Effect of Macroeconomic Indicators on Fisheries Output in Nigeria

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Abstract
This study investigates the impact of macroeconomic indicators on fisheries output in Nigeria from period 1981 to 2023. The study variables comprise the value fisheries output (FIO), lending rates (LEN), real effective exchange rate (EXC), and inflation (INF). The study employs an Autoregressive Distributed Lag (ARDL) estimation technique to capture both short-run and long-run dynamics. The short run result reveals a significant negative impact of LEN on FIO at 5 percent level. The study found the EXC in the current and first lag periods do not significantly influence FIO but in the second and third lag period it has a significant negative impact on the latter. On other hand, the result shows that lagged INF has significantly lagged effect on FIO despite not having any significant effect on FIO in the current period. The long run result reveals that neither LEN nor EXC exerts long run impact on FIO in Nigeria. However, the study shows that INF has a significant negative impact on FIO in the long run. The study recommends that Policymakers should consider stabilizing or lowering lending rates to support the sector and easing borrowing costs for fisheries businesses.
Keywords: Fisheries output, Lending rates, Exchange rate, Inflation, Nigeria

Introduction

Fish production is an enterprise that possesses the capacity to contribute significantly to the agricultural sector in Nigeria which is a maritime nation with a vast population of over 160 million people and a coastline measuring approximately 853 kilometres (Osagie, 2012; Ezihe, 2025). The Nigeria fisheries sub-sector contributes about 3% to 4% to the country's annual GDP and is an important contributor to the population's nutritional requirements, constituting about 50 percent of animal protein intake. In addition, the sub-sector generates employment and income for a significant number of artisanal fishermen and small traders (Olajide *et al.,* 2022). Although captured fisheries have now been declining, Nigeria has a big potential in both marine and freshwater fisheries including aquaculture (Okochukwu *et al.,* 2024).

Fishery sources provided more than 60% of the total protein intake among adults in Nigeria, especially in the rural areas. Strangely enough, the country is still unable to adequately cater for its requirement of fishery products for most of its citizens, in terms of both ample productive capacity and satisfying dietary needs. For instance, the per capita average annual domestic production of fish (i.e. aquaculture output and artisans' output) stood at 6.09 kg/annum in 2015 and at 5.67 kg/annum in 2016 in Nigeria. Assuming that if all that is produced is consumed fully, then these figures are obviously, far below the recommended daily protein intake of 0.75 g per kg of lean body weight, as asserted by the Food and Agriculture Organization (FAO)/World Health Organization (WHO) (Udoh & Akpan, 2019). Thus, the fish farming industry can best be described as being at the infant stage when compared to the large market potential for its production and marketing despite its popularity in Nigeria (Nwiro, 2012).

The subpar performance of the fishery sub-sector in Nigeria has been ascribed to a multitude of factors, with particular emphasis on the weakened agricultural policy and insufficient regulations regarding national water resources, in addition to other pertinent concerns such as oil spills, crude oil contamination, militant actions in the coastal States, and the disposal of hazardous wastes, alongside natural phenomena including global climate change (Udoh & Akpan, 2019). According to Udoh and Akpan (2019), inflation and exchange rate among other macroeconomic variables significantly affect fish production in Nigeria. This suggests that macroeconomic indicators have pivotal role to play in the regulation of agricultural markets and in the formulation of growth policies for the fisheries subsector and the agriculture in general (Boro and Agbugba. 2022).

While exchange rate and prices are important to inputs like fertilizers and machinery, the exchange rate and prices are very fundamental to farm gate prices, which are major incentives for farmers' productivity (Abiola, 2019). Fluctuations in exchange rates can greatly impact the competitiveness of goods in the market. When the local currency strengthens, prices of products increase for buyers, potentially leading to reduced demand and lower export levels. Lily et al. (2014) even stressed that link between strengthening exchange rate and the real sector is the surest route to accelerated development. To them, dynamics in exchange rate either build or reduce the confidence of foreign investors to invest in the real sector of the economy especially agriculture.

On the other hand, inflation is one macroeconomic indicator which has been described by Maiga (2024) and Mbah *et al.,* (2022) as a major impediment to its growth and sustainability. s. Persistent inflation leads to increased costs of production inputs, thereby reducing farmers' profit margins and their ability to invest in improved farming techniques. Consequently, agricultural productivity suffers, leading to lower output levels and higher food prices (Nneoma, 2024). This situation poses a significant threat to food security and the overall economic stability of the country. Despite its importance, there is limited empirical research that specifically quantifies the impact of inflation on agricultural output in Nigeria.

In another light, investment opportunities in the agriculture sector are heavily influenced by interest rates. As a means of controlling inflation, high interest rates can make it difficult for farmers to borrow money to purchase inputs or invest in new agricultural technologies. Interest rate cuts, on the other hand, might boost agricultural output by enticing more borrowing and investment (Muhammed, 2024).
Therefore, there is a need to investigate the effect of these macroeconomic indicators on the fisheries sub-sector so that policymakers can assess the magnitude of influence they have in determining fisheries development in Nigeria. As Muftaudeen and Abdullahi (2014) would argue that an effective macroeconomic policy framework is very much necessary in regulating the economic activities in order to guarantee a well-established and sustained economic growth in developing economies.

Literature Review

The theoretical foundation of this study is anchored on the macroeconomist theory. is founded on the theory of macroeconomics. Walter Robinson (1979) put forth this theory in order break away from the prevalent use of factor analysis for determining the different variables that are most likely to influence economic growth. The theory aims to examine how the different changes in macroeconomic variables contribute to the low volatility of market returns. According to this approach, changes in interest rates and other macroeconomic variables are what drive capital market activity. This approach is founded on the equilibrium theory, which conceptualizes the interactions among various sectors as an essential element in the analysis of macroeconomic phenomena. Given that this theory elucidates the ways in which macroeconomic variables influence economic development, its relevance should not be underestimated.

Empirical Review

This section looks at previous research works which examined the relationships between on macroeconomic indicators and fisheries output. Further, the methodologies and the outcomes of their findings are highlighted.

Muhammed (2024) examined the impact of monetary policy on agricultural productivity and food prices in Nigeria. The estimation technique used was Autoregressive distributed lag (ARDL). The results showed that exchange rates boost Nigeria's agricultural output and food prices in the short and long term. The estimation showed that interest rates negatively affect agricultural productivity and food prices in Nigeria in the long-run but positively affect agricultural sector growth in the short-run.

Owoh (2024) investigated the impact of inflation on agricultural output in Nigeria, a sector that plays a critical role in the nation's economy. The findings suggested that inflation had a significant negative impact on agricultural productivity, underscoring the need for stable economic policies to ensure sustainable agricultural growth.

Obekpa *et al.* (2020) 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 indicated 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.

Tepe *et al*. (2020) determined whether changes in the real exchange rates of countries affect their fisheries production levels. Accordingly, they used the causality test developed by Emirmahmutoglu and Kose (2011). The results revealed that changes in the real exchange rate affected fisheries production.

Asekome and Ikojie (2018) examined the impact of interest rate on agricultural investment in Nigeria for the period 1980–2015. The study employed the ARMA Least Square technique to determine the impact of interest rate on agricultural investment in Nigeria. The empirical findings showed that deposit interest rate and agricultural output have a positive impact on agricultural investment, growth, and development while lending interest rate impacts negatively on agricultural investment in Nigeria.

Methodology

The study relied on secondary data sources for the investigation which covered the period 1986 to 2023. The data for the study were obtained from reliable sources such like the World Bank Development Indicators (WDI) and the Central Bank of Nigeria (CBN) Annual Statistical Bulletins.

Model Specification

In capturing the effect of macroeconomic variables on fisheries output in Nigeria, the study adopted the Autoregressive Distributed Lags (ARDL) method. However, the model of this study is based on the modification of Busari and Ayanboye (2022) who investigated who analysed the effect of population, exchange rate, interest rate, and inflation rate on total fisheries supply. This study is different from that of Busari and Ayanboye (2022) because, it does not include population in the and it used real effective exchange rate and lending rate unlike the latter who used nominal exchange rate and interest rate. The model is specified as follows:

The functional form

$$FIO = (LEN, EXC, INF) \quad (1)$$

The linear econometric specification

$$FIO_t = a_0 + a_1 LEN_t + a_2 EXC_t + a_3 INF_t + \mu_t \quad (2)$$

Formulating the Autoregressive Distributed Lag (ARDL) long-run model gives;

$$\Delta(FIO)t = a_\circ + a_1(FIO)t + a_2(LEN)t + a_3(EXC)t + a_4(INF)t + \sum_{i=1}^{n} \Delta a_1 (FIO)_{t-1} + \sum_{i=1}^{n} \Delta a_2 (LEN)_{t-1} + \sum_{i=1}^{n} \Delta a_3 (EXC)_{t-1} + \sum_{i=1}^{n} \Delta a_4 (INF)_{t-1} + \mu_{1t} \quad (3)$$

While the short-run Error Correction Model derived from the ARDL model yields;

$$\Delta(FIO)t = \partial_\circ + \partial_1(FIO)t + \partial_2(LEN)t + \partial_3(EXC)t + \partial_4(INF)t + \sum_{i=1}^{n} \Delta \partial_1 (FIO)_{t-1} + \sum_{i=1}^{n} \Delta \partial_2 (LEN)_{t-1} + \sum_{i=1}^{n} \Delta \partial_3 (EXC)_{t-1} + \sum_{i=1}^{n} \Delta \partial_4 (INF)_{t-1} + \Pi ECM + \mu_{1t} \quad (4)$$

Where:

FIO = Value of fisheries output, LEN = Lending rate, EXC = Real effective exchange rate, INF = Inflation rate, a_0 = $Intercept$, $a_1 - a_3$ = $Slopes\ of\ the\ model$, $a_1 - a_4$ = $Long - run\ dynamic\ coefficients$, $\partial_1 - \partial_4$ = Short − run dynamic coefficients, μ_{1t} = $Disturbance\ or\ error\ term$, Δ= $First\ difference\ operator$, n = $Maximum\ lag\ lenght$, Π = $Error\ correction\ coefficient$, ECM = $Error\ correction\ term\ with\ one\ period\ lag$, f = $Functional\ Notaton.$

A priori Expectations**:** a_1 and $a_3 < 0$, $a_2 > 0$

Results and Discussion

Unit Root Test

Table 1 presents the results of the unit root test which was achieved using the Augmented Dickey Fuller (ADF) method.

Table 1: Augmented Dickey Fuller (ADF) Unit Root Test Results

Variable	**ADF Test Stat.**	**5% Critical Value**	**P-value**	**Order of Integration**	**Test Option**	**Remark**
FIO	-6.296052	-3.526609	0.0000	I(0)	Trend & Intercept	Integrated of order 0
LEN	-5.872863	-3.526609	0.0001	I(1)	Trend & Intercept	Integrated of order 1
EXC	-4.457180	-3.523623	0.0051	I(1)	Trend & Intercept	Integrated of order 1
INF	-14.30173	-3.520787	0.0000	I(0)	Trend & Intercept	Integrated of order 0

Source: Author’s computation from Eviews software, 2025

Table 1 indicates that the FIO and LEN series are integrated of order zero [I(0)]. This suggests that the series are stationary, that is, the mean and variance of the series do not vary systematically over time. This result is borne on the fact that at 5 percent level, the ADF test statistic values (-6.296052 and -14.30173) of the FIO and INF series respectively are more negative than their corresponding critical values (-3.526609 and -3.520787). On the other hand, LEN and EXC became stationary at 5 percent level after first differencing.

Lag Length Selection

Table 2 shows the result of the lag length criteria used in selecting the appropriate number of lags. The selection relied on the Akaike Information Criterion (AIC).

Table 2: Lag Length Selection Criteria Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-432.5266	NA	61976.98	22.38598	22.55660	22.44720
1	-368.2206	112.1233	5233.923	19.90875	20.76186	20.21484
2	-333.7933	52.96513	2092.490	18.96376	20.49935*	19.51472
3	-322.8494	14.59188	2914.513	19.22304	21.44113	20.01887
4	-282.2546	45.79919*	953.6767*	17.96178*	20.86234	19.00247*

*Indicate lag order selected by the criterion

Source: Author's computation from E-views software, 2025

The result in Table 2 shows that the optimum lag is 4. This is on the basis that the Akaike Information Criterion (AIC) yielded the lowest value of 36.39279 at lag 4 compared to other lags. Therefore, in estimating the model of the study, the optimum number of lags used was 4.

Cointegration Test Result

ARDL bounds cointegration test method was used to test for the existence of long-run relationship between the dependent variable and the independent variables. The result is given in Table 3.

Table 3: Result of the ARDL Bound test

Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**	**Decision**
F-statistic	8.937690	10%	2.37	3.2	
K	3	5%	2.79	3.67	Cointegrated
		2.5%	3.15	4.08	
		1%	3.65	4.66	

Note: K denotes number of explanatory variables

Source: Author's computation from Eviews software, 2025

The result in Table 3 points to the existence of long-run relationship among the variables of the study. This is based on the fact that the computed F-statistic value of 8.937690 is greater than the upper critical bound value of 4.08 at 5 percent level. This confirms the presence of a cointegration relationship between the value of fisheries output and the independent variables.

Model Estimation

The result of the regression analysis using the ARDL method is presented in Table 4.

Table 4: ARDL Long and Short Run for Model

Dependent Variable: FIO				
		Short run results		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FIO(-1))	0.660350	0.118228	5.585374	0.0000
D(FIO(-2))	0.435965	0.132138	3.299310	0.0038
D(FIO(-3))	0.421820	0.098963	4.262386	0.0004
D(LEN)	-0.008072	0.001920	-4.203324	0.0005
D(LEN(-1))	-0.012989	0.002314	-5.612195	0.0000
D(LEN(-2))	-0.011297	0.002088	-5.411626	0.0000
D(LEN(-3))	-0.005209	0.001858	-2.802817	0.0114
D(EXC)	7.70E-05	0.000121	0.634245	0.5335
D(EXC(-1))	0.000118	0.000104	1.134016	0.2709
D(EXC(-2))	-0.000303	8.69E-05	-3.490450	0.0024
D(EXC(-3))	-0.000263	9.20E-05	-2.859483	0.0100
D(INF)	-0.000442	0.000464	-0.953961	0.3521
D(INF(-1))	0.003787	0.000750	5.049854	0.0001
D(INF(-2))	0.001872	0.000548	3.416515	0.0029
D(INF(-3))	0.001015	0.000190	5.352996	0.0000
CointEq(-1)*	-0.854496	0.116178	-7.355035	0.0000
		Long-run results		
LEN	0.006174	0.003479	1.774773	0.0920
EXC	0.000364	0.000244	1.490766	0.1524
INF	-0.005463	0.001048	-5.213045	0.0000
C	0.392565	0.071074	5.523329	0.0000
R-squared	0.876791			
Adjusted R-squared	0.796437			
Durbin-Watson stat	2.106416			

Source: Author's computation from Eviews software, 2025

The result of the ARDL estimation in Table 4 indicates that in the short run, LEN had a significant negative impact on FIO at 5 percent level. Implying that the performance of FIO is influenced by changes in LEN in the short run. In contrast, in the long-run, a positive but insignificant impact of LEN on FIO was recorded at levels. Thus, the study can marginally infer that the null hypothesis that lending rate has no significant influence on the value of fisheries output in Nigeria is rejected.

In another development, EXC in the short run had no significant impact on FIO in the current period and in the previous one year. Nevertheless, the result of the second lag and third lag period suggest evidence of significant negative impact of EXC on FIO at 5 percent level. The coefficients of EXC in these lags of -0.000303 and -0.000263 respectively indicate that for every one unit increase in EXC, FIO will decrease by 0.000303 in the second lag period and 0.000263 in the third lag period. The long-run result of EXC shows that no significant impact was registered by EXC on FIO in the Nigerian economy within the period under evaluation.

INF on the other hand had evidence of significant negative impact on FIO in the long-run. However, the short run result discloses a significant positive impact of INF on FIO in the short run at 5 percent level except for the current period where INF had no impact of FIO.

In addition, Table 4 demonstrates that the error correction term (ECT) represented as CointEq(-1) had a coefficient of -0.854496 which is appropriately signed and significant at 5 percent level. This result indicates that the system corrects approximately 85.46 percent of the deviation from the long-run equilibrium in each period. In another light, the model yielded an R-squared of 0.876791 which implies that about 87.68 percent of the variation in the dependent variable is explained by the independent variables. On the other hand, the Durbin-Watson value of 2.106416 is close to 2 and can be generally considered acceptable. Thus, it follows that the presence of autocorrelation is lacking in the model**.** This result is consistent with the work of Obekpa et al. (2020).

Diagnostic Tests Results

The results of the diagnostic tests comprising of the Serial Correlation LM test, Heteroskedasticity Test, Ramsey RESET, and CUSUM test are presented in Table 5 and Figure 1 respectively.

Table 5: Result of Serial Correlation, Heteroskedasticity, Ramsey RESET Tests

Breusch-Godfrey serial correlation LM test	F-statistic	0.153415	Prob. F(2,17)	0.8589
	Obs*R-squared	0.691423	Prob. Chi-Square(2)	0.7077
Breusch-Pagan-Godfrey Heteroskedasticity	F-statistic	2.431655	Prob. F(19,19)	0.0299
	Obs*R-squared	27.63522	Prob. Chi-Square(19)	0.0907
Ramsey RESET	t-statistic	2.093522	Prob. Value	0.0507
	F-statistic	4.382833	Prob. Value	0.0507

Source: Author's computation from Eviews software, 2025

The result in Table 5 indicates the evidence of the absence of serial correlation and heteroskedasticity in the model. This outcome is hinged on the premise that the Obs*R-squared of the Breusch-Godfrey serial correlation LM test and Breusch-Pagan-Godfrey Heteroskedasticity had respective probability values of 0.7077 and 0.0907 respectively are greater than 0.05. Further, the result of the Ramsey RESET suggests that the model was well-specified ((i.e., no omitted variables or functional form issues) since the probability value of 0.0507 associated with the F-statistic is marginally greater than 0.05.

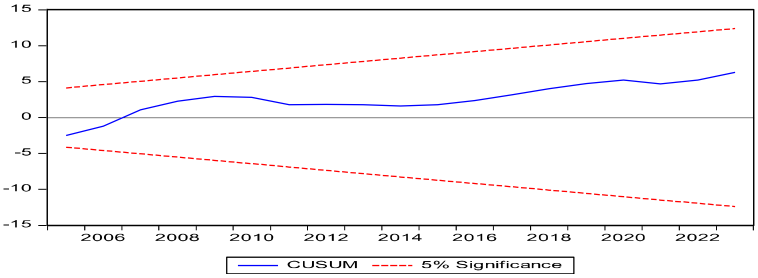

Figure 1: The Cumulative Sum Recursive Plot
Source: Authors estimation, 2025

The result in Figure 1 shows that the plotted CUSUM line, throughout the sample period does not deviate from the confidence bounds which is at 5% level. This indicates that the coefficients of the model are stable over time.

Discussion of Findings

The findings of the study show that in the short run, LEN had a significant negative impact on FIO. This result is in line with the a priori expectation and the theoretical postulation. The result suggests that the performance of the fishery sub-sector is influenced by changes in lending rate under the evaluation period. This pattern is consistent with the idea that higher borrowing costs reduce investment in fisheries (equipment, boats, or inputs like feed), with effects manifesting overtime due to financing and production lags. The consistently negative and significant coefficients in the result highlight the sensitivity of the fisheries sector to borrowing costs. Higher lending rates will likely constrain investment and operational financing, reducing output. This result corroborates with the findings of Asekome and Ikojie (2018). In contrast, the long-run result showed that LEN had a positive but insignificant impact of FIO within the sample period. This implies that in the long-run, lending rate in the economy losses its influence on the performance of the fisheries sub-sector. This could be attributed to monetary policy transmission measures by the apex bank which have long-run implications.

The result on EXC showed that in the long-run, the Nigerian economy did witness any impact of EXC on FIO. This long-run result disagrees with the findings of Obekpa et al. (2020). However, the short run result showed that immediate and first-lagged effects of EXC on FIO are positive but statistically insignificant, suggesting that short-run changes in the real effective exchange rate have little immediate impact on fisheries output. However, the results of the succeeding lags showed that EXC had a significant negative impact on FIO. Indicating that a depreciation (increase) in the real effective exchange rate reduces FIO after two and three periods. This delayed negative effect could reflect Nigeria's reliance on imported inputs (e.g., fishing gear, fuel) for fisheries, where a weaker naira (higher EXC) increases costs over time, squeezing profitability. The cumulative effect in the short run is mixed.

Further, there is evidence that contemporaneous INF changes do not significantly affect FIO in the current period of the short run. However, the positive outlook of the lagged effects of INF on FIO, indicates that inflation increases in previous periods boost fisheries output. This positive effect could arise because higher inflation increases nominal fish prices, benefiting producers in the short run, especially if input costs lag behind output price increases. In contrast, the long-run result shows that INF had a significant negative impact on FIO which suggests that sustained inflation erodes the fisheries sector's output over time. While short-run inflation may boost nominal fish prices and revenues (as seen in the positive lagged effects), persistent inflation likely increases input costs (feed, labor, fuel), reduces real purchasing power, and disrupts investment planning, leading to lower output in the long run. This is particularly relevant in Nigeria, where high inflation is a chronic issue, often driven by supply-side shocks (fuel price hikes, insecurity affecting agriculture) and monetary expansion. This long-run result agrees with the findings of (Owoh, 2024).

Conclusion

The study evaluated the effect of macroeconomic indicators on fisheries output in Nigeria through the period 1981–2023. The ARDL results show that fisheries output in Nigeria responds strongly to macroeconomic conditions. In the short run, higher lending rates consistently reduce output across several lags, reflecting the immediate financial pressure on fish farmers and operators. Exchange rate changes create mixed short-term effects, while inflation initially appears neutral but turns supportive through lagged positive impacts. Over the long-run, however, inflation stands out as a clear and powerful drag on fisheries output, seriously undermining sector performance. Lending rates show positive but insignificant association, suggesting no eventual benefits from credit access in the economy over the long term. Overall, controlling inflation remains the most critical factor for sustaining and growing fisheries output in the long term.

Recommendations

Following the empirical findings reached by the study, the following recommendations are made that:

1. Nigeria should prioritize proactive management of inflation using efficient monetary policies such as, inflation/interest rate targeting to protect long-run fisheries growth.
2. Government should develop affordable credit programmes for the fisheries sub-sector to offset short-run negative effects of high lending rates while capturing potential long-term gains.
3. Nigeria should strengthen exchange rate stability mechanisms to reduce short-term volatility shocks that disrupt input costs and export competitiveness.

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