World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

Trend in aquaculture production: The role of Nigeria's crude oil regimes

Shaibu SO *, David MJ, Akubo D, and Lawal AT

Department of Agricultural Technology, Kogi State Polytechnic, Lokoja (Itakpe Campus), Nigeria.

World Journal of Advanced Research and Reviews, 2024, 23(02), 1641–1646

Publication history: Received on 06 July 2024; revised on 19 August 2024; accepted on 21 August 2024

Article DOI: https://doi.org/10.30574/wjarr.2024.23.2.2482

Abstract

This study assessed aquaculture production trends in Nigeria, from 1960 to 2015. Secondary data on oil price per barrel and aquaculture were obtained from publications of the Food and Aquaculture Organization Statistics (FAOSTAT), Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), the Federal Department of Fisheries (FDF), and the Nigerian Meteorological Agency (NMA). Trend analysis and exponential growth rate model were used to estimate aquaculture production and growth rate trends. The study shows a high coefficient of variation for loan and fish farmers, implying a high level of instability in these variables. Furthermore, the annual growth rates in Nigeria's aquaculture production were 6.10%, 4.70%, 4.28%, 9.17%, 28.07%, 15.47% and 0.33% for the oil boom (1960-1973), oil glut (1974-1978), major glut 1979-198l), oil wave (1986-2000), windfall (2001-2008), moderate increase (2009-2015), and the entire period (1960 – 2015) under study respectively. The study therefore recommends that efforts should be strategized and intensified to improve the opportunities provided by subsequent oil price increases.

Keywords: Production; Aquaculture; Trend; Price; Crude oil.

1. Introduction

Aquaculture refers to the cultivation of freshwater and saltwater populations under controlled conditions. It is also known as aqua farming, it is the farming of aquatic organisms such as fish, crustaceans, molluscs and aquatic plants. Food and Agriculture Organization (FAO) (2017). Nigeria's inadequate fish supply results in the annual importation of N1 trillion worth of fish. Aquaculture remains the virgin and untapped area in the Nigerian fishing sector that has the prospect of bridging the demand-supply margin. In Nigeria, aquaculture has been driven by social and economic objectives, such as nutrition improvement in rural areas, generation of supplementary income, diversification of income activities, and the creation of employment. This is especially true in rural communities, where opportunities for economic activities are limited. The global oil demand has been increasing, outpacing any gains in oil production and excess capacity. In recent years fears of supply disruptions have been spurred by turmoil in oil-producing countries such as Nigeria, Venezuela, Iraq, and Iran (Brown 2014). Aside from the influence of other factors on oil prices, oil prices greatly affect production in other sectors, for instance, according to (Feyide, 2006), higher oil prices tend to make production more expensive for businesses and households.

Despite Nigeria's significant progress in aquaculture activities, the demand for fish still outstrips domestic production, and the country remains an importer of fish (FAO, 2013). Fish production is crucial to meeting the recommended protein requirement for challenges in Nigeria. Studies on agricultural production carried out by Ibitoye et al. (2017), Ojiako *et al*., (2007), Okoye, *et al*. (2006), Ojiako and Olayode (2008), Onyeweaku (2005) are limited to crops and livestock sectors and did not consider variations in oil prices and how they might influence aquaculture. Onuche (2015) who carried out a similar study on fish production was cast within the SAP framework (Pre-SAP, SAP and Post-SAP era).

* Corresponding author: Shaibu SO

Empirical studies on the impact of oil price changes on Nigeria's macro-economy have been investigated (Olomola 2006; Ojapinwa and Ejumedia 2011; Aliyu 2011; Akpan 2009; Adeniyi *et al* 2012; Iwayemi and Fowowe 2011). Gunu and Kilishi (2010) examined the impact of oil price changes on macroeconomic variables such as Real GDP, Money supply, unemployment and consumer price index, using a VAR model, they did not consider the response of aquaculture production to oil price. However, no study of such exists for the aquaculture production response to the price of crude oil considering the important role of oil in price determination and agricultural production in Nigeria. There is a need, therefore, to investigate the Aquaculture production trend in Nigeria and its growth rate under different oil regimes.

2. Methodology

2.1. The Study Area

This study was conducted in Nigeria. The country shares boundaries with Chad to the North, Cameroon to the east and the Benin Republic to the southwest. It is located between latitude 07^0 to 14^0N and longitude 03^0 and 15^0E. The population is made up of about 200 ethnic groups having about 500 indigenous languages. It consists of 36 states and the federal capital territory. It has a compact area of approximately 923,768 square kilometres. The land mass extends from the Gulf of Guinea in the south to the Sahel in the North. Nigeria has a coastline of about 853 km which has a border with the Atlantic Ocean in the Gulf of Guinea in the south. Some states along the coast are Akwa lbom, Bayelsa, Cross River, Delta, Ogun, Ondo, Lagos and Rivers. These states and other inland states such as Benue, Anambra, Kogi and Sokoto are engaged in aquaculture activities.

2.2. Method of Data Collection

This study relied on secondary data. Useful time series data was collected from the period of 1960 to 2015. A period of 55 years was selected because it captures the six different oil price regimes. Data collected on aquaculture production in tons were sourced from publications of Food and Aquaculture Organization Statistics (FAOSTAT), Central Bank of Nigeria, National Bureau of Statistics and Federal Department of Fisheries, while data on Temperature (^{0}C) was sourced from the Nigerian Meteorological Agency.

2.3. Method of Data Analysis

Summary statistics of variables used in the study were done using descriptive statistical tools such as frequency, table and coefficient of variation. The trend of aquaculture production from 1960-2015 was analyzed with the use of the trend growth rate model, and the trend equation was estimated with time as the explanatory variable. The trend equation is given as:

$$Yt = a + bt + e \quad (1)$$

Where Y = dependent variable (aquaculture production in metric tons)

t= period (Time)

a = intercept

b = slope/coefficient

e = error term

The exponential trend equation is given as:

$$Yi = \exp(\beta_0 + \beta_1 t_i + e_i) \quad (2)$$

Where Yi = aquaculture production output; t = trend (years); β0 and β1 are parameters to be estimated.

The linearized form of equation (2) is:

$$\text{Log } Y_i = \beta_0 + \beta_1 ti + e_i \quad (3)$$

Where log Y_i is the natural log of the real aquaculture production and β_0 and β_1 are parameters to be estimated.

The annual exponential or compound growth rate (g) in production is given as:

$$G = (e\beta 1 - 1) * 100\% \quad (4)$$

Where e represents the Euler's exponential constant = 2.71828.

The existence of acceleration, stagnation or deceleration in the growth of aquaculture production was determined by fitting the data for the four periods into the quadratic equations in the time trend variables. The quadratic equation is as follows:

$$\text{Log } Yi = \beta_1 t_i + \beta_2 t_{i2} + e_i \quad (5)$$

Where log Yi is the natural log of the real oil price and production, T_i is the time trend; β_0, β_1, and $\beta 2$ are parameters to be estimated.

3. Results and discussion

3.1. The Trend of Aquaculture Production in Nigeria

The graph (Figure 1) shows the trend in aquaculture production in Nigeria from 1960 to 2019. During the period from the 1960s through the 1990s, aquaculture production remained relatively stagnant, showing minimal growth. This era corresponds with Nigeria's heavy reliance on its oil sector, which became the backbone of the economy following the oil boom of the 1970s. The substantial revenue generated from oil exports led to a phenomenon commonly referred to as the "Dutch Disease," where the flourishing oil sector overshadowed and stunted the growth of other sectors, including agriculture. As a result, there was limited investment in non-oil sectors, including aquaculture, leading to the observed low levels of production during this period.

However, a significant shift is evident starting in the early 2000s, when a marked increase in aquaculture production was observed. This period coincides with the Nigerian government's growing recognition of the vulnerabilities associated with over-dependence on oil, particularly in the face of global oil price volatility and the economic instability it caused. The early 2000s were characterized by a series of economic reforms and diversification strategies aimed at reducing the economy's reliance on oil. These reforms included the introduction of policies to boost the agricultural sector, and by extension, aquaculture.

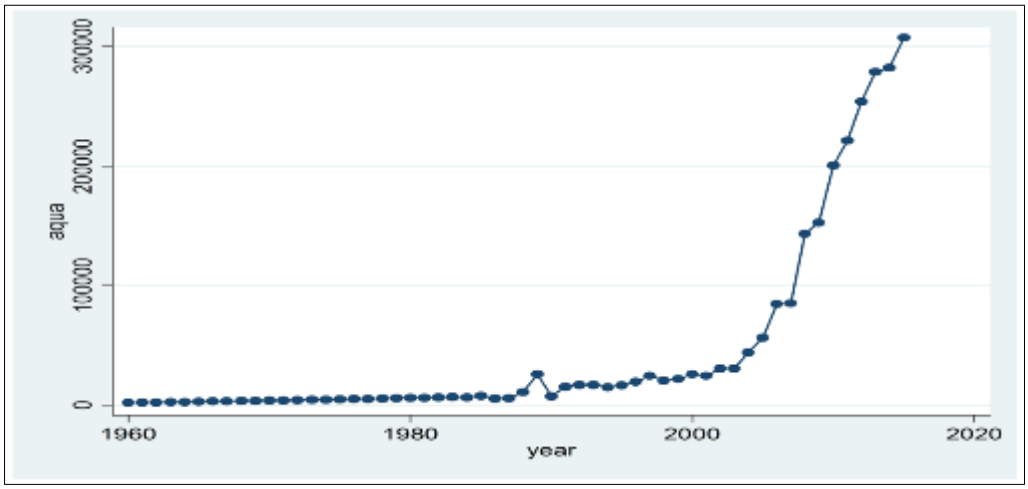

Figure 1 Trends in aquaculture production in Nigeria

The trend in aquaculture production takes on an exponential trajectory after 2010, indicating a period of rapid growth. This surge can be attributed to several factors. Firstly, there was a growing domestic demand for fish due to population growth and increased awareness of the nutritional benefits of fish, which outpaced the supply from capture fisheries. Secondly, government interventions, such as the Agricultural Transformation Agenda (ATA) launched in 2011, specifically targeted increasing fish production through aquaculture as a means to enhance food security and create

jobs. Additionally, the oil price crashes of the late 2000s and mid-2010s further underscored the need for economic diversification, leading to even greater focus and investment in non-oil sectors.

3.2. Growth Rate in Aquaculture Production Under Different Oil Regimes

The estimated trend equation for aquaculture production under different oil periods and the compound growth rates are presented in Tables 1 and 2 respectively. The result of the estimated trend equation for the periods under study is presented in Table 1. The coefficient of determination (R^2) is 99 percent for the period 1960-1973 (period I) which is the period of a slight increase in the oil price(oil boom), 0.99 for period II the fairly constant price period (semi glut), 0.81 for period III the period of a slight price decrease (glut), 0.96 for period V, the period of a sharp price increase (the boom) and 0.95 for period VI which is the period of a moderate increase in price (stable increase), but it was low for period IV at (0.59) which is the period of fluctuating prices (the doom) and the entire period at 0.0009. The result of the trend equation for period I present the coefficient of β as 0.059 representing growth in GDP at 5.9% and for the entire period (1960-2015) the coefficient of β was 0.0033 which reveals that aquaculture grew at 0.3%.

Table 2 presents the result of the estimated compound growth rates of aquaculture production in Nigeria for the various periods under study. The result shows the coefficient (β) of time variables of 0.59, 0.046, 0.042, 0.088, 0.247, and 0.144, over the oil economy era respectively, and the entire period with 0.33. The calculated instantaneous growth rate was 6.10% in oil boom 4.70% in semi-glut, 4.28% in glut, 9.17% in wavy, 28.07% in oil windfall, 15.47% in moderate increase, and 0.33% in the entire period under study.

Table 1 Estimated Trend Equation for Aquaculture Production for Different Oil Periods

Years	Periods	Constant	Coefficient	R^2	Adj. R^2	F-value	Sig.
1960 – 1973 n = 14	I	7.5921 (529.3)	0.0592 (35.16)	0.99	0.99	1236.24	0.0000***
1974 – 1978 n= 5	II	8.3959 (4628.19)	0.04589 (83.90)	0.99	0.99	7039.79	0.0000***
1979 – 1985 n = 7	III	8.616 (212.99)	0.0419 (4.64)	0.81	0.77	21.53	0.0000***
1986 – 2000 n= 15	IV	8.908 (48.23)	0.0877 (4.32)	0.59	0.56	18.64	0.001***
2001 – 2008 n= 8	V	9.757 (97.85)	0.2474 (12.53)	0.96	0.96	156.99	0.0000***
2009 – 2015 n= 5	VI	11.856 (7.83)	0.1438 (7.83)	0.95	0.94	61.27	0.004***
1960 – 2015 n= 54	Entire	9.372 (28.13)	0.0033 (0.21)	0.0009	-0.0184	0.04	0.834

Source: Data Analysis 2017; *** = Significant at 1%. The figures in parentheses are the t-values.

Table 2 Estimated Exponential Growth Rate for different oil periods

Years	Periods	Coefficient	$G = (e_i^2 - 1)100$
1960 – 1973 n = 14	I	0.0592	6.10
1974 – 1978 n= 5	II	0.04589	4.70
1979 – 1985 n = 7	III	0.0419	4.28
1986 – 2000	IV	0.0877	9.17

n= 15			
2001 – 2008 n= 8	V	0.2474	28.07
2009 – 2015 n= 5	VI	0.1438	15.47
1960 – 2015 n= 54	Entire	0.0033	0.33

Source: Data Analysis, 2017. G= Growth rate.

4. Conclusion

Fish farming is expanding rapidly throughout the world and has a high potential for the provision of valuable protein in less developed countries due to global population expansion, and demands for high-quality animal protein, especially from aquatic sources. This study has shown that aquaculture production has been growing positively over time. Significant growth was achieved during the whole period except for the fluctuating oil price period (1986-2000) when the production of aquaculture fell with a coefficient of 8.9%.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Adeniyi, O., Omisakin, O., Yaqub, J., & Oyinlola, A. (2012). Oil price exchange rate nexus in Nigeria: Further evidence from the Nigerian economy. *International Journal of Humanities and Social Science*, 2(8).

[2] Adeniyi, O. A. (2010). Oil price shocks and economic growth in Nigeria: Are thresholds important? Department of Economics and Business Studies, Redeemers University.

[3] Aliyu, S. (2011). Oil price shocks and the macroeconomy of Nigeria: A non-linear approach. *Journal of International Business and Entrepreneurship Development*, 179-198.

[4] Binuomote, S. O., Ajetomobi, J. O., & Omodunbi, C. O. (2012). Application of autoregressive distributed lags (ARDL) modeling approach to cointegration. *Continental Journal of Agricultural Economics*, 6(2), 1-8.

[5] Brown, S. P. A., & Yucel, M. K. (2014). Oil prices and US aggregate economic activity: A question of neutrality. *Federal Reserve Bank of Dallas Economic and Financial Review*, Second Quarter, 16-23.

[6] Food and Agriculture Organization (FAO). (2013). Fish production in canals: A review of factors limiting production. *Nigeria International Journal of Aquaculture and Rural Development (IJARD)*, 11-15.

[7] Food and Agriculture Organization (FAO). (2017). State of the world fisheries and aquaculture development. Global Aquaculture Production Fishery Statistical Collections. Retrieved October 2, 2011, from http://www.fao.org.

[8] Federal Department of Fisheries (FDF). (2008). State of the world fisheries and aquaculture development. Global Aquaculture Production Fishery Statistical Collections. Retrieved October 2, 2011, from http://www.fdf.gov.ng.

[9] Feyide, M. O. (2006). Oil in world polities: Proceedings of 1986 public lecture at University of Lagos.

[10] Ibitoye, S. J., Shaibu, U. M., & Omole, B. O. (2017). Assessment of the growth rate of cotton (Gossypium spp) production in West Africa: Evidence from Nigeria's pre–SAP, SAP and post–SAP periods (1960-2014). *Saudi Journal of Humanities and Social Sciences*, 2(2), 111-116.

[11] Ogazi, C. G. (2009). Rice output supply response to the changes in real prices in Nigeria: An autoregressive distributed lag model approach. *Journal of Sustainable Development in Africa*, 11(4), 83-100.

[12] Ohlsson, L. (2000). Livelihood conflicts: Linking poverty and environment as causes of conflict. Stockholm: SIDA, Environment Policy Unit.

[13] Ojiako, I. A., & Olayode, O. (2008). Analysis of trends in livestock production in Nigeria 1970-2008. *Journal of Aquaculture and Social Research*, 2, 114-120.

[14] Ojo, K., Cohen, B., & Adeokun, O. (2005). Issues of protein deficiency among Nigerians (1970-2010). *European Scientific Journal*, 8(12).

[15] Okoye, B. C., Asumugha, G. N., Okozie, C. A., Tanko, L., Onyenweaku, C. E., & Olayemi, J. K. (2006). Principles of microeconomics for applied analysis. Ibadan: Sisco Publishers.

[16] Oni, O., Kato, E., Nkonya, E., Pender, J., & Philips, D. (2009). Trends and drivers of agriculture productivity in Nigeria. Nigeria Strategy Support Program Report 001. Washington, DC: International Food Policy Research Institute.

[17] Onuche, U. (2015). Supply responsiveness of the fisheries sector to price and policy factors in Nigeria from 1971-2010 (Doctoral dissertation, University of Agriculture, Makurdi, Benue State).

[18] Owosekun, A. (1973). The demand for petroleum, groundnut, groundnut oil, groundnut cake and cocoa by European Economic Community (EEC) countries.

[19] Oyenweaku, C. E., & Okoye, B. C. (2007). Technical efficiency of smallholder cocoyam production. *Continental Journal of Agricultural Economics*, 1(1), 15-19.

[20] Pedini, M., & Shahade, R. (1997). Reducing poverty and protecting the environment: The overlooked potential of less-favoured lands (IFPRI 2020 Vision Initiative). Washington, DC: International Food Policy Research Institute.

[21] Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.

[22] Pretty, J. (2013). The petroleum industry in Nigeria: Joint operating agreements, memorandum of understandings, compensation and other related issues in perspective.

[23] Rahji, M. A. Y., & Fakayode, S. B. (2009). Rice production response to policy initiatives in Nigeria. *Agricultural Journal*, 3(3), 229-234.

[24] Watson, R., & Pauly, D. (2001). Systematic distortion in world fisheries catch trends. *Nature*, 414(6863), 534. https://doi.org/10.1038/35107050

[25] Rudaheranwa, N., Bategeka, L., Banga, M., & Mukungu, A. (2003). Supply response of selected export commodities in Uganda. *Research Series, Economic and Research Center*, 36, 1-54.