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# The Causal Relationship between Foreign Direct Investment (FDI) and the Macro-Economy of Selected West African Countries: Panel ARDL/Granger Causality Analysis

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**Abstract**

This study examined the long run and short run dynamic relationships between macroeconomic variables and FDI in West Africa using recent econometric techniques for Granger non-causality and PMG/ARDL for period of 1990 to 2016. Controlling for the influence of trade openness and exchange rate, the long-run effect of Foreign Direct Investment (FDI) on economic growth and gds are found to be positive and statistically significant. FDI is found to be negative and statistically significant on unemployment indicating that an increase in FDI would significantly reduce unemployment in the selected West African nations in the long-run. The coefficient of error correction model in all the specifications is negative and significant indicating that the short-run disequilibrium is corrected in the long-run. Panel Granger causality tests result indicates that causality do not run from any direction in the short run which could be attributed to poor economic activities among this developing countries and an important revelation for policy implication.

**Key Words/Phrases:** Foreign Direct Investment (FDI), West Africa, PMG/ARDL, cointegration, Granger causality, macroeconomic variables

## 1.0 Introduction

Financial liberalization is unarguably one of the key drivers of modern technological, economic and social activities, foreign investment and indeed generally considered as the underpinnings to growth in international trade across the globe (Juma, 2012). African and West African countries in particular are not left out in rest of the world in pursuit of foreign investment. This is witnessed by numerous policy reforms such as Structural Adjustment Programmed (SAP) of 1986-1993 and 1999 and also the formation of the New Partnership for Africa's Development (NEPAD) in the 1980s. These programmes were geared towards increasing foreign investment to Africa as a major component (Salami *et al* 2012). Before the introduction of SAP in West Africa, there exists various forms of restrictive trade policy measures in the likes of tariffs imposition, import and export licensing requirements, exchange restrictions in international transactions, ceilings on Central Bank foreign exchange disbursements (Kwabena, 2013).

Another point of interest to scholars is foreign investments as component of globalization process which has been widely recognized as very important factors in the economic growth process. Hence, attracting foreign investment in the form of FDI has become vital component of development strategies for developing countries. In West Africa, foreign investment has been regarded as a critical source of capital inflow and a stimulant of economic growth not only because policy makers believe that FDI for instance will help bridge the large resource gap (that is savings-investment gap) in their economy, but also because it will help in the attainment of Millennium Development Goals.

Despite increasing flow of foreign investment into African nations as a whole over the decades, West African countries have not been able to attract the required level of investment to boost her economy. Thus, there has been prevalence of large resource gaps due to the inability of domestic financial systems in mobilizing resources. This is caused by excess of imports over exports leading to unfavourable balance of payments, low domestic savings, investment discrepancies, low per capita income, high unemployment rates, fluctuating exchange rates, high rate of inflation and falling growth rates of GDP which are developmental problems that foreign investment is supposed to reduce to a great extent. Also, low domestic savings occur due to prevalence of low private income and high budget deficits common in the region of West Africa.

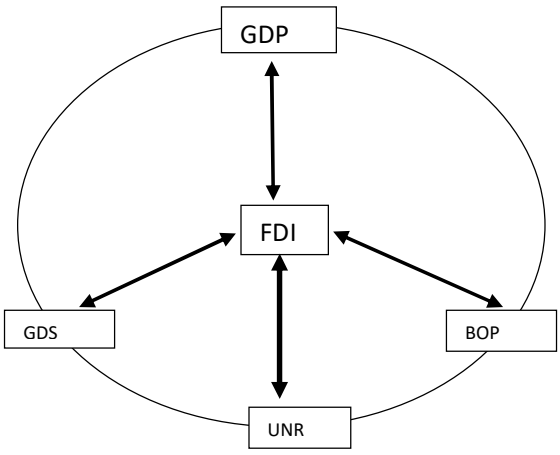


**Figure 1**: *Hypothesised possible link between foreign direct investment and the selected macroeconomic variables in West Africa: real gross domestic product (GDP), gross domestic savings (GDS), balance of payment (BOP) and unemployment (UNR).*

Figure 1 presents a hypothesised possible link between foreign direct investment and the selected macroeconomic variables in West Africa: real gross domestic product (GDP), gross domestic savings (GDS), balance of payment (BOP) and unemployment (UNR). In this framework, foreign direct investment may influence the macroeconomic variables and macroeconomic variables may determine the level of foreign direct investment. Among many empirical studies that have examined the causal effects of FDI on the economy Africa none has considered decomposing the economy into the selected variables. In fact, literature on FDI and Macro-economy in West African economy is still scarce. The focus of most studies has been on the effects of crude oil price on macroeconomic performance. Given the role of foreign direct investment in increasing the capital stock and promoting economic growth through financing capital formation and technological spillovers that offset the impact of diminishing returns to capital and allow the economy to continue to grow in the long run, it is important to empirically understand the interaction among these variables as presented in Figure 1.

From the foregoing, this study raises three important questions. First, does foreign direct investment stimulate the economy of West African? Only few studies have attempted to answer this question (See Sala &Trivin, 2014; Sukar& Hassan, 2011; Jugurnath, *et al*, 2016; *Sghaie* & Abida*,* 2013; Balasubramanyam*et al*., 1996). According to Akinlo (2003), FDI contributes to economic growth only when a sufficient absorptive capability is available in the host economy to absorb the advanced technologies. Furthermore, the beneficial impact of FDI is enriched in an environment characterized by an open trade and investment regime and macroeconomic stability (Balasubramanyam*et al*., 1996). Foreign investments are very important to every economy but in the world indicator it has been fluctuating due to poor investment climate, poor policy, financial crises, and corruption. However, most of the studies on the subject examine the effect of FDI on economic growth and a few examined the causal relation between FDI and the selected macroeconomic variables. But beyond economic growth, this study employed ten countries in West Africa to ascertain the effect of FDI on savings, investment, unemployment and balance of payments position.

Second, does macro-economy drives the foreign direct investment West Africa? Few studies have attempted to answer this question, and this shows the importance of this study. It is against the background that this study attempts to investigate the impact of foreign direct investment on selected macroeconomic variables in the selected West African countries and also investigate the long run relationship between these macro-economy variables and foreign direct investment in the selected West African countries. The study will establish the causal relationship between the macroeconomic variables of these economies and foreign direct investment inflows using Pedroni approach and Auto-Regressive Distributed Lag (ARDL) approach to cointegration analysis (pool mean group-PMG). This study extends its analysis by including trade openness and exchange rate in the analysis to capture the exposure of these economies to trade liberalization and international market.

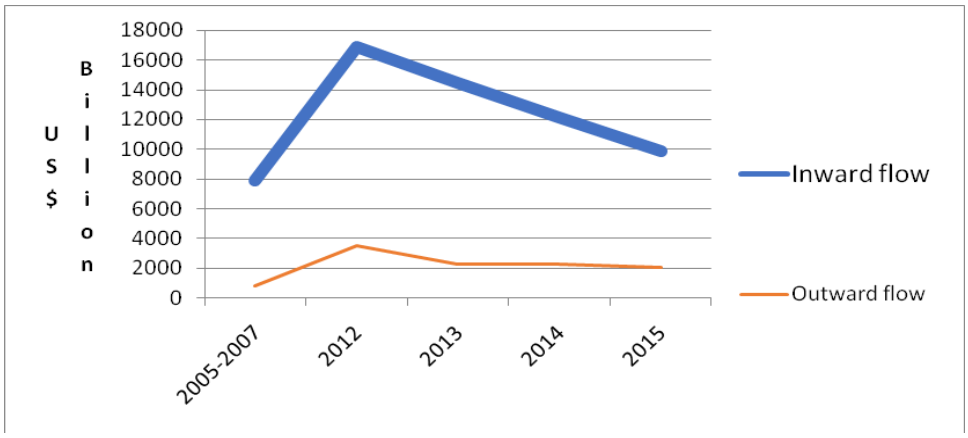
Furthermore, understanding the dynamic relationships that exist among foreign direct investment, growth, balance of payment, gross domestic savings, and unemployment is important since international trade and finance represent an important channel for resource and technological spill over among nations. Any impact of FDI on Macro-economy will significantly determine the pace of economic growth. Hence, the results of this study will be a

guide to policy makers in West Africa and other developing countries in developing countercyclical policies for addressing the effects of FDI on economic activities.

### 1.2 Stylized Facts on Foreign Direct Investment (FDI) Inflows in West Africa

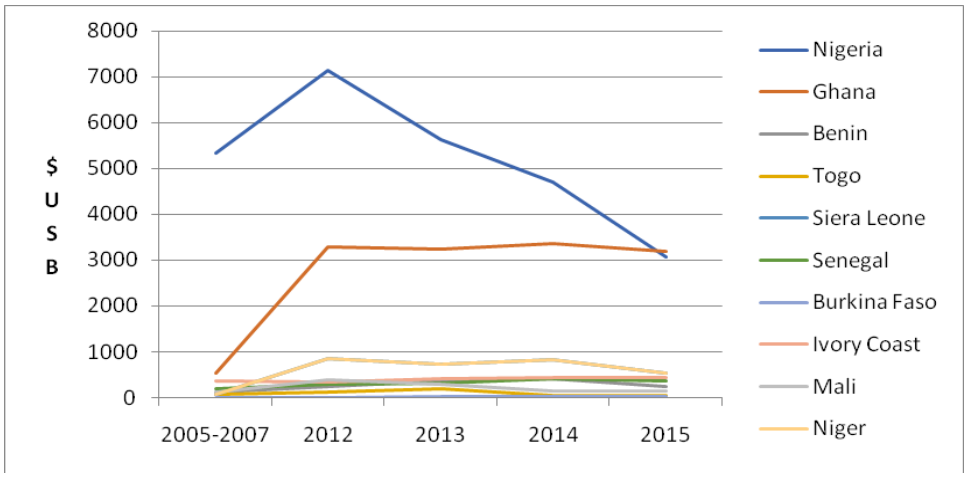
West Africa faces volatile FDI inflows. The global financial crises which began in United States of America and United Kingdom in the early 2004 until mid-2007 affected most economies of the world especially developing countries like West African countries. This brought about falling rates of investment (such as low remittances, decline in foreign aids, and low foreign direct investment (Ojuola, 2011). As can be seen in figures 2, FDI total inflow to West Africa was as low as US$ 7,920b in 2005-2007 but rose to US$16,873b in 2012. For the past few years FDI got to its peak in 2012 after which it continued falling at a rising rate in West Africa.

**Figure 2: Total FDI flow into West Africa (USS Billion) 2005-2015**



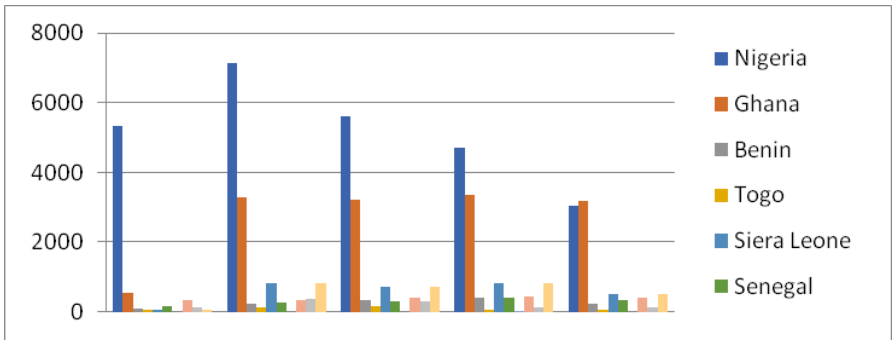

**Source: Author's Computation, using UNCTAD Stat online data**

**Figure 3 FDI Inflows by Countries (USS Billion) 2005-2015**




**Source: Author's Computation, using UNCTAD Stat online data**

**Figure 2.3 Recent Trend in FDI Inflows (US$b) to Selected West African Regions, 2005-2015**




**Source: Author's Computation, using UNCTAD Stat online data**

## 2. A Review of Theoretical and Empirical Literature of FDI and the Selected Macro-Economic Variables

### 2.1 Theoretical Review: The Neoclassical and the Endogenous Growth Models

The theoretical foundation on the effects of FDI and macro-economy with reference to growth identifies contrasting views from the Neoclassical and the Endogenous Growth models. First, the neoclassical model of economic growth proposed that the long-run growth could only result from technological progress in the form of labour force growth, which in econometrics terms is considered as exogenous variable. Some scholars like De Mello (1997) and Solow (1956) model have tried to model the effects of FDI within the neoclassical framework since it could stimulate economic growth if it influences technological progress positively and permanently. Their analysis was built on diminishing returns to capital inputs, economies are converging to the same steady-state growth rate in neoclassical growth theory. They conclude that FDI only affects growth in the short-run and leaves long-run growth unchanged. This proposition in neoclassical models stimulated the development of the endogenous growth model, which many regard as a more appropriate model emphasizing the role of technological change. Second, the endogenous growth model; at the forefront of theory are Lucas (1988), Rebelo (1991) and Romer (1986). They designed their model to encapsulate capital in the form of human capital accumulation and highlight the externalities that arise from these types of capital. The new growth theory places emphasis on technological change, on the other hand, FDI is assumed to have a positive impact on economic growth, both in the short and the long-run (Herzer & Klasen., 2008). According to the new growth theory, FDI is more productive than domestic investment, as FDI-related technological spillovers might offset the impact of diminishing returns to capital and allow the economy to continue to growth in the long run.

Building on the above models, FDI encourages the incorporation of new inputs and technologies in the production systems of host countries. FDI could also stimulate economic growth endogenously if it generates productivity, positive externalities and spill over effects. Since FDI is considered as an important source of know-how, human capital and technological diffusion, these factors can be initiated to promote economic growth through FDI inflows. Both direct and through channels from endogenous growth models can explain the effects of FDI inflows on growth more clearly, compared to the neoclassical growth

model. As such, it may be more appropriate to use endogenous growth models to explain the FDI–growth association.

Another point of interest to recent scholars is the direction causality between FDI and macroeconomic variables. The causality relation between FDI and growth is not necessarily unidirectional, and causality can work on both directions. The primary explanation brought by standard economic theory for the possibility of a reverse causality direction (i.e. from economic growth to FDI) is again based on the process of "cumulative causation." Reclining on this evidence, a long-term process of economic growth based on the development of productive capacities might well create new economic activities, new markets and a higher demand for new consumer products, which will in turn attract a higher level of FDI.

Other strand of literature documented that FDI might have an adverse effect on growth due to the intervening mechanisms of dependence and decapitalization theory. Amin (1974) proposed that foreign capital flows would not influence long-term economic growth in developing countries. The empirical study by Bornschier *et al*. (1978) found that FDI, foreign aid and trade have the long-term effect of decreasing the rate of economic growth and of increasing inequality. An adverse effect of FDI on growth can also be explained by decapitalization if FDI displaces savings in the country or diverts domestic capital toward areas of FDI activity from other more productive areas. According to Bornschier (1980) decapitalization is defined as the reduction in funds available for investment in the host country. Bornschier provides examples of decapitalization in the recipient country, especially least developed countries (LDCs). For example, LDCs strive to attract foreign investment in order to transfer advanced technology into their economies. These flows are mainly concentrated in industrial sectors, which are likely to employ much of the available capital for investment. Therefore, the capital formation available for use in other sectors of the host economy may be reduced. Consequently, FDI could influence higher investment and consumption in the short-term and reflect negatively on long-term growth (Bornschier, 1980, O'Hearn, 1990, Stoneman, 1975). This is another form of crowding out effect.

**2.2 Studies on the Relationship between Economic Growth and Foreign Investment**

There is a growing literature on the FDI and economic growth with a focus on developed economies but fewer discussions have been done in West Africa. Notable FDI and economic growth literatures in likes of (see NKOA, 2013; Agrawal, 2015; Samad, 2009; Hansen & Rand, 2006; Saqib, Masnoon, &Rafique, 2013). NKOA (2013) assessed the influence of FDI on economic growth in the CEMAC region (which includes Cameroon, Chad, Gabon, CAR, Equatorial Guinea, and Congo) from 1980-2010. The study used generalized moments method (GMM) to analyze the panel data and found that FDI contributed positively and significantly both to economic growth across the sub-region as well as in individual member states. Jugurnath*et al* (2016) investigated the effect of Foreign Direct Investment on the economic growth for Sub-Saharan African countries (consisting of 32 countries) from 2008-2014. They employed both static panel regression and dynamic panel techniques and found out that FDI have a positive and significant impact on economic growth.

Another strand of literature found negative relationship between FDI and economic growth.Saqib*et al* (2013) analyzed the impact of foreign direct investment on economic growth in Pakistan from 1981-2010. Considering FDI, Debt, Trade, Inflation and Domestic Investment (as explanatory variables), and GDP (the dependent variable.), they employed OLS and Cointegration techniques in analyzing the time series data. Their findings revealed that all the independent variables had negative relationship with GDP. Statistically, all the

variables except Debt showed a significant impact and they concluded that FDI had a negative role to play in Pakistan economy within the period of study. Agrawal (2015) explored the relationship between foreign direct investment and economic growth in the five BRICS economies from 1989–2012 Using panel cointegration method, the result revealed that foreign direct investment and economic growth are co-integrated, that is there is a long-term equilibrium relationship between them.

Hansen and Rand (2006) empirically investigated the casual relationship between FDI and GDP in 31 developing countries. They employed estimators for heterogeneous panel data and found a unidirectional causality between FDI and GDP (FDI causes growth). Esso (2010) studied the causal relationships between FDI and economic Growth in ten Sub-Sahara African countries, including Angola, Cameroon, Congo, Cote d'Ivoire, Ghana, Kenya, Liberia, Nigeria, Senegal, and South Africa from 1970 – 2007. The study employed cointegration, ECM and non-causality techniques and found out that there is a long-run relationship between foreign direct investment and economic growth in Angola, Cote d'Ivoire, Kenya, Liberia, Senegal and South Africa. Also, there is positive and significant long-run effect of foreign direct investment on growth in Angola and Cote d'Ivoire, while it is insignificant in Kenya. More so, FDI significantly causes economic growth in Angola, Cote d'Ivoire and Kenya, while economic growth causes FDI in Liberia and South Africa.

Samad (2009) examined the causal link between foreign direct investment and economic growth in 19 developing countries of South-East Asia and Latin America. Employing Cointegrationtest, Granger causality test and ECM, the result revealed that five countries in Latin America and one country in East and South East Asia have long run relationship. To these countries also, causality run from GDP to FDI implying unidirectional causality. While to seven countries (two from Latin America and five from East and South East Asia), there is bidirectional causality between GDP and FDI. Finally, to the remaining Four countries (one from Lain America and three from East and South East Asia), the unidirectional causality run from GDP to FDI.

### 2.2.1 Studies on the Relationship between Balance of Payment and Foreign Direct Investment

Several researches have been carried out in this area with mixed findings as well. Some studies document positive relationship between FDI and balance of payment. (See, Nguku, 2013; Hossain, 2010; Ehimare 2012). Nguku (2013) examined the impact of FDI on Balance of Payment in Kenya with time series data spanning 1993-2012. The study employed descriptive analysis as well as OLS regression in analysis of the data and the result showed that FDI did not have a significant impact on current account balance at all acceptable levels of significance. The study also concludes that FDI does not impact on exports, imports, or current account balance and as such there is no evidence of FDI having a significant impact on balance of payments in Kenya.

Ehimare (2012) analyzed the effect of FDI inflows on Nigeria's Balance of Payments from 1980-2009. Employing OLS technique, the findings revealed that FDI have positive and significant impact on the current account balance in the BOP while domestic investment is inelastic to BOP.

However, another strand of literature document negative relationship between FDI and balance of payment. Abayomi-Alli*et al* (2012) assessed the impact of FDI on Nigeria's BOP from 1980-2011 by adopting cointegration and ECM methods and found out that FDI, openness of the economy and GFCF had negative and insignificant impact on BOP. Also the

findings revealed that only government expenditure and exchange rates met apriori signs and significance.

### 2.2.2 Studies on the Relationship between Domestic Savings and Foreign Investments

The empirical evidence on the relationship between Domestic investments and foreign investments are enormous. A study conducted by Eregha (2012) for African countries revealed that FDI have positive and significant impact on domestic investment and economic growth. A similar result was found in a study carried out by Ghazali (2010) on the relationship between FDI, Domestic Investment and economic growth in Pakistan. That is, there exist long run relationship between FDI and domestic investment and economic growth.

Wang (2010) examined the impact of inward FDI on domestic investment in 50 developed and developing countries panel data from 1970 to 2004. Employing pooled regression technique, the result revealed a negative and significant effect on domestic investment of the LDCs while a neutral impact occur in the developed countries.

Acar, Eris and Tekce (2012) explored the relationship between FDI and domestic investment in Mena region using panel data spanning 1980 to 2008. The study adopted dynamic panel GMM technique and the result showed that FDI had negative and significant impact on domestic investment (GFCF) and concludes that FDI crowds out investment.

Saglam and Yalta (2011) examined the dynamic linkages among foreign direct investment, private and public investment in Turkey from 1970-2009. The study employed VAR technique and the result revealed that there is no long run relationship between foreign direct investment, private investment and public investment. Hence FDI had a poor contribution to Turkey investment path.

Lean and Tan (2011) analyzed the relationship between foreign direct investment, domestic investment and economic growth in Malaysia with time series data spanning 1970-2009. Using VAR methodology, the result revealed that FDI crowds in domestic investment. Thus, FDI had positive and significant effect on domestic investment. There is also a long run relationship among FDI, domestic investment and economic growth.

Pilbeam and Obolevciute (2012) in the quest to ascertain whether FDI crowds in or out domestic investment in 26 European Union countries with data from 1990-2008, employed panel GMM and found out that FDI had negative and significant impact on domestic investment for the new EU. While for the older EU of 14 states, FDI was detected to have crowd out investment. In the same manner Kamaly (2014) using data on 16 emerging countries to analyze whether FDI crowds out or in investment for 30-year period with a 2 stage least square method found out that FDI had a positive and significant effect on domestic investment.

Mileva (2008) carried out a panel study on the impact of capital flows (including foreign direct investment, foreign loans and portfolio flows) on the domestic investment in 22 transition economies from 1995-2005. The study adopts both panel and static panel and the result showed that FDI and loans were positive and significant in influencing domestic investment while in the dynamic panel, FDI and loans were insignificant. Portfolio investment has no effect on domestic investment in both models.

### 2.2.3 Studies on the Relationship between Unemployment Rates and Foreign Investments

A lot of studies have also been carried out on the relationship between foreign investments and unemployment rate. Tshepo (2014) investigated the impact of foreign direct investment on economic growth and employment in South Africa from 1990-2013. The study employed cointegration and granger causality techniques to analyze the time series data. The results revealed a long run relationship between the variables. Also the causality result runs from FDI to GDP and from FDI to employment.

Habib and Sarwar (2013) studied the impact of foreign direct investment on employment level in Pakistan from 1970-2011. The variables used include employment level (as dependent) and FDI, GDP per capita and exchange rates (as independent variables). Using cointegration approach, the findings revealed that there is a long run relationship among the variables. Also, there is positive and significant relationship between Employment level and FDI and between employment level and GDP per capita while there is a negative and significant relationship between employment level and exchange rate in Pakistan.

Brincikova and Darmo (2014) analysed the impact of foreign direct investment on employment in V4 countries from 1993-2012. Using panel OLS and modified Okun's law, the result revealed that there is no statistically significant impact of FDI on employment and as such could not confirm positive effect of FDI inflow on employment of V4 countries.

Elekwa, Aniebo and Ogu (2016) analyzed the impact of foreign portfolio investment on employment rate in Nigeria from 1980-2014. The study employed single equation and reduced form specification techniques and their result revealed that portfolio has a long term positive and significant impact on employment rate. Hence the outcome supports the general view of positive relationship between FPI and GDP.

Okoro, Mathew, and Atan (2014) examined the impact of Foreign Direct investment on employment generation in Nigeria. Employing OLS and granger causality approach, their findings indicated that FDI had positive and significant impact on employment rate in Nigeria. Mehra (2013) empirically examined the impact of foreign direct investment on employment and economic growth in India. The study employed multiple regressions and the result revealed that FDI had positive and significant impact on GDP of India while FDI had negative influence on employment rate.

## 3. Data and Methodology

### 3.1 Data and Measurement

The selection of the sample period and countries are based on the availability of annual data, spanning the period 1990 to 2016. The selected West African market is classified by World Bank. Thus, this study makes use of a balanced panel data set of 10 West African countries; Benin, Burkina Faso, Cote D'Ivoire, Ghana, Mali, Niger republic, Nigeria, Senegal, Sierra Leone, and Togo. The considered panel data series data on output, FDI inflows, trade openness and exchange rate are obtained from the World Development Indicators (WDI) online database published by the World Bank. The measurement of the above variables is as follows:

Gross domestic product (Output): GDP figures are measured in current US dollars by using current exchange rates of domestic currency against the US dollar. The GDP figures are divided by total population of the country to get the per capita GDP measure. Invariably, it based on constant currency unit.

Foreign direct investment (FDI): FDI is measured in current US dollars and this is the total of equity capital, reinvestment of earnings, and also other long- and short-term capital as indicated in the balance of payments. FDI is divided by total population of the country to get per capita FDI inflows.

Gross domestic savings (GDS): This represents gross domestic savings scaled by GDP. Gross savings is GDP less final consumption expenditure (total consumption). We expect to see a positive relationship between this variable and foreign direct investment.

Openness: A host country's trade openness is an important element for FDI, and its importance increasing specifically with Sub-Saharan African FDI. Openness is essential for foreign investors who target a particular country and planning to operate export-motivated FDI in that country. A high openness degree reflects good connections with the regional and global markets and foreign investors can be confident that they will have accessible channels for their trade. Given that the data sample in this thesis covers the selected African countries, and these countries assumed to have already established effective trade channels, it is expected, therefore, to find a positive impact of openness on FDI inflows in these countries.

Exchange rates: The exchange rate between the host and home country is often used to measure the costs of production inputs. Clegg and Scott-Green (1999) showed that if all things being equal, an appreciation of the home country's currency should increase growth as it becomes cheaper to 'hire' a given amount of labour in that host country. Thus, an increase in the real exchange rate (a real depreciation of the currency of the host country) is expected to have a positive effect on growth in the host country. Exchange rate in year t, defined as the ratio of domestic currency to US dollars.

### 3.2 Model Specification

Given that the goal is to investigate the long-run association among economic growth and FDI, while trade openness and exchange rate are used as control variables. The empiricalanalysis makes use of panel cointegration methodologies. To thisend, the empirical analysis employs a panel cointegration approach, aswell as panel non-causality tests to identify the directionof causality among these variables. Based on the study objectives, thebenchmark model equation yields:

$$(MAE)_{it} = f(fdi_{it}, opn_{it}, exr_{it}, v_i) \quad (1)$$

MAE represents macroeconomic variables, economic growth (rgdpc), balance of payment (bop), gross domestic savings (gds) and unemployment (unr). We have also foreign direct investment net inflows as our main variable of interest,while our moderators or control variables are trade openness and exchange rate. represents individual fixed country effects. Similarly, countries are indicated by the subscript i (i=1, ..... ,N),while t represents the time period (t=1, .....,T).Building on the past empirical evidence, we have decomposed eqt.1 into four specification to accommodate various macroeconomic variables. It is represented as thus;

**Specification 1**

$$rgdpc_{it} = \alpha_i \mid \delta_i t \mid \beta_{1i} fdi_{it} \mid \beta_{2i} opn_{it} \mid \beta_{3i} exr_{it} \mid v_{it} \quad (1a)$$

**Specification 2**

$$bop_{it} - \alpha_i + \delta_i t + \beta_{1i} fdi_{it} + \beta_{2i} opn_{it} + \beta_{3i} exr_{it} + v_{it} \quad (1b)$$

**Specification 3**

$$gds_{it} = \alpha_i + \delta_i t + \beta_{1i} fdi_{it} + \beta_{2i} opn_{it} + \beta_{3i} exr_{it} + v_{it}$$

**Specification 4**

$$unr_{it} = \alpha_i + \delta_i t + \beta_{1i} fdi_{it} + \beta_{2i} opn_{it} + \beta_{3i} exr_{it} + v_{it} \quad (1d)$$

Where $\alpha i$ and $\delta i$ are the intercept and the parameter associated with the trends respectively. The use of the logarithm permits to remove heteroscedasticity from the regression model and also to interpret the coefficients as long-term elasticities.

### 3.3 Cross Dependence (CD) and Unit Root Tests

We first identify whether the given series are cross-sectional dependent. To this end, the empirical analysis employs Pesaran's (2004) CD test. To select the correct type of unit root test, we must first test for cross-sectional dependence for the variables and the cointegrating equation. To that aim, we employ the Lagrange Multiplier (LM) and bias-adjusted Lagrange Multiplier tests developed by Breusch and Pagan (1980) and Pesaran, Ullah, and Yamagata (2008), respectively. It is well known that when T is larger than N (T > N, as is the case in this paper), LM and LMadj tests are favourable to the tests suggested by Frees (1995) and Pesaran (2004). The LM test has a $\chi 2$ distribution with a cross-sectional independence null hypothesis. It is based on the sum of squared coefficients of correlation among cross-sectional residuals obtained through ordinary least squares (OLS). However, the LM test is biased when the group mean is equal to zero and the individual mean is different from zero. Therefore, Pesaran et al. (2008) corrected for bias by including variance and mean in the test statistic. In this way, they obtained the bias-adjusted LM test, which has standard normal distribution.

#### 3.3.1 Panel Unit Root Tests

Since none of the panel unit root test is free from some statistical shortcomings in terms of size and power properties, it is better for us to perform several unit root tests to infer an overwhelming evidence to determine the order of integration of the variables. In this paper three panel unit root tests: Levin, Linand Chu (LLC 2002), Im, Peasaran and Shin (IPS, 2003), and Breitung (2000) tests are applied.

The LLC test is based on the assumption that the persistence parameters are common across cross-sections so that $\rho_i = \rho$ for all $i$ , but this assumption is not true for several variables. The second and third tests assume cross-sectional independence. This assumption is likely to be violated for the selected variables. It has been found by Banerjee et al. (2001) that these tests have poor size properties and have a tendency to over-reject the null hypothesis of unit root if the assumption of cross-section independence is not satisfied. Pesaran (2007) and Choi (2006) have derived other tests statistics to solve this problem.

Levin, Lin and Chu (LLC, 2002) considered the following regression equation:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{z_i} \gamma_{ij} y_{it-j} + X'_{it}\delta + \varepsilon_{it} \quad (2)$$

where, $\Delta y_{it} = y_{it} - y_{i,t-1}$ here the assumption is $\alpha = \rho - 1$ i.e. $\rho_i = \rho$ for all , but allow the lag order for the difference terms $\rho_i$ to vary across cross-sections. Here the null

hypothesis to be tested is $H_0: \alpha - 0$ against the alternative hypothesis $H_0: \alpha < 0$. The null hypothesis indicates that there is a unit root while the alternative hypothesis indicates that there is no unit root.

Im, Pesaran and Shin (IPS, 2003) proposed the test statistic using the following model:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{p_i} \gamma_{ij} y_{it-j} + X_{it}'\delta + \varepsilon_{it} \quad (3)$$

where, $\Delta y_{it} = y_{it} - y_{i,t-1}$, $y_{it}$ $(i = 1,2, \ldots\ldots\ldots\ldots\ldots, n; t = 1,2 \ldots\ldots\ldots\ldots T)$ , is the series under investigation for country i over period t, pi is the number of lags in the ADF regression and $\varepsilon_{it}$ errors are assumed to be independently and normally distributed random variables for all $i$ and t with zero mean and finite heterogeneous variance $\sigma_i^2$. Both $\alpha_i$ and $\rho_i$ in Eq. (3) are allowed to vary across the countries. The null hypothesis to be tested is that each series in the panel contains a unit root, i.e. $H_0: \alpha_i = 0 \; \forall \; i$ against the alternative hypothesis that some of the individual series have unit root but not all.

$$H_1: \begin{cases} \alpha_i = 0; & for\ i \\ \alpha_i < 0; & for\ at\ least\ one\ i \end{cases}$$

Breitung (2000) showed that when individual-specific trends are included, the IPS test can suffer from a loss of power due to bias correction. He proposes an alternative test unit root which corrects for the loss of power and shows that it has greater power than the IPS test. The null hypothesis of Breitung's test is that the panel series exhibits non-stationary difference, and the alternative hypothesis assumes that the panel series is stationary.

### 3.3.2 Heterogeneous Panel Cointegration

Granger (1981) showed that when the series becomes stationary only after being differenced once (integrated of order one), they might have linear combinations that are stationary without differencing. In the literature, such series are called ''cointegrated''. If integration of order one is implied, the next step is to use cointegration analysis in order to establish whether there exists a longrun relationship among the set of the integrated variables in question. Earlier tests of cointegration include the simple two-step test by Engle and Granger (1987) (EG). However, the EG method suffers from a number of problems. Therefore, this study shall follow the recently developed panel cointegration tests by Pedroni (2004) provide a technique that allows for using panel data thereby overcoming the problem of small samples, inaddition to allowing for heterogeneity in the intercepts and slopes of the cointegrating equation. Pedroni's method includes a number of different statistics for the test of the null of no cointegration in heterogeneous panels. A group of the tests are termed ''within dimension'' (panel tests) and the other group as ''between dimension'' (group tests). The ''within dimension'' tests pool the data across the "within dimension". It takes into account common time factors and allows for heterogeneity across members. The ''between dimension" tests allow for heterogeneity of parameters across members, and are called "group mean cointegration statistics''.

Seven of Pedroni's tests are based on the estimated residuals from the following long-run model:

$$y_{it} = \alpha_i + \sum_{j=1}^{m} \beta_{ji} x_{jit} + \varepsilon_{it} \quad (4)$$

where $\varepsilon_{it} = \rho_i \varepsilon_{i(t-1)} + w_{it}$ are the estimated residualsfrom the panel regression.The null hypothesis tested is whether $\rho_i$ is unity. Theseven statistics are normally distributed. The statisticscan be compared to appropriate critical values, and ifcritical values are exceeded then the null hypothesis ofno cointegration is rejected implying that a long-run relationship between the variables does exist.

### 3.3.3 The Panel ARDL (Autoregressive Distributed Lag) Approach (Short and Long Run Elasticity)

Following recent empirical studies on panel ARDL analysis, we could estimate the long-run parameters from the panel ARDL approach developed by Pesaran, Shin, and Smith (1999).We correctly chose the pooled mean group estimator (PMGE) given that the Hausman test result indicated slope homogeneity in the cointegrating vector. In a panel ARDL (p, q) framework, it enjoys several advantages over other estimators like MG: Firstly, estimate short and long-run effects simultaneously from (ARDL) model. Secondly, failure to test hypothesis on the estimated coefficients in the long-run due to endogeneity problems in Engle Granger method can be resolved by autoregressive distributed lag approach. Furthermore, PMG allows short-run coefficients, including the intercepts, the speed of adjustment to the long-run equilibrium values, and error variances to be heterogeneous country by country, while the long-run slop coefficients are restricted to be homogeneous across countries. Interestingly, this methodology allows estimations of different variables with different order of stationarity, i.e. it is valid whether the variables of interest are I(1) or I(0).

### 3.3.4 The general form of the empirical specification of the PMG model can be written as below.

$$\Delta lnMAE_{it} = a_{1t} + \sum_{k=1}^{m} \beta_{1k} \Delta lnMAE_{it-k} + \sum_{k=1}^{m} \delta_{1j} \Delta lnfdi_{it-k} + \sum_{k=1}^{m} \delta_{1j} \Delta lnopn_{it-k} + \sum_{k=1}^{m} \delta_{1j} \Delta lnexr_{it-k} + u_{1it} \quad 5$$

where MAE is a set macroeconomic variables, fdi is foreign direct investment, opn is trade openness and ext is exchange rate, the subscripts $i$ *and* $t$ represent country and time, respectively. $u$ represents stochastic error term

### 3.3.5 Panel Granger Causality

Next we examine the direction of causality between the variables in a panel context. Engle and Granger (1987) show that if two non-stationary variables are cointegrated, a VAR in first differences will be miss-specified. Given that we found a long-run equilibrium relationship between selected macro-economy and FDI when testing for Granger causality, we specify a model with a dynamic error-correction representation. The VAR model is augmented with a one-period lagged error- correction term that is obtained from the cointegrated model. This crucial part of the analysis reveals which of the three specifications apply for each case and how policy making can be administered, so that to improve the economic growth. Therefore, the following specification will be estimated.

**Specification 1**

$$\Delta lnrgdpc_{it} = a_1 + \sum_{k=1}^{m} a_{11}\Delta lnrgdpc_{it-k} + \sum_{k=1}^{m} a_{12}\Delta lnfdi_{it-k} + \sum_{k=1}^{m} a_{13}\Delta lnopn_{it-k} + \sum_{k=1}^{m} a_{14}\Delta lnexr_{it-k} + \psi_{1i}ect_{it-1} + u_{1it} \quad (6)$$

$$\Delta lnfdi_{it} = a_1 + \sum_{k=1}^{m} a_{11}\Delta lnrgdpc_{it-k} + \sum_{k=1}^{m} a_{12}\Delta lnfdi_{it-k} + \sum_{k=1}^{m} a_{13}\Delta lnopn_{it-k} + \sum_{k=1}^{m} a_{14}\Delta lnexr_{it-k} + \psi_{1i}ect_{it-1} + u_{1it} \quad (7)$$

**Specification 2**

$$\Delta lnbop_{it} = a_1 + \sum_{k=1}^{m} a_{11}\Delta lnbop_{it-k} + \sum_{k=1}^{m} a_{12}\Delta lnfdi_{it-k} + \sum_{k=1}^{m} a_{13}\Delta lnopn_{it-k} + \sum_{k=1}^{m} a_{14}\Delta lnexr_{it-k} + \psi_{1i}ect_{it-1} + u_{1it} \quad (8)$$

$$\Delta lnfdi_{it} = a_1 + \sum_{k=1}^{m} a_{11}\Delta lnbop_{it-k} + \sum_{k=1}^{m} a_{12}\Delta lnfdi_{it-k} + \sum_{k=1}^{m} a_{13}\Delta lnopn_{it-k} + \sum_{k=1}^{m} a_{14}\Delta lnexr_{it-k} + \psi_{1i}ect_{it-1} + u_{1it} \quad (9)$$

**Specification 3**

$$\Delta lngds_{it} = a_1 + \sum_{k=1}^{m} a_{11}\Delta lngds_{it-k} + \sum_{k=1}^{m} a_{12}\Delta lnfdi_{it-k} + \sum_{k=1}^{m} a_{13}\Delta lnopn_{it-k} + \sum_{k=1}^{m} a_{14}\Delta lnexr_{it-k} + \psi_{1i}ect_{it-1} + u_{1it} \quad (10)$$

$$\Delta lnfdi_{it} = a_1 + \sum_{k=1}^{m} a_{11}\Delta lngds_{it-k} + \sum_{k=1}^{m} a_{12}\ \Delta lnfdi_{it-k} + \sum_{k=1}^{m} a_{13}\Delta lnopn_{it-k} + \sum_{k=1}^{m} a_{14}\Delta lnexr_{it-k} + \psi_{1i}ect_{it-1} + u_{1it} \quad (11)$$

**Specification 4**

$$\Delta lnunr_{it} = a_1 + \sum_{k=1}^{m} a_{11}\Delta lnunr_{it-k} + \sum_{k=1}^{m} a_{12}\Delta lnfdi_{it-k} + \sum_{k=1}^{m} a_{13}\Delta lnopn_{it-k} + \sum_{k=1}^{m} a_{14}\Delta lnexr_{it-k} + \psi_{1i}ect_{it-1} + u_{1it} \quad (12)$$

$$\Delta lnfdi_{it} = a_1 + \sum_{k=1}^{m} a_{11}\Delta lnunr_{it-k} + \sum_{k=1}^{m} a_{12}\Delta lnfdi_{it-k} + \sum_{k=1}^{m} a_{13}\Delta lnopn_{it-k} + \sum_{k=1}^{m} a_{14}\Delta lnexr_{it-k} + \psi_{1i}ect_{it-1} + u_{1it} \quad (13)$$

where m is the lag length determined by significance tests. Short run Granger causality is examined by testing  = 0, i, j = 1. . .6, with i ≠ j. The coefficient in $ect_{it-1}$represents how fast deviations from the long-run equilibrium are eliminated following changes in each variable, therefore we test $\psi_{ji} = 0$ ∀j, i. Estimation results from Eqs. (6)–(13) are summarized in Table 5. The null hypothesis is that there is no Granger-causal relation-ship between variables. The values shown are p values for Wald tests with $X^2$ distribution. Symbol Δ is the first difference operator. Based on this test, an endogenous variable is treated as exogenous. The $X^2$ Wald statistic tests the joint significance of each of the endogenous variables and the joint significance of all endogenous variables in each equation (we have two of them). For example, the value of $X^2$ for $\Delta lnfdi_{it}$ with respect to  stands for the hypothesis that the lagged coefficients of fdi are equal to zero. The same applies for the rest of the variables in each of the Eqs. (6)–(13)shown in Table 5.  Example, FDI and the other variables Granger cause *rgdpc.* If the null hypothesis of block exogeneity cannot be rejected, that means that *FDI* does not Granger cause *rgdpc.*

## 4.0 Empirical Results and Discussion of Findings

### 4.1 Cross Sectional Dependency and Unit Root Test

We first presented the results of cross-sectional dependence tests in Table 1.As seen in Table 1, all the LM tests indicate the presence of cross-sectional dependence at a 1% significance level for the variables. Thus, we can proceed by implementing unit root tests that allow for cross-sectional dependence. The results of panel unit root tests reported in Table 2 shows that all variables are integrated with first order independently on the type of the tests used. This evidence of first order integration of all variables informed the use of hypothesis of cointegration among the variables in the respective models.

Table 1: Results of cross-sectional dependence tests

| *Variables* | **Breusch-Pagan LM** | **Pesaran scaled LM** | **Bias-corrected scaled LM** | **Pesaran CD** |
|---|---|---|---|---|
| ***lnrgdpc*** | 500.679 [0.0000] | 46.9787 [0.0000] | 46.7864[ 0.0000] | 18.0043 [0.0000] |
| ***Lnbop*** | 121.858 [0.0000] | 7.04748 [0.0000] | 6.85517[ 0.0000] | 4.2144[0.0000] |
| ***Lngds*** | 274.954[0.0000] | 23.1851[0.0000] | 22.9928[0.0000] | 11.4595[0.0000] |
| ***lnunr*** | 136.174[0.*0000*] | 8.5565[0.0000] | 8.3642[0.0000] | -.1.8080 [0.0000] |
| ***Lnfdi*** | 449.159[0.0000] | 41.5480[0.0000] | 41.3557[0.0000] | 20.0322[0.0000] |
| ***lnopn*** | 350.413[0.0000] | 31.1393[0.0000] | 30.947[0.0000] | 16.5004[0.0000] |
| ***lnexr*** | 826.774[0.0000] | 81.3521[0.0000] | 81.1598[0.0000] | 27.8826[0.0000] |

Notes: P-values of test statistics are presented in parentheses

Source: Authors' calculations.

Table 2: LLC Briet IPS unit root test

| *variables* | **Level I(0)** | | | **Difference I(1)** | | |
|---|---|---|---|---|---|---|
| | **LLC** | **Briet** | **IPS** | **LLC** | **Briet** | **IPS** |
| ***lnrgdpc*** | **3.01211** (0.9987) | **2.13533** ( 0.9836) | **3.32785** (0.9996) | **-10.20***** (0.0000) | **-2.502***** (0.0062) | **-9.885***** (0.0000) |
| ***lnbop*** | **-6.39449** (0.0000) | **5.56027** (1.0000) | **-3.07131** (0.0011) | **-11.98***** (0.0000) | **5.504***** (1.0000) | **-12.11***** ((0.0000) |
| ***lngds*** | **-2.19228** (0.0142) | **5.13919** (1.0000) | **-1.19244** (0.1165) | **-14.17***** (0.0000) | **3.636***** (0.9999) | **-15.01***** (0.0000) |
| ***lnunr*** | **-2.33857** (0.0097) | **-1.57620** (0.0575) | **-2.01034** (0.0222) | **-15.66***** (0.0000) | **-3.793***** (0.0001) | **-15.70***** (0.0000) |
| ***lnfdi*** | **-3.83728** (0.0001) | **-2.7846** (0.0027) | **-4.51222** (0.0000) | **-12.56***** (0.0000) | **-6.656***** (0.0000) | **-13.153***** ((0.0000) |
| ***lnopn*** | **0.06364** (0.5254) | **-0.45496** (0.3246) | **0.94731** (0.8283) | **-13.29***** (0.0000) | **-5.328***** (0.0000) | **-12.36***** (0.0000) |
| ***lnexr*** | **-6.37156** (0.0000) | **1.31842** (0.9063) | **-4.18379** (0.0000) | **-12.58***** (0.0000) | **-6.541***** (0.0000) | **-11.41***** ((0.0000) |

All the variables are in the natural log form. *Significance at 10%. **Significance at 5%. ***Significance at 1%.

The asterisks indicate the rejection of the null hypothesis of unit root

**4.1.2 Results of Panel Cointegration Test**

In this paper, the hypothesis of cointegration between all variables is tested using Pedroni (2004)cointegration tests, all seven panel cointegration tests. The results of both tests (between and within dimension) indicate that the null hypothesis of no-cointegration is rejected at 5% and 1% significance levels. Hence, the empirical results support the hypothesis of cointegrationamong all variables in the specification [1-4]. This empirical finding proves evidence for the presence of a long-term equilibrium between real GDP, balance of payment; gross domestic saving, unemployment and foreign direct investment respectively (see Tables 3). Our findings supportthe endogenous growth model and also in line with some empirical studies (see Lucas, 1988; Rebelo, 1991; Romer, 1986).

Now our co-integration results have confirmed that in the long run the error is connected by the short run dynamics. Furthermore, we want to check for error corrections and granger causality after short and long run analysis by error correction mechanism.

**4.1.2 Long Run Analysis**

Next, this study estimated the long-run parameters in the cointegrating vector using the PMG estimator. This is informed with a strong evidence from the hausman test which indicates a Prob> chi2 of 0.6406, 0.0567, 0.3654 and 0.2386 respectively, which are more than 5% level of significance indicating that PMG mean is preferred to MG estimator (see table 4). Also, building on the existing literature, PMG estimator allows for heterogeneous slope coefficients across group members and accounts for crosssectional dependence. This indeed shows that PMG estimator is the most appropriate model. FDI coefficients are statistically significant at the 10% and 1% level in Spec. 1 & 3 as demonstrated in Table 4. The coefficients can be interpreted as long-run elasticity estimates due to the fact that all variables are expressed in natural logarithms. They indicate that for the Spec.1 a 1% increase in FDI raises economic growth by 0.1309%. Meanwhile, a 1% improvement in FDI in Spec.3 boosts gds by 0.3991% in the long run. These two coefficient estimates are positively significant as expected in theory. Surprisingly, the coefficient of FDI in spec.4 is negative and statistically significant at 10% level indicating that an increase in FDI by 1% would significantly reduce unemployment -0.0062% in the selected West African nations in the long-run. The negative relationship between fdi and unr is similar to the findings of a number of existing studies in the literature including Elekwa, Aniebo and Ogu (2016), Okoro, Mathew and Atan (2014), Brincikova and Darmo (2014), Habib and Sarwar (2013). Exchange rate and trade openness elasticity indicate statistically significant at the 10% and 1% level across Spec. [1-3].

**4.1.3 Short Run Analysis**

The short-run estimates are presented in Table 4. The coefficient of ECM (-1) in all the specifications is negative and significant at 1 per cent level with over 35 per cent of the short-run disequilibrium corrected in the long-run. Surprisingly, all the FDI is statistically significance in all the specifications even coefficients are in line with the apriori expectations.

Table 3; Pedroni Cointegration Result

| | Spec 1 | | | | Spec 2 | | | | Spec 3 | | | | Spec 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Within-dimension** | | | | | | | | | | | | | | | | |
| | Stat | Prob. | w.Stat | Prob. | Stat | Prob. | W. Stat | Prob. | Stat | Prob. | W. Stat | Prob. | Stat | Prob. | W.Stat | Prob. |
| Panel v-Statistic | -0.159 | 0.5631 | 0.563 | 0.2866 | 0.010 | 0.4958 | -1.921 | 0.9726 | -0.078 | 0.5311 | -1.645 | 0.9500 | 3.6626*** | 0.0001 | -0.040 | 0.5158 |
| Panel rho-Statistic | -0.997 | 0.1594 | -1.658** | 0.0486 | -4.204*** | 0.0000 | -5.109*** | 0.0000 | -1.143 | 0.1265 | -0.879 | 0.1896 | -3.616*** | 0.0001 | -1.844** | 0.0326 |
| Panel PP-Statistic | -2.276** | 0.0114 | -3.112*** | 0.0009 | -9.315*** | 0.0000 | -10.93*** | 0.0000 | -4.586*** | 0.0000 | -4.125*** | 0.0000 | -6.067*** | 0.0000 | -3.929*** | 0.0000 |
| Panel ADF-Stat. | -1.967** | 0.0246 | -2.345*** | 0.0095 | -8.232*** | 0.0000 | -7.602*** | 0.0000 | -4.162*** | 0.0000 | -3.646*** | 0.0001 | -5.542*** | 0.0000 | -3.134*** | 0.0009 |
| **Betwn-dimension** | | | | | | | | | | | | | | | | |
| | Stat | Prob. | | | Stat | Prob. | | | Stat | Prob. | | | Stat | Prob. | | |
| Group rho-Statistic | -0.964 | 0.1675 | | | -2.630** | 0.0043 | | | -0.148 | 0.4413 | | | -0.613 | 0.2700 | | |
| Group PP-Statistic | -3.272*** | 0.0005 | | | -15.77*** | 0.0000 | | | -3.963*** | 0.0000 | | | -3.437*** | 0.0003 | | |
| Group ADF-Stat. | -2.516*** | 0.0059 | | | -7.986*** | 0.0000 | | | -3.278*** | 0.0005 | | | -2.113** | 0.0173 | | |

Table 3: Pedroni [2004] Cointegration tests

Notes: Null hypothesis: No cointegration. Trend assumption: Deterministic intercept and trend. Lag selection: Automatic AIC with a max lag of 2. *** designate the significance at the 1% significance level. ** designate the significance at the 5% significance level.

Table 4: Results of panel ARDL estimation.

| | **Pool mean group** | | | | **Mean group** | | | |
|---|---|---|---|---|---|---|---|---|
| ***Long run Elasticity*** | | | | | | | | |
| **Panel A** | **Spec 1** | **Spec 2** | **Spec 3** | **Spec 4** | **Spec 1** | **Spec 2** | **Spec 3** | **Spec 4** |
| ***Variables*** | ***lnrgdpc*** | ***lnbop*** | ***lngds*** | ***lnunr*** | ***lnrgdpc*** | ***lnbop*** | ***lngds*** | ***lnunr*** |
| ***Lnfdip*** | 0.1309*** | -0.0989 | 0.3991*** | -0.0062* | 0.2555 | -0.1251 | -0.0983 | -0.0057 |
| | [0.000] | [0.077] | [0.000] | [0.074] | [0.090] | [0.253] | [0.768] | [0.771] |
| ***lnopn*** | -0.0536 | -1.363*** | 1.7449*** | 0.0288** | 0.2504 | -2.6039 | 4.161 | 0.038 |
| | [0.199] | [0.000] | [0.000] | [0.001] | [0.529] | [0.105] | [0.170] | [0.303] |
| ***lnexr*** | -0.0406** | -0.0503 | 0.7192*** | 0.0079*** | 0.2657 | 0.6446 | 0.329 | -0.076 |
| | [0.106] | [0.807] | [0.000] | [0.003] | [0.128] | [0.083] | [0.628] | [0.242] |
| ***Short run*** | | | | | | | | |
| ***Panel B*** | | | | | | | | |
| ***variables*** | ***Δlnrgdpc*** | ***Δlnbop*** | ***Δlngds*** | ***Δlnunr*** | ***Δlnrgdpc*** | ***Δlnbop*** | ***Δlngds*** | ***Δlnunr*** |
| ***ect(-1)*** | -0.3557*** | -0.876*** | -0.367*** | -0.388*** | -0.5416*** | -0.5782 | -0.633*** | -0.614*** |
| | [0.0001] | [0.000] | [0.000] | [0.000] | [0.000] | [0.352] | [0.000] | [0.000] |
| ***Δlnfdi*** | 0.0285 | -0.2092 | 0.0800 | 0.0320 | -0.0188 | 0.0732 | 0.0306 | 0.0223 |
| | [0.365] | [0.101] | [0.238] | [0.145] | [0.199] | [0.385] | [0.551] | [0.167] |
| ***Δlnopn*** | -0.1078 | -0.1832 | -0.0333 | 0.0935 | -0.1172 | 1.1869 | 0.1697 | 0.0116 |
| | [0.469] | [0.808] | [0.948] | [0.587] | [0.573] | [0.529] | [0.773] | [0.956] |
| ***Δlnexr*** | 0.0547 | -1.307*** | -0.4979 | 0.0736 | 0.1421 | -1.3098 | -0.4927 | 0.0766 |
| | [0.235] | [0.0001] | [0.472] | [0.427] | [0.216] | [0.021] | [0.373] | [0.287] |
| ***Model Selection*** | | | | | | | | |
| ***Hausman test*** $\chi^2$ | [0.6406] | [0.0567] | [0.3654] | [0.2386] | | | | |

Notes: The maximum number of lags for each variable is set at two, and optimal lag lengths are selected by the AIC. The MG estimates are used as initial estimates of the long-run parameters for the pooled maximum likelihood estimation. The PMG estimators are computed by a 'back-substitution' algorithm. Numbers in brackets are the p-value.ECT denotes the estimated coefficient on the error correction term. The vector error correction model is estimated using panel regression techniques with fixed effects for cross section. Probability value is also reported for the Hausman test. *** indicates 1% level of significance and ** designate the significance at the 5% significance level.

Source: Authors' calculations.

### 4.2 Granger Causality Test

The cointegration relationship between economic growth, balance of payment, gross domestic savings and foreign direct investment is investigated with the use of PMG/ARDL approach, but it does not indicate the direction of causality between variables. Identifying the causal direction among economic growth, balance of payment, gross domestic savings and foreign direct investment provides policy makers with a clearer understanding of the role and interaction of foreign direct investment (FDI) and macroeconomic variables in West African countries. We employ panel VEC Granger causality/block exogeneitywald tests to examine the causal relationship between mentioned variables. The Engle and Granger (1987) causality test in the first difference variable by means of a VAR (Vector Autoregressive) model will give misleading results in the presence of cointegration. Therefore it is necessary to include the Error-Correction Term (ECT) as an additional variable to the VAR system. The direction of causality can be detected through the panel VEC Granger causality/block exogeneitywald tests of long-run cointegration and this is summarized in table 5.

In table 5 spec 1, the causality test result indicates that when rgdpcis used as dependent variable, there is no individual and joint causality running from independent variables to dependent variable and vice versa. This could be as result poor economic activities among these developing countries. This finding is contrary to that of Samad (2009) for South East Asia and Latin America, Hansen and Rand (2006) Esso (2010) for ten Sub-Sahara African countries and document evidence of causal relationships between FDI and economic Growth. Our attention is limited to rgdpc and FDI since we could not establish indirect causal relationship running from the control variables to the variables of interest. In table 5 spec. 2 the causality test result indicates that in that when BOPis used as dependent variable, there is no individual and joint causality running from independent variables to dependent variable. Using FDI as dependent variable, bop does not granger-cause FDI while opn and exr granger-cause FDI. In spec 3, the causality test result indicates that GDS as dependent variable, there is no individual and joint causality running from independent variables to dependent variable. Using fdi as dependent variable, gds does not granger-cause FDI while opn and exr granger-cause FDI. In spec. 4, the causality test result indicates that in UNR as dependent variable, there is no individual and joint causality running from independent variables to dependent variable contrary to the findings of Tshepo (2014) for South African nations. When fdi is used as dependent variable, unrdoes not granger cause FDI. Also, opn and exr granger-cause FDI, that is, there is causality running form independent to dependent variable. In sum, there is no causality running from both directions - macroeconomic variables to FDI and vice versa in the short run. Even though we could not observe any indirect effect from the control variables, but we witnessed a slight causality running from them to the respective variables on interest.

**Table 5:** Panel causality tests for Spec [1-4]
Notes: Partial F-statistics reported with respect to short-run changes in the independent variables. The sum of the lagged coefficients for the

| ***Spec1*** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Variables* | **Δlnrgdpc** | | ***Δlnfdi*** | | ***Δlnopn*** | | ***Δlnexr*** | | ***All*** | |
| *Δlnrgdpc* | | | 1.7207 | [0.4230] | 2.5453 | [0.2801] | 1.2668 | [0.5308] | 0.6604 | [0.3534] |
| *Δlnfdi* | 0.511 | [0.7744] | | | 37.334*** | [0.000] | 10.284** | [0.0058] | 48.361*** | [0.0000] |
| *Δlnopn* | 0.188 | [0.9101] | 13.037** | [0.0015] | | | 1.6589 | [0.4363] | 15.136** | [0.0192] |
| *Δlnexr* | 1.203 | [0.5480] | 4.9306 | [0.0850] | 1.5752 | [0.4549] | | | 7.837 | [0.2502] |
| ***Spec 2*** | ***Δlnbop*** | | ***Δlnfdi*** | | ***Δlnopn*** | | ***Δlnexr*** | | ***All*** | |
| *Δlnbop* | | | 0.5349 | [0.7653] | 0.6243 | [0.7319] | 0.1037 | [0.9495] | 1.0951 | [0.9817] |
| *Δlnfdi* | 2.7929 | [0.2475] | | | 39.750*** | [0.0000] | 11.6573 | [0.0029] | 52.717*** | [0.0000] |
| *Δlnopn* | 0.2507 | [0.8822] | 17.954*** | [0.0001] | | | 2.4797 | [0.2894] | 20.327*** | [0.0024] |
| *Δlnexr* | 4.4913 | [0.1230] | 4.6797 | [0.0963] | 3.1436 | [0.2077] | | | 11.4429 | [0.0756] |
| ***Spec 3*** | ***Δlngds*** | | ***Δlnfdi*** | | ***Δlnopn*** | | ***Δlnexr*** | | ***All*** | |
| *Δlngds* | | | 2.1832 | [0.3357] | 1.3358 | [0.1528] | 0.1921 | [0.9084] | 4.0707 | [0.6671] |
| *Δlnfdi* | 1.2969 | [0.5228] | | | 38.821*** | [0.0000] | 10.072 | [0.0065] | 49.63*** | [0.0000] |
| *Δlnopn* | 2.2762 | [0.3204] | 15.399*** | [0.0005] | | | 1.7738 | [0.4119] | 18.712** | [0.0047] |
| *Δlnexr* | 2.1994 | [0.3340] | 5.5087 | [0.0636] | 1.9735 | [0.3728] | | | 9.1779 | [0.1639] |
| ***Spec 4*** | ***Δlnunr*** | | ***Δlnfdi*** | | ***Δlnopn*** | | ***Δlnexr*** | | ***All*** | |
| *Δlnunr* | | | 0.5763 | [0.7496] | 0.6208 | [0.7331] | 2.9784 | [0.2255] | 5.0655 | [0.5354] |
| *Δlnfdi* | 5.7703 | [0.0558] | | | 41.642*** | [0.000] | 9.7569*** | [0.0076] | 55.117*** | [0.0000] |
| *Δlnopn* | 1.0263 | [0.5986] | 14.900*** | [0.0006] | | | 2.1218 | [0.3461] | 18.127*** | [0.0059] |
| *Δlnexr* | 1.2488 | [0.5356] | 5.1587 | [0.0758] | 1.9085 | [0.3851] | | | 7.4989 | [0.2772] |

respective short-run changes is also performed and is denoted in parentheses. Probability values, which represented the probability values of the partial F-statistic and the Wald chi-square tests, are in brackets [.] and reported next to the corresponding partial F-statistic and sum of the lagged coefficients, respectively.*** indicate the significance at the 1% significance level. ** indicate the significance at the 5% significance level.

## 5.0 Conclusion and Policy Implications

The main objective of this study is to estimate the long run and short run dynamic relationships between macroeconomic variables and FDI in West Africa. To achieve this objective, the present paper enjoyed advantage of a recent development in econometric testing techniques for Granger non-causality in heterogeneous panels that takes into consideration the effects of cross section dependence across the units of the panel dataset and PMG/ARDL techniques over the period of 1990 to 2016. The results provided useful evidence of cointegration between the macroeconomic variables and foreign direct investment while controlling influence of trade openness and exchange rate. The long-run effect of FDI on economic growth and gds are found to be positive and statistically significant. However, the coefficient of FDI in spec.4 is negative and statistically significant indicating that an increase in fdi would significantly reduce unemployment in the selected West African nations in the long-run. This is in line with economic expectation and the negative relationship between fdi and unr is similar to the findings of a number of existing studies in the literature including Elekwa, Aniebo and Ogu (2016), Okoro, Mathew and Atan (2014), Brincikova and Darmo (2014), Habib and Sarwar (2013). Exchange rate and trade openness elasticity indicate statistically significant at various levels across Spec. [1-3]. The coefficient of error correction model in all the specifications is negative and significant indicating that the short-run disequilibrium is corrected in the long-run. Granger causality tests result indicated that causality do not run from any direction in the short run which could be attributed to poor economic activities among this developing countries and important revelation for policy implication. Therefore, policy-makers in West African countries should make policies that favour foreign investors to avoid fluctuation in FDI inflows.

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