komijani, A.; Mohammadi, T. & Memarnejad, A. (2020). Factors Associated with FDI Inflows to MENA Region: An Empirical Examination. *Iranian Economic Review*, 24(2), pp. 313-331

Katrakilidis, C. & Trachanas, E. (2012). What drives housing price dynamics in Greece: New evidence from asymmetric ARDL cointegration. *Economic Modelling*, 29(4), pp. 1064-1069.

Lardic, S. & Mignon, V. (2008). Oil prices and economic activity: An asymmetric cointegration approach. *Energy Economics*, 30(3), pp. 847-855.

Nyoni, T. & Bonga, W. G. (2018). What Determines Economic Growth in Nigeria? *Dynamic Research Journals (DRJ) Journal of Business & Management*, 1(1), pp. 37-47.

Pesaran, M. H.; Shin, Y. & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, 16(3), pp. 289-326.

Pesaran, M. H. & Shin, Y. (1998). An autoregressive distributed-lag modelling approach to cointegration analysis. *Econometric Society Monographs*, 31, pp. 371-413.

Pesaran, M. H.; Shin, Y. & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American statistical Association*, 94(446), pp. 621-634.

Sahoo, P. & Dash, R. K. (2014). India's surge in modern services exports: Empirics for policy. *Journal of Policy Modeling*, 36(6), pp. 1082-1100.

Safarzadeh, G. & Khodavaisi, H. (2020). *Asymmetric Effect of Inflation on Attracting Foreign Direct Investment in Iran*.

Schorderet, Y. (2003). *Asymmetric cointegration*. Genève: Université de Genève/Faculté des sciences économiques et sociales.

Shin, Y.; Yu, B. & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. *Festschrift in honor of Peter Schmidt*, pp. 281-314. Springer, New York, NY.

Singhania, M. & Gupta, A. (2011). Determinants of foreign direct investment in India. *Journal of international trade law and policy*.

Tobin, J. (1965). Money and economic growth. *Econometrica: Journal of the Econometric Society*, pp. 671-684.

Qamruzzaman, M.; Karim, S. & Jianguo, W. (2019). Revisiting the Nexus Between Financial Development, Foreign Direct Investment and Economic Growth of Bangladesh: Evidence from Symmetric and Asymmetric Investigation. *Journal of Sustainable Development Studies*, 12(2).

Uddin, M.; Chowdhury, A.; Zafar, S.; Shafique, S. & Liu, J. (2019). Institutional determinants of inward FDI: Evidence from Pakistan. *International Business Review*, 28(2), pp. 344-358.

Valli, M. & Masih, M. (2014). Is there any causality between inflation and FDI in an 'inflation targeting'regime? *Evidence from South Africa*.

Vijayakumar, N.; Sridharan, P. & Rao, K. C. S. (2010). Determinants of FDI in BRICS Countries: A panel analysis. *International Journal of Business Science & Applied Management (IJBSAM)*, *5*(3), pp. 1-13.

World Bank. (2020). *World Development Indicators.* https://data.worldbank.org/country/nigeria.

Yi, C. F.; Idris, S. & Lily, J. (2020). Determinants of Foreign Direct Investment (FDI) in Asean-5 Countries: A Review. *Malaysian Journal of Business and Economics (MJBE)*, p. 77.

Yol, M. A. & Teng, N. T. (2012). Estimating the domestic determinants of foreign direct investment flows in Malaysia: Evidence from cointegration and error-correction model. *Jurnal Pengurusan (UKM Journal of Management)*, 28.

Zakari, M. (2017). The impact of exchange rate fluctuations on foreign direct investment in Nigeria. *Journal of Finance and Accounting*, *5*(4), pp. 165-170.

Zangina, S. & Hassan, S. (2020). Corruption and FDI inflow to Nigeria: a nonlinear ARDL approach. *Journal of Financial Crime*.