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Nexus between Economic Phenomena and Growth Rate of Fishery Sector in Nigeria

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Abstract. Time series data that spanned from 1981-2019 sourced from CBN, FAO, and UNCTAD data banks were used to determine the growth of fishery sector in Nigeria. The obtained data was analyzed using the two-step methodology of Engel and Granger, Granger causality, and the impulse response function. The result showed evidence of co-integration between fishery GDP growth rate and the economic phenomena. Also, the GDP growth rate of the sector is efficient as it established a long-run equilibrium but the slow pace at which it corrects the distortion in its equilibrium makes the state of the efficiency to be a weak one. Furthermore, the fishery's GDP growth rate is affected by high inflationary trend, red-tapism, and poor credit utilization. Empirical evidences showed that unexpected local shocks on the economic phenomenon will have a transitory effect on FGDP growth rate, thus will die-out over time. It was observed that the effect of the internal mechanism on the growth rate is passive while the external system effect is active on the growth rate. Therefore, the study recommends the need for policy strengthening by the concerned stakeholders viz: tiding of inflationary trend, red-tapism, and ineffective credit utilization, thus enhancing the growth of the sector.

Keywords: economic phenomena, fishery, GDP, growth rate, Nigeria

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1. Introduction

Keeping in mind the incontrovertible fact that macroeconomic imperatives have a considerable impact on agricultural development direction and scale. In order to attain well-established and sustained economic growth, [1] discovered that an effective macroeconomic policy structure is necessary for the regulation of economic activity in emerging economies. Obviously, this assumption is based on a Keynesian theory tenet that claims that public policy has a direct impact on aggregate demand in the short run, which has multiplier effects on the growth of actual economic sectors [2].

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The most common human activity that has an impact on the world's seas is fishing [3]. Because the fishing industry employs over 10 million people and fish is the most traded food, it plays an important role in the global economy. As a result, the industry has become a significant source of socioeconomic progress [3]. Capture fisheries are important for the poorest countries' economic, social, and nutritional well-being, providing around half of the animal protein consumed domestically and accounting for almost half of export revenues. The whole value of catch fishing, including retail and manufacture, is expected to be around US$ 80 billion, with a total volume of around US$ 200 billion [4] and [5].Fisheries and aquaculture production has gradually increased over the previous few decades, and it is now a key seafood provider. The ability of the sectors to address mounting ecological, social, and economic challenges that could threaten the ability to sustain the production of ethical, sustainable, and environmentally sound fish has grown in lockstep with the scale of the industry [6].

Total fish production in 2012 was 185 million tons, with 91 million tons from capture (containing 11.6 million tons from inland and 79.7 million tons from marine harvests, respectively) and the rest from aquaculture [4], [7]. Aquaculture-based fish production continues to play a significant role in increasing global fish production. Aquaculture accounted for 90.4 million tons, or $144.4 billion, in 2012 [8]. Capture fisheries employ 58.27 million people worldwide, whereas fish/shellfish farming employs 18.86 million. According to the [4], approximately 7.2 billion people consume 136.2 million tons of fish food annually, or 19.2 kg per capita, whereas 21.7 million tons of fish are used as feed reduction/raw materials for fish and animal feeds. With the passage of time, the fisheries sector is remarkably increasing all over the world, thanks to multiple opportunities for self-employment [9] and [10].

Nigeria holds excellent fisheries with an 853-kilometer coastline and over 14 million hectares of inland waters. Fishery sources provided more than 60% of total protein intake among adults in Nigeria, according to [2] and [11], particularly in rural areas. Surprisingly, both in terms of production capacity and dietary requirements, the country is still unable to meet the majority of its people's fishing demands. For example, in 2015, the country's average annual domestic fish production (including aquaculture and artisanal production) per capita was 6.09 kg, while in 2016, it was 5.67 kg. If all of what is produced is sold, these amounts are clearly below the FAO/WHO recommended daily protein requirement of 0.75 g per kg of lean body weight.This validates the reliance on imports and the proclivity to smuggle for a significant share of domestic consumption. In 2012, the country's national demand was 2,000,000 tons, while supply was 690,000 tons, resulting in a 1,310,000-ton deficit, according to the Federal Department of Fisheries (2018). The government sought 2,175,000 tons of fish for domestic consumption in 2014, with a peak supply of 730,000 tons and a shortfall of 1,404,000 tons. In 2013, Nigerian fish exports totaled US$ 284,390 million, while imports were estimated to be at US$1.2 billion. According to the [12], Nigeria is one of the world's largest importers of fish products. As a result, aquaculture development is the key to realizing the country's much-desired fish-food sufficiency.

A review of the trend pattern of Nigerian fishery sector showed the real Gross Domestic Product (GDP) trend to be marked by a marginal change that was characterized by intermittent upward and downward swings for almost four decades as against the nominal GDP trend which showed a steep increase (Table 1 and Figure 1).

Table 1. GDP at 2010 Constant Basic Prices (Naira Million)

Year	TGDP	AGDP	NFGDP	RFGDP	%GDP	%AGR	FGDP (GR%)
1981	15258004	2364373	90299.23	18793.82	0.59	3.82	100
1982	14985078	2425961	93856.08	7224.80	0.63	3.87	3.94
1983	13849725	2409082	97963.82	22739.69	0.71	4.07	4.38
1984	13779255	2303505	68010.74	12119.88	0.49	2.95	-30.58
1985	14953913	2731062	43969.46	3269.28	0.29	1.61	-35.35
1986	15237987	2986835	51511.83	2945.01	0.34	1.72	17.15
1987	15263929	2891672	40648.69	4589.37	0.27	1.40	-21.09
1988	16215371	3174568	59794.67	32594.81	0.37	1.88	47.10
1989	17294676	3325947	94809.39	47847.16	0.55	2.85	58.56
1990	19305633	3464716	101294.10	7459.70	0.52	2.92	6.84
1991	19199060	3590837	105346.40	13702.38	0.55	2.93	4.00
1992	19620190	3674793	94811.77	42275.47	0.48	2.58	-10
1993	19927993	3743666	71109.13	40649.71	0.36	1.90	-24.10
1994	19979123	3839675	66486.88	37918.60	0.33	1.73	-6.50
1995	20353202	3977382	73135.57	53268.66	0.36	1.84	10
1996	21177921	4133548	88347.90	25857.92	0.41	2.14	20.80
1997	21789098	4305680	98331.07	8387.52	0.45	2.28	11.30
1998	22332867	4475241	112196.00	11215.54	0.50	2.51	14.10
1999	22449410	4703644	128124.40	8479.75	0.57	2.72	14.20
2000	23688280	4840971	133249.20	9238.56	0.56	2.75	3.99
2001	25267542	5024542	143908.90	27160.86	0.57	2.86	7.99
2002	28957710	7817085	153017.10	19703.37	0.53	1.96	6.33
2003	31709447	8364832	159227.10	22342.40	0.50	1.90	4.06
2004	35020549	8888573	173019.40	25949.51	0.49	1.95	8.66
2005	37474949	9516992	183426.90	32766.44	0.49	1.93	6.02
2006	39995505	10222475	195432.50	16074.75	0.49	1.91	6.54
2007	42922408	10958469	208285.80	11222.45	0.48	1.90	6.58
2008	46012515	11645371	221970.10	25706.53	0.48	1.91	6.57
2009	49856099	12330326	235657.60	29586.72	0.47	1.91	6.17
2010	54612264	13048893	249711.50	34260.92	0.46	1.91	5.96
2011	57511042	13429379	270323.40	29303.13	0.47	2.01	8.25
2012	59929893	14329706	291306.70	35591.22	0.49	2.03	7.76
2013	63218722	14750523	317469.90	26908.20	0.50	2.15	8.98
2014	67152786	15380389	338754.10	27312.00	0.50	2.20	6.70
2015	69023930	15952220	358701.60	32316.82	0.52	2.25	5.89
2016	67931236	16607337	356128.40	55824.34	0.52	2.14	-0.72
2017	68490980	17179495	360913.40	59635.66	0.53	2.10	1.34
2018	69799942	17544148	366834.10	44367.60	0.52	2.09	1.64
2019	17286701	4288200	91706.88	10451.65	0.53	2.14	-75.00

Source: CBN database, 2020

Note: GDP = Gross Domestic Product; T = Total; A = Agriculture; F = Fishery; N = Nominal value; R = Real value; GR = Growth rate

The spike in the nominal GDP was majorly due to inflation and not shortage in output supply. Thus, what accrued to the sector has not been impressive. In addition, the graph showed that the fishery GDP trend has been on the decline from 2017 till 2019. In the same vein, the growth rate of the fishery GDP has not been impressive for the past four decades: been almost stagnant for almost two decades (2000-2015).

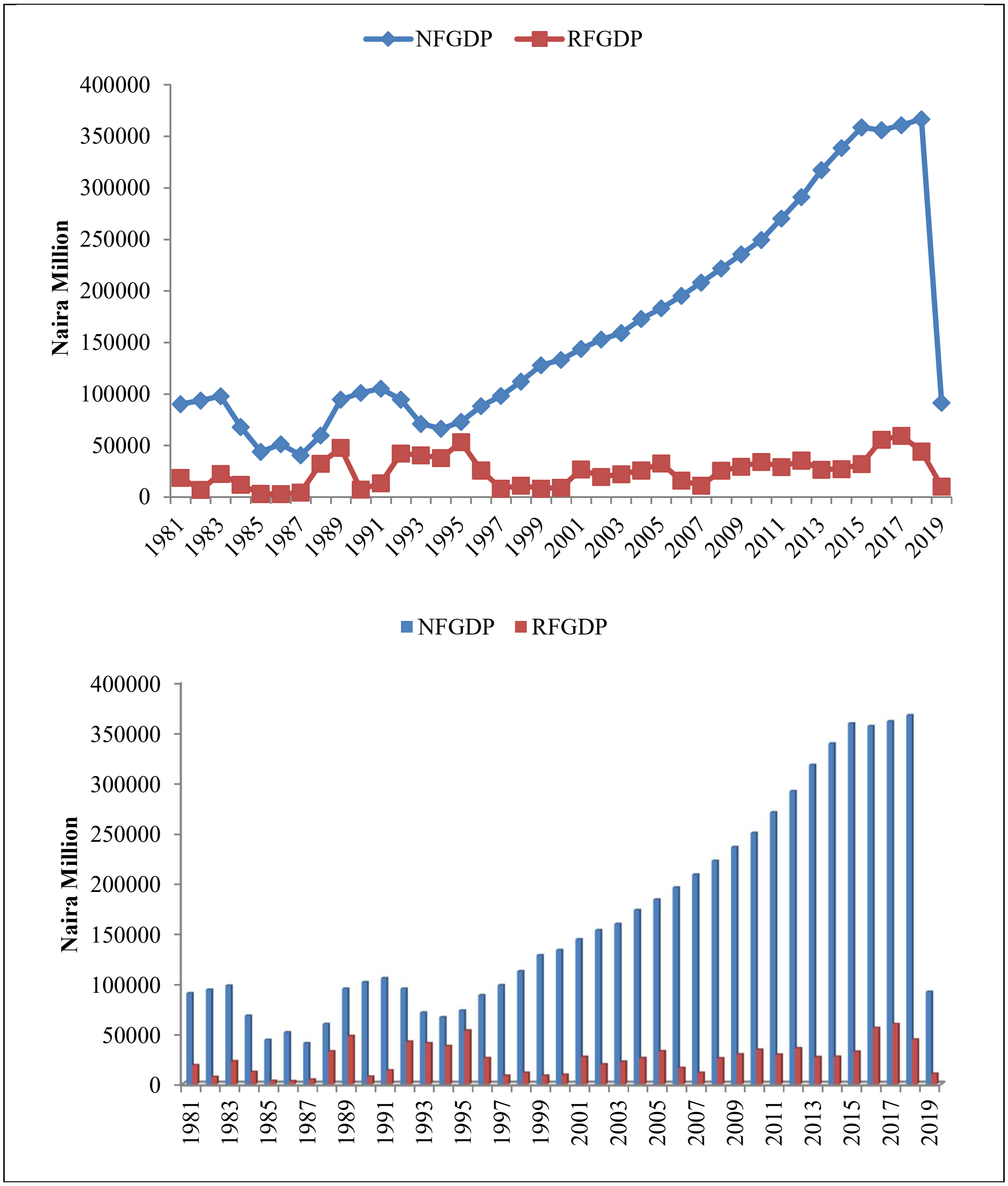

Figure 1. Nominal and Real GDP of Fishery Sector

From the year 2016 to 2019, the graph showed a steep declining trend which transit into an uncomfortable zone (Table 1 and Figure 2).

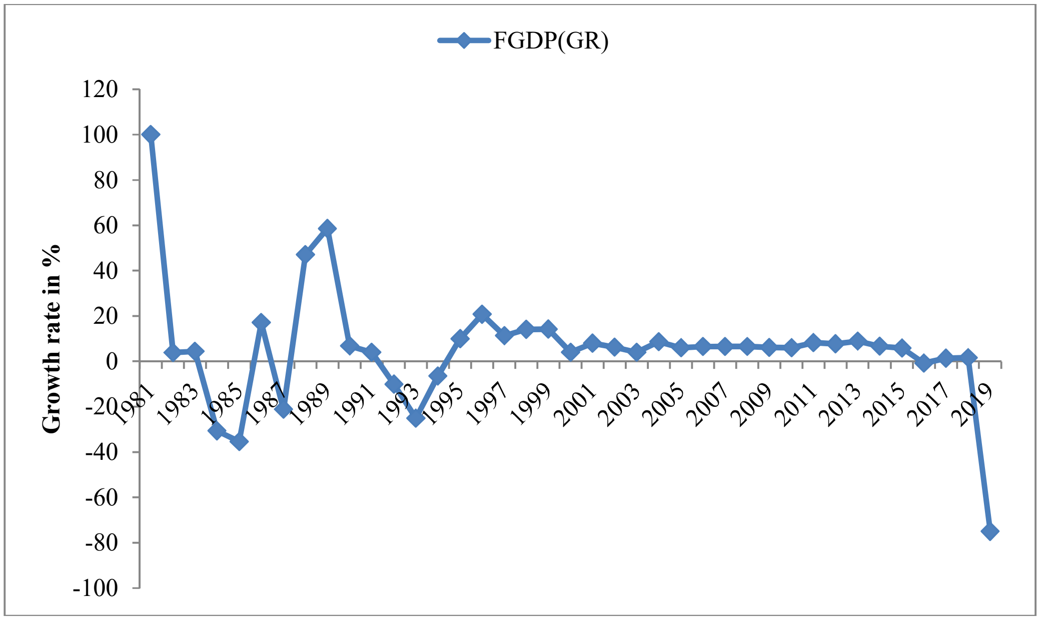

Figure 2. Growth Rate of FGDP

Furthermore, research showed that the contribution of the fishing GDP to the total GDP and agriculture GDP was dismal (Figure 3).

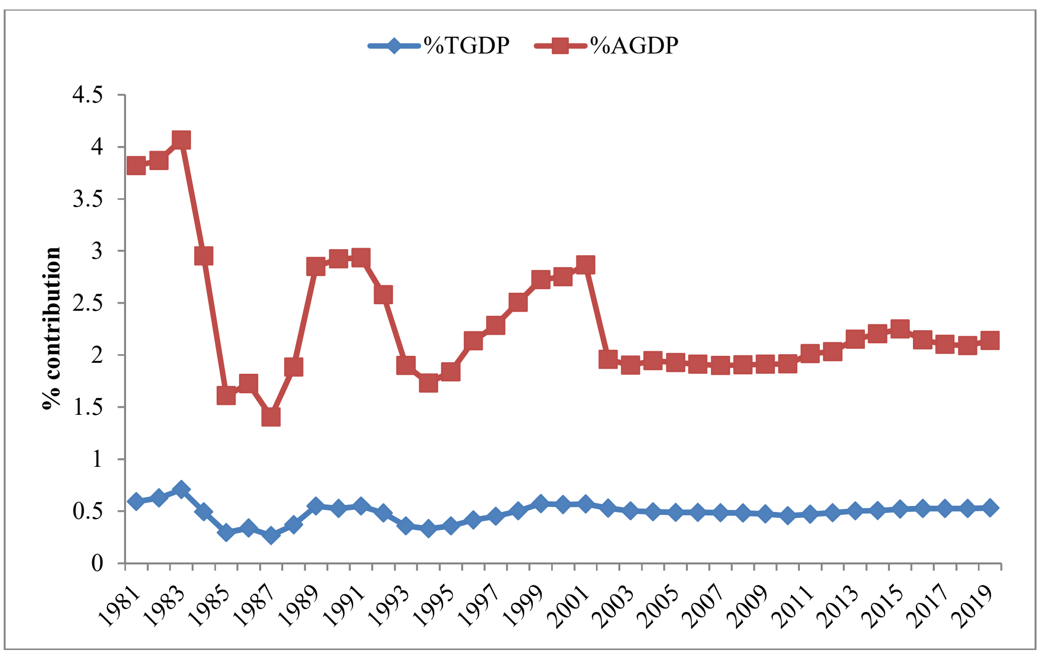

Figure 3. Percentage Contibution of FGDP to TGDP and AGDP

On the average, for the past four decades, the sector contributions to the total GDP and Agriculture GDP were 0.49% and 2.30% respectively. For the past three decades, the sector contributions to total GDP and Agriculture GDP were less 1 and 2.5% respectively. Infact, the contributions of the sector to total GDP and Agriculture have been stagnant for almost two decades. Thus, this poor performance of the country's fishery sector calls for an empirical research so as to identify the economic phenomenon slowing down the sector. This research is timely because it will give an insight to policymakers on how to arrest the situation, thus enhancing the economy of the country. In addition, this research will add to the existing body of knowledge as related studies had a narrow scope, thus creating a vacuum for additional studies on the nexus between economic phenomenon and the growth rate of the fishery sector in Nigeria. As a result of the preceding, the study determined the relationship between economic phenomena and fishery GDP growth rate in Nigeria. The precise goals were to identify the impact and effect of economic phenomena on the fishing sector's growth rate; determine the causal relation between the fishery GDP growth rate and the economic phenomenon; and, determine the effect of economic shocks on fishery GDP growth rate.

2. Research Methodology

The study employed data from the Central Bank of Nigeria (CBN), the Food and Agriculture Organization (FAO), and the United Nations Conference on Trade and Development (UNCTAD) databases, which covered the years 1981 to 2019. The data covered Fishery's Gross Domestic Product (FGDP), General Government Final Consumption Expenditure (GCE), Share of General Government Final Consumption Expenditure as percentage of GDP (SGCE), Nominal Gross National Income (GNI), Nominal Gross National Income Per Capita (GNIC), Consumer Price Index (CPI), Agricultural Science and Technology Indicators (ASTI)-Expenditures (Total spending) (TSAT), ASTI-Expenditures (Share of value added) (SAT), ASTI-Researchers (Total researchers) (TAR), ASTI-Researchers (Per 100,000 farmers) (RPF), Credit to allied sector (CR) and Exchange Rate. ADF, Engle and Granger cointegration test, and error correction model (ECM); Granger causality test, and Impulse response functions were used to achieve objectives 1, 2, and 3.

2.1. Model Specification: Augmented Dickey-Fuller Test (ADF)

The Augmented Dickey-Fuller test (ADF) utilized is shown below, based on [13]-[15].

$$\Delta P_t = \alpha + P_{t-1} + \sum_{j=2}^{it} \beta_i \Delta P_{it-j+t} + \varepsilon \tag{1}$$

Where, P_{it} is the i^{th} variable at the time t;$\Delta P_{it}(P_{it}-P_{t-1})$and $\alpha$is the trend and intercept terms respectively.

2.2. Model Specification: Engle and Granger Co-Integration Test

The formulation tests on residual from the co-integration test are given below, according to [16] and [17].

$$P_1=\alpha+P_2+P_n+\varepsilon \quad (2)$$

Where P_1, P_2, and P_n are different economic series,α is constant, and ε is noise.The residuals from the following equations are considered short-term deviations from long-run equilibrium. The residual derived from equation is then subjected to an ADF unit root test (2).

2.3. Model Specification: Engel-Granger Two-Step Approach

[18] used the Engel-Granger two-step technique, often known as ECM, which is shown below:

$$FGDP_t=\beta_0+\beta_1GCE_t+\beta_2SGCE_t+\beta_3GNI_t+\beta_4GNIC_t+\beta_5INF_t+\beta_6SAT_t+\beta_7TSAT_t+\beta_8TAR_t+\beta_9RPF_t+\beta_{10}CR_t+\beta_{11}REER_t+\varepsilon_t \quad (3)$$

$$\Delta FGDP_t=\beta_0+\beta_1\Delta GCE_t+\beta_2\Delta SGCE_t+\beta_3\Delta GNI_t+\beta_4\Delta GNIC_t+\beta_5\Delta INF_t+\beta_6\Delta SAT_t$$

$$+\beta_7\Delta TSAT_t+\beta_8\Delta TAR_t+\beta_9\Delta RPF_t+\beta_{10}\Delta CR_t+\beta_{11}\Delta REER_t+ECT_{t-1}+\varepsilon_t \quad (4)$$

$$EER = (CPI_{Nigeria}/CPI_{USA})*\text{Nominal Exchange Rate} \quad (5)$$

$$INF = [(CPI_{current}-CPI_{base})/CPI_{base}]*100 \quad (6)$$

Long-run and short-run dynamics are represented by equations (3) and (4), respectively. The FGDP stands for gross domestic product; INF stands for inflation; REER stands for real effective exchange rate; ECT stands for error correction term coefficient/attractor coefficient; ε is the white noise; Δ is the difference operator; β_0 stands for intercept; β_{1-n} stands for parameter estimate coefficients; ‘t' stands for time; and ‘t-1’ stands for lag 1 of time ‘t'. The methodology's body text contains information about the remaining symbols.

2.4. Model Specification: Granger Causality Test

The model used to determine whether indicator P_1Granger affects indicator P_2 or vice versa, according to [19], is as follows:

$$P_t=\alpha+\sum_{i=1}^{n}(\emptyset P_{1t-i}+\delta_iP_{2t-i})+\varepsilon_i \quad (7)$$

A simple test of the joint significance of $\delta_i$was used to check the Granger causality i.e. $H_0:=\delta_1=\delta_2=\ldots\ldots\delta_n=0$.

2.5. Model Specification: Impulse Response Functions

In the case of an arbitrary current shock (δ) and history(ω_{t-1}), the Generalized Impulse Response Function (GIRF) is as follows [20]-[23]:

$$GIRF_Y(h,\delta,\omega_{t-1})=E[Y_t+h\mid\delta,\omega_{t-1}]-E[Y_{t-1}\mid\omega_{t-1}] \quad (8)$$

3. Results and Discussion

3.1. Unit Root Test

All of the variable series had unit roots at the level, showing that they are non-stationary, as evidenced by their ADF tau-statistics, which were all equal to zero at the 5% probability level. Following the initial difference, however, all of the variable series were stationary, or trendless, as demonstrated by their individual tau-statistics, which were all within the permissible margin of 5 percent degree of freedom (Table 2). As a result, these variable series can be inferred to be integrated of the same order-all variables are integrated of order one, i.e. (1). The Engel and Granger co-integration test was done to examine if there was any co-integration between these variables because they are integrated of order one. In their investigations, [2] and [24] discovered a similar scenario; however, [3] discovered the opposite condition (integration of distinct orders).

Table 2. Unit Root Test

Items	Stage	ADF		Decision
		tau-stat	t-critical	
FGDP	**Level**	-1.05	0.26	Non-stationary I(0)
	$1^{st}\Delta$	-2.02**	0.04	Stationary I(1)
GCE	**Level**	-0.77	0.81	Non-stationary I(0)
	$1^{st}\Delta$	-3.78**	0.01	Stationary I(1)
SGCE	**Level**	-1.22	0.65	Non-stationary I(0)
	$1^{st}\Delta$	-4.65**	0.00	Stationary I(1)
GNI	**Level**	-0.76	0.83	Non-stationary I(0)
	$1^{st}\Delta$	-3.66**	0.01	Stationary I(1)
GNIC	**Level**	-0.89	0.79	Non-stationary I(0)
	$1^{st}\Delta$	-3.59**	0.01	Stationary I(1)
INF	**Level**	-2.52	0.11	Non-stationary I(0)
	$1^{st}\Delta$	-5.14**	0.00	Stationary I(1)
SAT	**Level**	-1.69	0.42	Non-stationary I(0)
	$1^{st}\Delta$	-5.38**	0.00	Stationary I(1)
TSAT	**Level**	-0.93	0.76	Non-stationary I(0)
	$1^{st}\Delta$	-5.53**	0.00	Stationary I(1)
TAR	**Level**	-1.69	0.73	Non-stationary I(0)
	$1^{st}\Delta$	-4.66**	0.00	Stationary I(1)
RPF	**Level**	-1.78	0.69	Non-stationary I(0)
	$1^{st}\Delta$	-4.66**	0.00	Stationary I(1)
CR	**Level**	-0.83	0.80	Non-stationary I(0)
	$1^{st}\Delta$	-5.52**	0.00	Stationary I(1)
REER	**Level**	-2.40	0.63	Non-stationary I(0)
	$1^{st}\Delta$	-4.86**	0.00	Stationary I(1)
ECT	**Level**	-4.89**	-3.34^^	Stationary I(0)

Note: **& ^^ indicate rejection of unit root at 5% significant level and Engel-Granger critical value at 5% respectively

3.2. Co-Integration Test

The Engle and Granger co-integration tests revealed that all of the economic data series were non-stationary at the level, as demonstrated by their individual ADF-tau values, which were outside the allowed margin of 5%. The residual from the co-integrating regression using FGDP (predict variable) vs the remaining variables (predictor variables) was also found to be stationary, as demonstrated by the ADF-tau statistic, which is smaller than the Engel and Granger t-critical level at the 5% significant level (Table 2). It is possible to conclude that there is evidence of a co-integrating relationship because the unit root hypotheses are not rejected at the level for all variables and the unit root for residual from the co-integrating regression is rejected at the level. In a nutshell, these variables move together over time, implying that they have a long-term relationship.

3.3. Effect and Impact of Macro-Economic Indicators on FGDP Growth Rate

Having established a co-integrating relationship, the ECM was estimated to determine whether the co-integrated relationship established a long-run equilibrium. The short-run dynamics measured by the ECM showed the attractor coefficient to have the appropriate sign i.e. negative sign and significant at 1% probability level, thus implying that the FGDP growth rate established a long-run equilibrium (Table 3).

Table 3. Long-Run and Short-Run Predictions of FGDP

Variable	long-run dynamic model			short-run dynamic model		
	Coefficient	SE	t-ratio	Coefficient	SE	t-ratio
Intercept	106.04	27.940	3.795***	−1.8229	4.6581	0.391^{NS}
GCE_t	0.0024	0.0011	2.076*	0.0028	0.0013	2.264**
$SGCE_t$	−4.0325	3.9779	1.014^{NS}	−5.5916	4.5565	1.227^{NS}
GNI_t	0.0017	0.0005	3.507***	0.0019	0.0003	6.070***
$GNIC_t$	−0.2777	0.0754	3.681***	−0.3132	0.0506	6.186***
INF_t	−0.2792	0.1308	2.134**	−0.4018	0.0836	4.809***
SAT_t	16.940	22.233	0.761^{NS}	22.581	19.548	1.155^{NS}
$TSAT_t$	−0.0074	0.0066	1.115^{NS}	−0.0067	0.0042	1.583^{NS}
TAR_t	−0.6226	0.2686	2.318**	−0.3434	0.2769	1.240^{NS}
RPF_t	73.004	33.164	2.201**	38.958	34.521	1.129^{NS}
CR_t	−0.0211	0.0085	2.483**	−0.0218	0.0076	2.853**
$REER_t$	−0.0367	0.0309	1.195^{NS}	−0.3290	1.2607	0.261^{NS}
ECT_{t-1}	-	-	-	−0.8977	0.1554	5.777***
R^2	0.7505			0.8048		
R^2Adjusted	0.5889			0.6487		
F-statistic	4.15***			9.183***		
BLM	$11.80(0.378)^{NS}$			$10.53(0.568)^{NS}$		
D-W	1.529			1.464		
ALM	$1.056(0.555)^{NS}$			$1.182(0.382)^{NS}$		
Arch LM	$15(0.378)^{NS}$			$3.101(0.540)^{NS}$		
Normality test	$0.432(0.805)^{NS}$			$0.186(0.911)^{NS}$		
CUSUM test	$1.129(0.275)^{NS}$			$-0.507(0.619)^{NS}$		

Source: Authors' computation, 2020

Note: *** ** * & NS mean significant at 1, 5, 10%, and non-significant; BLM = Breusch-Pagan Heteroskedasticity Langrage Multiplier test; ALM = Autocorrelation Langrage Multiplier; D-W = Durbin-Watson statistic.

Therefore, the FGDP growth rate is capable of absorbing any shocks that emanates from any of the economic dynamics. An economic shock that induces deviation in the growth rate of FGDP would force the fishery sector to respond to the shock in a way that the FGDP growth rate will converge towards its equilibrium. The speed of adjustment been -0.898, implies that if there is any deviation from the equilibrium due to an economic shock, it will take approximately 10.8 months for the FGDP growth rate to correct the error/disequilibrium before re-establishing an equilibrium. Given the slow rate response of the FGDP growth rate as evidenced by the long duration of the time length requirement, it can be inferred that the fishery sector of the country is weakly efficient. Furthermore, there is delay in the short-run economic transmission as evident by the significance of the coefficients of the differenced explanatory economic variables. The result is in line with the findings of [2] and [24].

The co-integrated regression is the long-run dynamics while the ECM is the short-run dynamics (Table 3). The empirical evidences showed that economic variables viz. Government Consumption Expenditure (GCE), Gross National Income (GNI), Gross National Income per Capita (GNIC), Inflation (INF), and Credit (CR) had influence on FGDP growth rate both in the short and long-runs; while Total Agricultural Researchers (TAR) and Researcher per 1000 Farmers (RPF) had influence on FGDP growth rate in the long-run as indicated by their respective estimated coefficients which were different from zero at 10% probability level.

The positive significant of GCE coefficient implied that government recurrent and capital expenditures triggered output expansion in the fishery sector which in turn stimulated positive growth rate in FGDP. Therefore, the marginal implication of a unit increase in GCE will leads to an increase in the FGDP growth rate by 0.0028 and 0.0024% in the short and long-runs respectively. The result of the short run conforms with the finding of [24] in their studies on the impact of macro-economic policy on capture fishery in Nigeria. The positive significant of the GNI implied that income rise in the economy triggered increase in consumption of fish products which in turns increased demand for capital goods for fish production, thus increase in the FGDP growth rate. The marginal implication of a unit increase in the GNI will leads to an increase in FGDP growth rate by 0.0019 and 0.0017% in the short and long-runs respectively. The negative significant of the GNIC coefficient showed how low consumer purchasing power due to inflation in the general price level i.e. a declining consumer purchasing power in relation to an inverse high inflationary trend in general price level affected consumption of fish, thus the decline in the FGDP growth rate. Therefore, the marginal implication of a unit increase in GNIC will leads to a decrease in FGDP growth rate by 0.313 and 0.278% in the short and long-runs respectively. These results are contrary to the findings of [2].

The negative significance of INF estimated coefficient indicated how inflation due to high cost of inputs, shortage of production and weak government policy plummet the FGDP growth rate. Thus, the marginal implication of a percent increase in the INF rate will make FGDP growth rate plummets by 0.402 and 0.279% in the short and long-runs respectively. [2] found a similar result, though non-significant. The negative significant of the CR coefficient revealed non-productive and productivity of the credit advanced to the sector due to diversion for other purposes by the upstream participants and market imperfection which characterized the supply chain, thus plummeted the FGDP growth rate. [24] and [2] had a contrary trend but the parameter was non-significant. Therefore, the marginal implication of a unit increase in CR will leads to a decrease in the FGDP growth rate by 0.021 and 0.022% in the short and long-run respectively.

Though non-significant, the negative sign associated with the REER implied that devaluation in the country currency triggered inflation that affects import of tradable inputs, thus plummeted FGDP growth rate. However, the non-significant of the REER coefficient may be attributed to a high patronage of locally sourced tradable inputs utilized in the sector. This finding is in line with the result of [2] and contrary to the finding of [24].

The negative significant of the TAR coefficient showed presence of red tapism due to bloat in the work force of the researchers, thus plummeted the FGDP growth rate. Thus, the marginal implication of a unit increase in TAR will make FGDP growth rate plummets by 0.623% in the long-run. However, in the case of researchers-farmers' ratio, high labour productivity efficiency was observed as evident by the positive significant of RPF. Therefore, the marginal implication of a unit adjustment in the ratio of RPF will lead to an increase in FGDP growth rate by 73.0% in the long-run.

The short and long-run dynamics coefficients of multiple determinations are 0.805 and 0.751 respectively, implying that 80.1 and 75.1% of FGDP growth rates in the former and latter were determined by the economic phenomenon while disturbed economic reality accounted for the remaining percentages. Furthermore, the diagnostic tests for both the dynamics showed their residuals to be normally skewed; devoid of heteroscedasticity, no auto-regression, and no Arch effect as indicated by their respective Langrage multiplier test statistics which were not different from zero at 10% significance level. In addition, the parameter estimate of the dynamics were stable i.e. no change in the parameter estimates as evident by their respective CUSUM Harvey-Collier test statistics which were beyond the plausible margin of 10% degree of freedom. These dossierevidences showed that the parameter estimates in both the short and long-run dynamics are reliable for future prediction with accuracy, consistency, and certainty.

3.4. Granger Causality of FGDP Growth Rate *vis-a-vis* Macro-Economic Indicators

A cursory review of the Granger causality test showed FGDP to have forward unidirectional causalities with GNI, GNIC, and REER; a backward unidirectional causality with CR; and bidirectional causality with INF as indicated by their respective Chi^2 test statistics which were within the acceptable margin of 10% probability level (Table 4). Bidirectional causality was observed between FGDP and INF as evident by the significant of their respective Chi^2 test statistics at 10% acceptable margin while FGDP in pairs with GCE, SGCE, SARTI, TSARTI, TAR, and RPF had no causality as indicated by their respective Chi^2 test statistics which were not different from zero at 10% level of significance. In other words it means that the variable pairs viz. FGDP-GNI, FGDP-GNIC, FGDP-REER, and FGDP-CR had unidirectional causality while FGDP-INF had a bidirectional causality as indicated by their respective Chi^2 test statistics which were within the plausible margin of 10% probability level. However, pairs of FGDP-GCE, FGDP-SGCE, FGDP-SARTI, FGDP-TSARTI, FGDP-TAR, and FGDP-RPF showed no causality as evident by their respective Chi^2 test statistics which were not different from 10% degree of freedom.

Table 4. Long-Run and Short-Run Predictions of FGDP

Null hypothesis	Chi^2	P< 0.10	Granger cause	Direction
FGDP ↔ GCE	0.1247	0.724	No	None
	0.00444	0.947	No	
FGDP ↔ SGCE	0.84098	0.359	No	None
	0.3379	0.561	No	
FGDP ↔ GNI	10.266**	0.001	Yes	Unidirectional
	0.00637	0.936	No	
FGDP ↔ GNIC	8.2005**	0.004	Yes	Unidirectional
	1.8e-05	0.997	No	
FGDP ↔ INF	2.7478**	0.097	Yes	Bidirectional
	4.708**	0.030	Yes	
FGDP ↔ SAT	0.1354	0.713	No	None
	1.0313	0.310	No	
FGDP ↔ TSAT	0.75587	0.385	No	None
	0.03787	0.846	No	
FGDP ↔ TAR	2.3298	0.127	No	None
	6.0e-05	0.994	No	
FGDP ↔ RPF	2.1557	0.142	No	None
	0.05133	0.821	No	
FGDP ↔ CR	0.8938	0.344	No	Unidirectional
	3.6737**	0.055	Yes	
FGDP ↔ REER	4.2907**	0.038	Yes	Unidirectional
	0.00477	0.945	No	
FGDP ↔ ALL	17.74**	0.088	Yes	Multidirectional

Note: ** denotes rejection of the H_0 at 5% level of significance
NS: Non-significant
→ ← means forward and backward directions respectively

In a pair-wise, the implication is that a change in the FGDP would granger causes a change in GNI, GNIC, and REER, whereas changes in the latter will not be transmitted to FGDP. However, a change in FGDP is not feed forward to CR, while a change in the latter is feedback to the former. A change in FGDP is not transmitted to GCE, SGCE, SARTI, TSARTI, TAR, and RPF; likewise changes in the latter economic variables are not transmitted to FGDP. Therefore, it can be inferred that FGDP had strong endogeneity with INF; weak endogeneity with GNI, GNIC, REER, and CR; and strong exogeneity with GCE, SGCE, SARTI, TSARTI, TAR, and RPF. For the strong endogeneity, it means that both economic variables in a pair contain useful information to predict the future of each other. In addition, this useful information was determined by the internal system. For the strong exogeneity, it implies that the economic variables in pair were independent of each other with none containing useful information to predict the future of each other. Thus, useful information in both economic variables was determined outside the system. The weak endogeneity showed that FDGP contains useful information to predict the future of GNI, GNIC, and REER; while FGDP didn't contain useful information to predict the future of CR but the latter contains useful information to predict the future of the former.

3.5. Effect of Local Shock on FGDP Growth Rate

A cursory review of the impulse response graph showed that unexpected shocks that are local to GCE, SGCE, GNI, GNIC, INF, SARTI, TSARTI, TAR, RPF, CR, and REER will have a transitory effect on the FGDP. Also, an orthogalized shock to the FGDP will have a transitory effect on the FGDP (Figure 4). Therefore, it can be inferred that the effect of the shocks that emanated from any of the economic variables on the FGDP will die-out overtime.

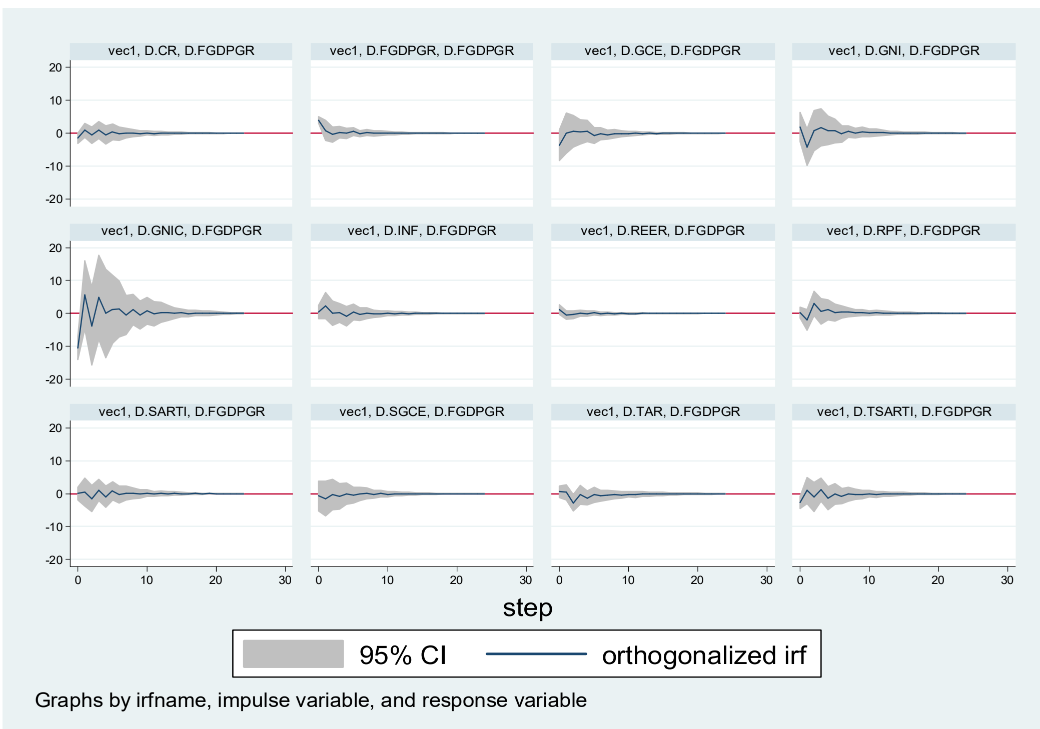

Figure 4. Effect of Shock on FGDP Growth Rate
(Note: FGDPGR=Fishery Gross Domestic Growth Rate)

4. Conclusion and Recommendation

Based on the findings it can be inferred that the fishery sector is weakly efficient as it pace at slow rate in reverting back to equilibrium if there is any distortion in the economy. In addition, inflation, reed-tapism, and ineffective credit utilization were the major economic phenomenon that affects the growth of the sector. The empirical evidence showed the role of the internal mechanism to be passive as the growth of the sector is major determined outside the system. Therefore, the study calls on the policymakers to put in place effect policy mechanism that will contain the high inflationary trend affecting the sector. Also, the red-tapism should be tamed viz. channeling the excess research labour force to other useful sectors. There is need for capacity building, linking of credit to marketing and provision of consumption credit so as to overcome the challenge of poor credit utilization in the sector.

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