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Influence of foreign direct investment and exchange rate on fisheries in Nigeria

Many studies have explored the impact of macroeconomic factors on the growth and output of the agricultural sector in Nigeria with focus on the aggregate output. Some studies narrowed down focus on the crop subsector while neglecting the fisheries subsector which is an important source of cheap protein for our increasing population, a source of employment for the unemployed and also key to achieving the first three sustainable development goals 2030. In this study, we investigated the influence of FDI on agriculture and exchange rates on the output of the fisheries subsector using time series data that spans from 1980-2018. A Vector Autoregressive Model was also used alongside a growth model. The findings indicate positive growth in the fisheries subsector. FDI to agriculture and exchange rate movements were both found to affect the fisheries subsector positively in the long run, whereas only FDI to agriculture was found to exert a positive influence in the short run. Policies to attract FDI to the sector are thus advocated for, while macroeconomic policies to stabilise the Nigerian currency (naira) against the US dollar are also advised.

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Introduction

The driving force behind economic globalisation and trade liberalisation for the past 50 years has been Foreign Direct Investment (FDI) and FDI inflows to developing countries have risen enormously during this period (Nathaniel *et al.*, 2020). Agricultural production remains low despite the enormous increase in FDI to developing nations (Dhahri and Omri, 2020). The agricultural sector in Nigeria employs the majority of the population, who are subsistent farmers and still poor compared to employees in other sectors of the economy. The production of food in the advanced nations has been viewed by some as inadequate and demands significant expenditure in agriculture due to the limitations of agricultural technologies and adverse weather conditions (Donato and Marino, 2018). FDI, as opined by Ahmed *et al.* (2017), is an engine for agricultural development in many developing countries. FAO (2009) recommended that US\$ 83 billion (in 2009 US\$) should be annually invested in the agricultural sector of developing countries to ensure food production for a projected 9.1 billion worldwide population by 2050. Anetor *et al.* (2016) more recently stated that the main problem facing the country's agricultural industry is the shortage of sufficient finance required to revitalise the sector. A country's exchange rate provides a strong indicator of how well an economy is performing. The value of Nigeria's currency began to nosedive in relation to the dollar from 1986 when a second-tier exchange rate was introduced, and it has since not recovered from this decline. In today's world, where international trade laws and technology are constantly changing, the role of exchange rates is significant in determining the value of agricultural output and equipment.

Considered a significant agricultural sector in the coastal states, 'fishery' is one of the most important, most relevant and vital sub-sectors in terms of income generation, poverty reduction and meeting dietary requirements in Nigeria. Fish remains a very important source of protein to most Nigerians, a fact which was emphasised by the Food and Agricultural Organization (2018), who further underlined the importance of fish to strengthening food nutrition and security in most rural areas. Fish has been found to be a rich source of good protein, some micronutrients and fatty acids that are important for the development of the human brain (Tacon and Metian, 2013). The fisheries subsector has strengthened a lot of livelihoods in Nigeria, but the future of the sector still remains uncertain. The Nigerian fisheries subsector has been reported specifically to have created outright job opportunities for more than 8,700,000 Nigerians and an additional 19,600,000 partially, with women up to 70%. Recent investigations have shown that fish production in Nigeria currently amounts to only 1,000,000 metric tons as compared with an estimated demand of about 3.3 million metric tonnes, leaving an estimated imported deficit of over 2.2 million metric tons annually (Nigeria Fishery Statistics, 2016; WorldFish, 2018). The fishing sector in Nigeria involves 3 main subsectors, artisanal, industrial and aquaculture (Adewuyi *et al.,* 2010). The fishery sector in Nigeria contributes 3.2 percent to the total output of the agricultural sector, thus huge investment potential can arise for this sector if it receives foreign direct investment directed at bridging the gap between local levels of consumption and production (Oyinbo *et al.*, 2013).

The purpose of this analysis is to find out if FDI to agriculture and stable exchange rates can be linked to growth in the Nigerian fisheries sub-sector in such a way as to maximise the potential of this sector. In Nigeria, studies on the effect of FDI on economic growth have yielded varying results and many of the submissions documented over time have not considered the sheer lucrativeness of the agricultural sector should it succeed in attracting FDI, thereby boosting the country's exchange rate as well as contributing to overall economic development and growth. The agricultural sector has been overlooked for years and the government seems not

to be attentive to the sector in such a way as to revive it (Olagbaju and Akinlo, 2018; Akinyemi *et al*., 2018).

While it is possible for FDI to achieve high returns on the output of the fisheries subsector, we also want to examine the counterfactual. First, we have chosen the fisheries subsector because fish are more efficient in converting feed into protein compared to other animal source of proteins. They are also a cheap protein source as opposed to other animal sources, as they can be found in the wild and also cultivated domestically. Secondly, Sub-Saharan Africa, which houses about 14 percent of people living in the world, has suffered from hidden hunger and as the most populous country in Sub-Saharan Africa and Africa, Nigeria's overall fish exports were estimated at $284,390 million, while the imports stood at around $1.2 billion in 2013. Accordingly, Nigeria is considered one of the worlds 's biggest importers of fishery products (FAO, 2018), making Nigeria an important and good area to study.

Based on the foregoing, Nigeria was selected for this study as the rest of the region can base some policy actions on the conclusions arrived at. In light of the significance of both FDI and exchange rate movements for agricultural production, a considerable amount of research literature has attempted to investigate different factors that could be responsible for the poor performance of the fishery sector in Nigeria. Some of the factors include micro and macro-economic factors like labour cost, cost of inputs, exchange rate, GDP, inflation rate and agricultural policies like food importation (Akpan *et al*., 2012; Edet and Akpan, 2019; Akpan, 2012; Oluwatoyese *et al*., 2016; Oloyede, 2014 and Kareem *et al*., 2013). Against this backdrop, unlike previous studies that focused on exchange rate and other macro-economic variables on the agricultural sector, this study aims to contribute to this growing area of research by exploring simultaneously the impact of foreign direct investment and exchange rate movements on the fisheries subsector in Nigeria, an area that has not been studied to the best of our knowledge, while also controlling for other significant variables. The span of the data the study uses extends from 1980 to 2018 to capture the recent recession of 2016, and sporadic flooding which occurred in 2018 in Nigeria.

The remainder of the paper proceeds as follows. First comes a literature review; next, the methodology section explains the data and method used; then the results and discussion section outlines and explaining the results of our analysis. The final part concludes.

Literature Review

The literature is filled with different arguments concerning the extent to which foreign direct investment and exchange rate stability foster economic growth and development of agricultural sector. Capital inflows (private and public inflows) have been opined to boost the performance of the economy according to the endogenous and neoclassical growth theory.

The neoclassical theory of growth suggests that the inflow of international capital gives emerging countries the ability to acquire the technologies needed to improve and encourage production, accelerate demand and ensure a sustainable agricultural development (Adegbite and Adetiloye, 2013). Guided by the neoclassical theory of growth, we therefore review the literature in this section so as to put our discussions in the proper empirical perspective. The literature is subdivided into two sections, one dealing with FDI and agricultural production, and the other exchange rate movements and agricultural production.

Foreign Direct Investment and Agricultural Production

Many papers show FDI has become a sustainable strategy conducive to profitable investment, taking into account the future prospects of the allocated agricultural production. Agricultural production has the potential to attract FDI, especially in developing countries, which need much more investment to enhance the positive and/or ameliorate the negative effect on agricultural productivity given the agricultural resources available. Macro-economic adjustments and deregulation, plus policies to attract foreign direct investments are believed to strongly affect the overall productivity of the agricultural sector of a developing nation like Nigeria (Odior, 2014).

Ikpesu and Okpe (2019) investigated the impacts of capital inflows and exchange rates on agricultural output in Nigeria from 1981 to 2016. They explored this relationship using the autoregressive distributed lag model and revealed that both private and public capital inflows have a positive impact on the growth of the agricultural sector. Ajuwon and Ogwumike (2013) meanwhile examined how uncertainty affects FDI inflows to the agricultural sector using data from 1970 to 2008. They examined this relationship by utilising an investment-cointegration error correction model and revealed that FDI positively impacted agriculture in the short and long run. Similarly, Oloyede (2014) using a Granger causality test found a positive relationship between FDI and agricultural sector development in Nigeria with data that spanned from 1981 to 2012. Other research works showed a positive relationship between FDI and agricultural output includes Kareem *et al*. (2013) and Gameli Djokoto *et al*. (2014). They all used different techniques but arrived at similar conclusions.

Contrary to previous studies, Djomo *et al*. (2017) examined the effect of FDI and exchange rate movements on agricultural production in Cameroon from 1978-2014 using VECM. The results revealed that FDI accounted for a negative response in agricultural growth for both the short and long run periods, whereas exchange rate stability accounted for positive response of agricultural growth in the short and long run. Owutuamor and Arene (2018) investigated the effect of foreign direct investment and other macroeconomic factors on Nigeria's agricultural development from 1981 to 2014, using co-integration tests, ordinary least square (OLS) regression and Granger causality test. They pointed out a strong, non-significant relationship between agricultural growth and FDI, implying that FDI in agriculture has no direct impact on agricultural development.

Meng and Li (2014) observed that agricultural foreign direct investment will have a significant and negative effect on Total Factor Productivity (TFP), with no enhanc-

ing impact on technical development considering the Data Envelopment Analysis (DEA) method to find the correlation with agricultural TFP and FDI in agricultural from fifteen city capitals from 2000 to 2011 in China. Since 1990 to 2012 a bilateral data that involves the flows of FDI with host countries of 108 with resident nations of 240.

Exchange Rates and Agricultural Production

Exchange rates have been theorised to affect agricultural outputs through prices of products and cost of inputs. Since the seminal work of Schuh (1974), a country's exchange rate has been considered a medium for transferring macroeconomic policy to the agricultural sector. Some research results (Obasan and Maduekwe, 2013; Juselius *et al*., 2014) indicated that there was a savings-investment deficit in most African economies (including Nigeria) as well as a foreign exchange gap that has discouraged emerging countries from embarking on growth programmes. Depreciation of the exchange rate allows the market price of exported goods to decline in foreign exchange and leads to an increase in domestic currency, thereby stimulating domestic production (Odior, 2014). Baek and Koo (2007) studied the effect of the US's exchange rate, income, money supply and major trading partners on agricultural trade balance using an autoregressive distributed lag model. The exchange rate was found to be a key determinant of the manners of short- and long-term trade equalisation. Imoughele and Ismaila (2015) more recently observed that exchange rates, money supply, private sector credit and real GDP had significant effects on non-oil export production, while exchange rate appreciation had a negative influence on Nigeria's non-oil exports. In another analysis by Akinlo and Adejumo (2014), the impact of exchange rate fluctuations on non-oil exports in Nigeria between 1986 and 2008 was studied using the error correction model (ECM) methodology. They argued that lagging international income and actual exchange rates had strong and significant impacts on exports outside of the oil sector. According to the researchers, variability in the exchange rate still has a long-term impact, but not a short-term impact.

Similarly, Obayelu and Salau (2010) applied cointegration and VECM methods to the agricultural production response to price and exchange rates from 1970 to 2007. They reported that total agricultural production responded positively to exchange rate changes (i.e. exchange rate depreciation) in the short run and long run but negatively to food price increases. Oyinbo *et al*. (2014) explored the relation between deregulation of exchange rates and agricultural share of gross domestic product in Nigeria using the Granger causality test and VECM over the period 1986-2011. They noticed there was unidirectional causality from the exchange

rate to the share of real GDP in the agricultural sector. They also found that deregulation of exchange rates had a detrimental effect on the agricultural share of GDP. The impact of exchange rate changes on components of agricultural production was studied by Yaqub (2013) using the two-stage-least-square techniques for the duration 1970 to 2008. The result obtained indicates that variations occur in how the performance of various sub-sectors reacts to changes in the exchange rate. Changes in the exchange rate have negative effects on crop and fisheries output, while it had positive impact on forestry and livestock.

Conversely, Oluwatoyese *et al*. (2016) established a long run relationship between the agricultural sector and some macroeconomic variables using a multivariate cointegration approach and a vector error correction model. They concluded that the inflation rate, exchange rate and unemployment rate all exerted insignificant influence on agricultural growth in Nigeria. Eyo (2008) found that the exchange rate system did not stimulate agricultural exports after investigating the macroeconomic strategies' impact on agricultural growth in Nigeria. Oyinbo *et al*. (2014) also reported that exchange rate variability affects the share of GDP in agriculture negatively.

Most of the literature available exhibits conflicting views on the contribution of FDI and exchange rates to the output of the agricultural sector. Besides, there is still no study that has investigated the simultaneous influence of FDI and exchange rates on the fisheries subsector in Nigeria using the available data 1980-2018.

Methodology

The study uses time series data for exploring the relationship between FDI, exchange rates and the fisheries subsector in Nigeria. Table 1 shows all the variables used in this research and their sources. In order, to obtain more meaningful insight, logarithmic transformation of these variables was adopted to remove large and extreme bias that might be associated with the variables.

First of all, the unit root test of all variables was carried out. The Phillip and Perron (1988) test alongside with the Dickey and Fuller (1981) method was used to check for the presence of unit root in each variable (an indication for non-stationarity). As the use of data characterised by unit roots may lead to serious errors in statistical inference, lag length structure was used to select lag length for the model. A third test, the Zivot and Andrews (1992) test was also used to check for bias when there is a structural break, a weakness not covered for in the previous two tests. The Johansen procedure was employed to test for co-integration in the model.

Table 1: Description of variables.

Variables	Measurement	Source	Symbol
Fisheries	Naira equivalent	CBN annual report	FIS
FDI to agriculture	Naira to USD equivalent	CBN annual report	FDI
Exchange rate	Naira to USD equivalent	CBN annual report	Exch Rate
Labour	Number of persons involved in agric.	CBN annual report	Labour

Source: Author's Compilation from CBN Annual Bulleting (www.mundi.com)

A growth model was used to arrive at the direction of growth in the sector. A VECM was used to determine the impact of FDI and exchange rate on fisheries in the long and short run. The forecast error variance decomposition was utilised to forecast the contribution of FDI and exchange rate to the fisheries subsector.

Growth Model

A growth model was used to ascertain direction and growth rates of variables of interest. Specifically, the variables of interest were modelled as follows:

$$\ln Y_t = \alpha + \beta fs_t + \mu_t \tag{1}$$

$$\ln Y_t = \alpha + \beta fdi_t + \mu_t \tag{2}$$

$$\ln Y_t = \alpha + \beta exch\ rate_t + \mu_t \tag{3}$$

$$\ln Y_t = \alpha + \beta labour_t + \mu_t \tag{4}$$

where α = intercept, β = vector of the trend variable and μ is the econometric error term, β_{fs}, β_{fdi}, $\beta_{exch\ rate}$ and β_{labour} = coefficients stand for the trend variables for Fisheries, FDI, Exchange rate and Labour, respectively. Instead of a linear trend model, a semi-log growth rate model was developed, since the analysis is interested in both absolute and relative change in interest parameters for this research. The parameter of β is the coefficient of β, the slope coefficient that calculates the constant proportional / relative change in Y for a given absolute change in the regressor t value.

Firstly, calculating IGR over time, β was multiplied by 100. Secondly, in calculating Compound Growth Rate (CGR), the difference after subtracting 1 from the β antilog was multiplied by 100. The Compound Growth Rate (CGR) in percentage can be recovered from the equations in the following manner:

$$CGR = (e^{\beta i} - 1)100 \tag{5}$$

where β_i = the coefficient of the trend variable in the respective cases. Finally, the analysis shows that growth accelerates when β is positive and proves to be significant

statistically, growth decelerates when β is negative and proves to be significant statistically, but the growth cycle stagnates when β is not significant statistically.

Vector Error Correction Model (VECM)

The following models were calculated:

$$\ln FS_{t-i} = a_0 + a_1 \ln EXCH_{t-i} + \\ + a_2 \ln FDI_{t-i} + a_3 \ln LABOR_{t-i} + \\ + a_4 \ln FS_{t-i} + \partial ECM_{1t} + u_{1t} \tag{6}$$

$$\ln FDI_{t-i} = a_0 + a_1 \ln EXCH_{t-i} + \\ + a_2 \ln LABOR_{t-i} + a_3 \ln FS_{t-i} + \\ + a_4 \ln FDI_{t-i} + \partial ECM_{2t} + u_{2t} \tag{7}$$

$$\ln EXCH_{t-i} = a_0 + a_1 \ln FDI_{t-i} + \\ + a_2 \ln LABOR_{t-i} + a_3 \ln FS_{t-i} + \\ + a_4 \ln EXCH_{t-i} + \partial ECM_{3t} + u_{3t} \tag{8}$$

$$LABOR_{t-i} = a_0 + a_1 \ln EXCH_{t-i} + \\ + a_2 \ln FDI_{t-i} + a_3 \ln LABOR_{t-i} + \\ + a_4 \ln FS_{t-i} + \partial ECM_{4t} + u_{4t} \tag{9}$$

where:
FS_{t-i} = fisheries in naira
$EXCH_{t-i}$ = Exchange rate in (dollars/naira)
FDI_{t-i} = Foreign Direct investment in naira
$LABOR_{t-i}$ = Labour (Number of persons involved in agricultural sector)
ECM_t = error correction term
u_t = error term

Results and Discussion

The descriptive statistics of the variables used in the analysis is presented in Table 2 below. Results showed that fisheries, FDI, exchange rate and labour showed positive

Table 2: Descriptive Statistics.

Descriptive Statistics	Fisheries	FDI	Exchange Rate	Labour
Mean	13.0262	21.0133	3.3144	17.4468
Median	13.0760	20.9131	4.5255	17.4617
Maximum	13.9958	25.1345	5.7239	17.9186
Minimum	11.9732	18.5803	-0.5979	16.9668
Std. Dev.	0.6292	2.01358	2.0539	0.2947
Skewness	0.7471	0.5806	0.7095	0.0210
Kurtosis	1.7537	2.3691	2.1312	1.7701
Jarque-Bera	2.5384	2.8383	4.4986	2.4610
Probability	0.2810	0.2419	0.1055	0.2921
Sum	508.0226	819.5171	129.2595	680.4241
Sum Sq. Dev.	15.0420	154.0707	160.2978	3.3011
Observations	39	39	39	39

Source: own composition

skewness to the right tail and are all platykurtic. Also, the Jarque-Bera probability test of normality indicates all variables were normally distributed.

Table 3 presents preliminary investigation of the properties of variables prior to regression using Phillip-Perron (PP) PP and Augmented Dickey–Fuller (ADF) tests. Results indicate that all the variables were not stationary at level but stationary at first difference, implying that the level form of these variables exhibited a random walk pattern, had multiple means of covariance or else featured both. However, the first difference between these variables is integrated or stationary. The existence of a unit root when the variable is level necessitated a test of co-integration to determine whether there is a long-term relationship between those variables.

The linear combination of non-stationary variables according to Enger and Granger (1987) is often co-integrated. Variables were also stationary at first difference with the Zivot and Andrew method, given the potential break points of each variable with their respective break point year in other to correct for the tendency towards bias in Philip-Perron and ADF statistics, which could not themselves account for a structural break in the model.

Table 4 presents the result of lag length from six different selection criteria; AIC was chosen because of its lowest value -5.680 at lag 1. Lag 1 is the appropriate lag to be in used for the model.

Figure 1 presents the results of testing for structural break in the model using the CUSUM and CUSUM of squares test. The CUSUM line is situated between the gridlines; this implies that it lies between two standard deviations or at a 95% confident interval level. The graphs show that the fitted model is parsimonious, stable, and relevant for policy direction.

Table 3: Unit Root test for all Variables.

Variables	Phillip-Perron (PP)		Augmented-Dickey Fuller (ADF)			
	At level	Difference	At level		Difference	
	T-statistic	T-statistic	T-statistic	Prob	T-statistic	Prob.
Ln*FS*	-0.7988	-6.6874	-0.7109	0.8319	-6.5784***	0.0000
Ln*FDI*	-0.3587	-4.7041	-0.6889	0.8378	4.3344***	0.0000
Ln*EXCH*	-1.8403	-5.2373	-1.8393	0.3565	-5.2373***	0.0001
Ln*Labour*	-0.2853	-35.6600	-0.2689	0.9201	-6.8002***	0.0000

Variables	Zivot and Andrew Test			
	Level		First Difference	
	t-statistic	Break Year	t-statistic	Break Year
Fisheries	-3.2764	2006	-3.5484	1989
FDI	-2.0267	2001	-6.6523	1995
Exchange Rate	-2.8897	2001	-3.7248	1999
Labour	-2.5673	2004	-7.8563	1995

*** denotes rejection of the null hypothesis at 1 percent level of significance.
Source: own composition

Table 4: Lag Structure for the Model.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-47.1165	n.a.	0.0002	2.7631	2.9372	2.8245
1	111.8176	274.9131*	8.27e-08*	-4.9632*	-4.0924*	-4.6562*
2	141.0904	44.3047	4.17e-08	-5.6806	-4.1132	-5.1280

* indicates lag order selected by the criterion.
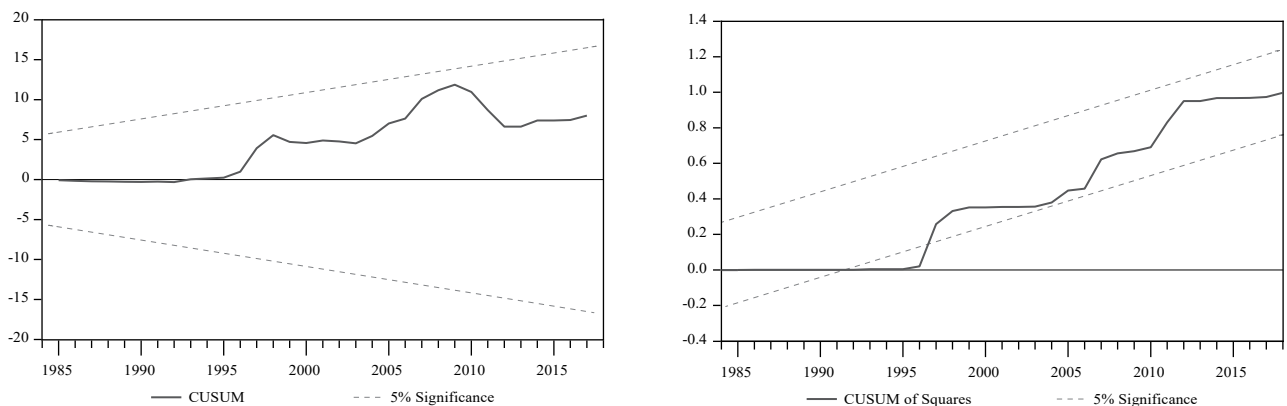Source: wn compositiono

Figure 1: CUSUM and CUSUM sum of squares graphs.
Source: own composition

Co-integration test investigation was carried out on the series properties of I (1) variables through the Johansen co-integration test to determine whether long run linear combination of non-stationary variable is stationary. This assumes that linear combination of non-stationary variables can be stationary (Enger and Granger, 1987). The result of the Johansen Co-integration tests is shown in Tables 5. Using trace statistics, the result revealed that combination of these variables has one co-integrating equation, and this implies that the linear combination of these variables has a single long run linear combination or relationship.

However, the maximum Eigen statistics criterion also shows one co-integration equation, and this means that the linear combination of these variables has one co-integration equation. The implication is that the linear combination of these variables can be modelled with OLS without the risk of spurious results. However, trace statistics have been adopted in this research for the purpose of simplicity in analysis. Thus, based on the trace statistics value (85.43), which is greater than the critical value of (54.0), a long run relationship can be said to exist between fisheries, FDI, exchange rate and labour with one co-integrating equation.

The result of the trend analysis is presented in Table 2. The exponential growth model was chosen from the different function forms as the fitted model to the data based on the low level of Akaike Information Criterion and coefficient of determination (R-square). The result showed that 99.2% variation in agricultural subsector (fisheries) is explained by the trend model. The result revealed that the coefficient of fisheries was positive (0.054) and significant at 1% probability level. This positive and significant value of fisheries implies that there is acceleration in the growth of this agricultural sector output over time which implies that there is still more room for the government and private sector to make investment in this growing sector.

The result of foreign direct investment (FDI) using the parametric growth model further revealed that the exponential form indicated a good fit of the model to the data over time. This is based on the low level of Akaike Information Criterion and coefficient of determination (R-square). The result showed that 86.6% of variation in Foreign Direct Investment (FDI) is explained by the trend model. The result revealed that the coefficient of FDI was positive (0.164) and significant at 1% probability level. The instantaneous and compound growth rates were found to be 16.4% and 17.3% respectively, this implies there is acceleration in the growth of FDI over time.

The government should continue with policies that can attract and sustain FDI into Nigeria. This result is in variance with findings of Ukpe *et al.* (2018) who found that decrease in FDI could be as a result of inability of the government to regulate the inflow and outflow of FDI. The result further showed that exchange rate has R-square of 0.889 which implies that 88.9% variation in exchange rate is explained by the trend model. The result showed that the instantaneous and compound growth was found to be positive and significant with value 17.1% and 18.65% respectively. This is in harmony with the work of Ammani (2012) who found positive growth in domestic production of selected crops which showed acceleration in growth rate of selected crops in Nigeria.

The equilibrium relationship between the variables in the long run was motivated the construction of the Error Correction Mechanism (ECM). The application of ECM was necessary because of the existence of co-integration among variables. The result of ECM is presented in Table 8. Results show the long run influence of foreign direct investment (FDI) and exchange rate on fisheries, the coefficient of determination (R^2) of the model was 0.825 indicating that 82.5% variation in fisheries was explained by fisheries,

Table 5: Unrestricted Co-integration Rank Tests.

Hypothesized No of (ECS)	Eigen Value	Trace Statistic	0.05 Critical value	Probability
Trace				
None	0.7189**	85.4350	54.0790	0.0000
At most 1	0.4768	38.4674	39.2310	0.3216
At most 2	0.2265	14.4972	20.2618	0.2566
At most 3	0.1262	4.9912	9.1655	0.2849
Maximum Eigenvalue				
None	0.7190**	46.9679	28.5880	0.0000
At most 1	0.4768	23.9700	23.9920	0.1123
At most 2	0.2266	9.5059	15.8990	0.3815
At most 3	0.1261	4.9912	9.1651	0.2849

** denote rejection of null hypothesis at 5% significant level.
Sources: own composition

Table 6: Growth rate and direction of growth (Instantaneous and Compound Growth Rate).

Variable	Instantaneous %	Compound growth %
Fisheries	5.4	6.5
FDI	16.4	17.3
Exchange Rate	17.1	18.6

Sources: own composition

FDI, exchange rate and labour in the previous year. Results further showed that in the long run, FDI and exchange rate significantly affected fisheries. Specifically, the coefficient of FDI (0.02) is positive and significant at 1% level of probability and this is in line with the *a priori* expectations. This implies that a unit increase in FDI will increase fisheries by 0.02. This increase in fisheries could be due to an attractive macroeconomic policy of the government that encourages production through FDI, and it is advisable that such a policy be strengthened. The Federal Government can also take policy measures that encourage local production as well as protect infant industries. This is in line with the findings of Adeleke *et al.* (2014) who found that an increase in FDI increases agricultural output in Nigeria.

The coefficient on exchange rate is negative (-0.027) and significant at 5% probability level. This means a unit increase in exchange rate will decrease fisheries by 0.027. Most people import fisheries and their inputs which in turn affects the country substantial domestic production. This is due to the monetary policy of government, which has made the naira weak against the US dollar. While the government is encouraged to make efforts to strengthen the naira, research and development should be encouraged so that inputs needed for fisheries can be developed and produced locally, so as to reduce the high cost of inputs that are imported and also boost local production to meet the country's expected demand. This is different from findings of Aliyu (2011) who claimed to have shown that appreciation of the country's exchange rate exerted a positive impact on real economic growth in Nigeria.

The short run result from the Error Correction Model (ECM) is presented in the Table 9 below. The Error Correction Term (ECT) is -0.192 is statistically significant and negative which indicates a moderate speed of adjustment of variable towards equilibrium. This implies that previous year's error is corrected within the current year at a convergence speed of 19.2%. The coefficient of determination R square is 0.826 indicating that 82.6% of the variation in fisheries was explained by fisheries, FDI, exchange rate and labour in previous year. Change in coefficient of FDI is negative (0.018) and significant at 1% probability level. This means that an increase in FDI leads to acceleration in fisheries output by 0.081 in short run. The result shows that FDI is very beneficial to the fisheries subsector and as such government must continually work and make attractive policies for investors in Nigeria. Change in coefficient of exchange rate is negative (-0.022) and not significant. This result does not agree with the study of Oyakhilomen *et al.* (2014) who found that exchange is detrimental to the gross domestic product in Nigeria.

Table 7: Trend Regression Based on Growth.

Variables	Model	Determinant	Coefficient	T-value	Prob.	Adj R²	AIC
Fisheries	Linear	Trend	27596.4200	23.6400	0.0000	0.9630	25.5200
		Constant	21552.9000	0.8400	0.4080		
	Quadratic	Trend	3106.1430	1.6400	0.1090	0.9880	23.9100
		At Trend^2	644.4800	10.0400	0.0000		
		Constant	172576	11.5700	0.0000		
	Exponential	Trend	0.0540	71.9000	0.0000	0.9920	-2.9500
		Constant	28.3378	655.1700	0.0000		
FDI	Linear	Trend	-1.05E+09	4.6700	0.0000	0.3500	49.8600
		Constant	-1.060E+10	-2.1300	0.0400		
	Quadratic	Trend	-1.56E+09	-2.0100	0.0510	0.5040	49.6200
		At Trend^2	68738113	3.4900	0.0000		
		Constant	5.50E+09	0.8800	0.3920		
	Exponential	Trend	0.1640	15.2400	0.0000	0.8620	2.3300
		Constant	17.8967	75.3100	0.0000		
Exchange Rate	Linear	Trend	7.0760	14.9200	0.0000	0.8570	9.9000
		Constant	-48.1610	-4.6000	0.0000		
	Quadratic	Trend	-0.3250	-0.2400	0.8140	0.9200	9.3300
		At Trend^2	0.0194	5.5400	0.0000		
		Constant	-2.5750	-0.2200	0.8250		
	Exponential	Trend	0.1710	17.4900	0.0000	0.8890	2.2200
		Constant	0.0816	0.3800	0.7060		

Source: own composition

Table 8: Long Run Influence of FDI on Fisheries using VECM.

Variables	Coefficient	Standard Error	t-Statistics
Fisheries	-	-	-
FDI	0.0206	0.0598	-2.9039
Exchange rate	-0.0276	0.0535	-1.9370
Labour constant	-1.9249	0.2638	-7.2969

Source: own composition

Table 9: Short Run Influence of FDI on Fisheries using VECM.

	D(Fisheries)	D(FDI)	D(Exch rate)	D(Labour)
CointEq1	-0.19222 (0.3910) [-2.0341]	0.1387 (0.9210) [0.1507]	1.7610 (0.3982) [4.4226]	0.2722 (0.0716) [3.8024]
D(Fisheries(-1))	-0.0826 (0.1560) [-1.8886]	-0.4730 (1.9975) [-0.2368]	-1.5306 (0.8636) [-1.7723]	-0.4191 (0.1552) [-2.6994]
D(FDI(-1))	0.0181 (0.0051) [2.7780]	0.3229 (0.1774) [1.8197]	-0.0651 (0.0767) [-0.8487]	0.0161 (0.0138) [1.1666]
D(Exchange Rate(-1))	-0.0225 (0.0281) [-0.8005]	0.1383 (0.0274) [0.5052]	0.10112 (0.1184) [0.8543]	-0.0057 (0.0213) [-0.2687]
D(Labour(-1))	-0.2820 (0.2009) [-1.4038]	-0.3137 (1.9581) [-0.1602]	4.7669 (0.8466) [5.6308]	-0.3624 (0.1522) [-2.3813]
C	0.0659 (0.0167) [3.9525]	0.1149 (0.1625) [0.7073]	0.12055 (0.0703) [1.7158]	0.0552 (0.0126) [4.3660]
R²	0.8270	0.1032	0.5970	0.4982
F-statistics	1.3859	0.7135	9.1832	6.1553

Source: own composition

Conclusions

The study investigated the influence of Foreign Direct Investment (FDI) and exchange rate movements on the fisheries subsector in Nigeria. With the same order of stationarity, a cointegration test was carried out confirming a long run relationship among all the variables that were useful as descriptors of future behaviour in the fisheries subsector.

The study revealed a positive growth in the fisheries sector. All the variables were found to affect output of the fisheries subsector in the long run - only FDI was found to positively affect the output of fisheries in the short run. The positive impact of FDI on fisheries sector both in the short and the long run suggests that Nigerian government should revisit sustainable policies that can lead to increased inflow of FDI to the fisheries subsector, so that demand for fish can better match other local production in the agricultural sector.

Better macroeconomic policies to strengthen the Nigerian currency (Naira) are also advised as exchange rate movements were found to affect the fisheries subsector in the long run. The study has some limitations, which include the availability of data for fisheries output as well as the lumping together of industrial, aquaculture and artisanal production. Future research could exploit this limitation and further narrow down the analysis to consider these different approaches to cultivating fish that potentially attract agricultural FDI, while at the same time considering the effect of exchange rates on the fisheries subsector.

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