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Supply Responsiveness of Nigerian Fisheries to Price and Policy Factors from 1971-2010

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Authors' contributions

This work was carried out in collaboration among all authors. Author UO designed the study and undertook the empirical analysis of data. Author GAA undertook the literature review and general scrutiny of the work while the problem statement was provided by author PIA. Finally, author TAA was engaged in the discussion and final correction. All authors read and approved the manuscripts.

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ABSTRACT

In this study the long run and short run supply responsiveness of Nigerian fisheries sector to price and policy variables for the 1971 to 2010 period were estimated using the bounds testing approach to cointegration. The goal was to present policy makers with empirical evidence of the viability of economic policies. The work was undertaken using time series data on fish production from 1971-2010. These data were obtained from the Federal Department of Fisheries, National Bureau of Statistics, Central Bank of Nigeria and the FAO. Results show that fish supply was generally inelastic to price and policy variables in both long and short run implying that although prices and policy variables are important, they have not elicited the desired change for the fisheries subsector. Proper policy mix to support price initiatives, like provision of more loans, and

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increased productivity through training as well as access to modern equipments may provoke greater elasticities.

Keywords: Supply; responsiveness; fisheries; price; policy; elasticities.

1. INTRODUCTION

The Food and Agriculture Organization (FAO) has recommended daily per capita animal protein of 35 g. On the average however, a Nigerian consumes less than 9g in a day. This is in spite of her enormous fisheries resources which confer on her capacity for producing cheap animal protein. Poor exploitation of these resources has led to low level of fish production and consumption. Over time, world average consumption of per head has been increasing while Nigerian per capita consumption has been declining (Fig. 1).

Per capita production has been unsatisfactory and, has until recent times been unsteady (Fig. 2).

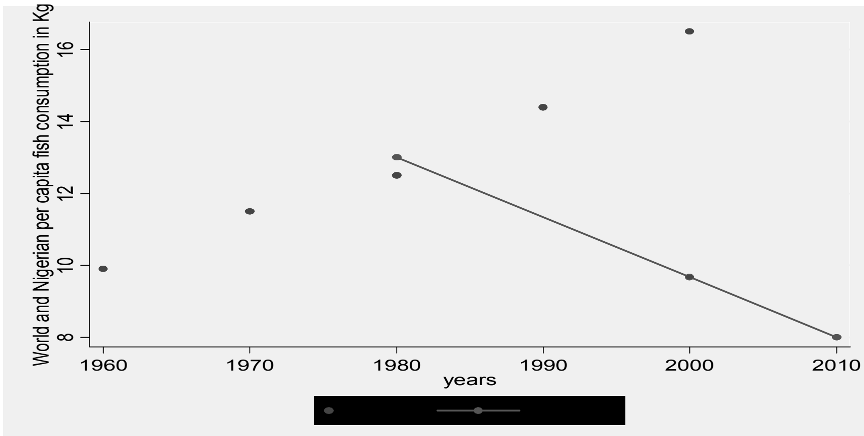

Fig. 1. World and Nigerian per capita fish consumption by year
Source: Constructed from FAO and Nigerian Federal Department of Fisheries data

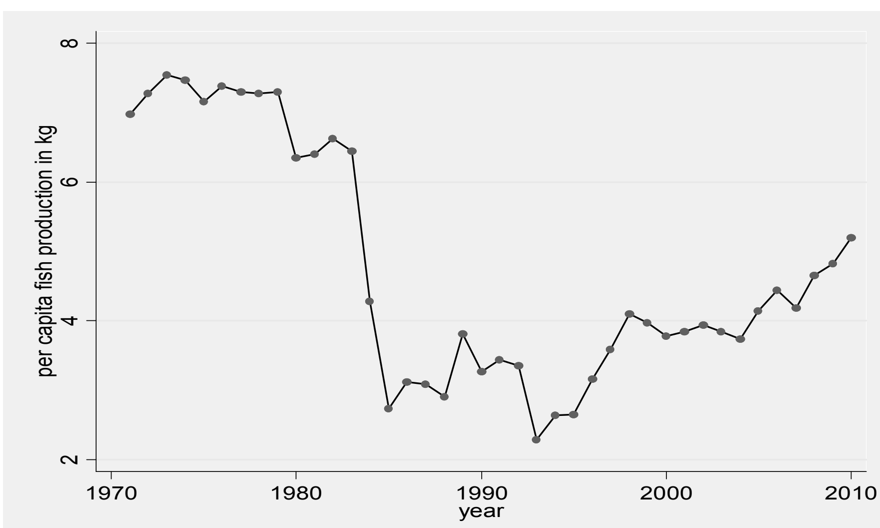

Fig. 2. Trend in per capita fish production over time
Source: Constructed from miscellaneous data source

In fisheries deficient countries where both social and economic concerns often dominate, intelligent policy making requires an adequate understanding of both economic and human factors. This understanding takes into consideration the economic structure and dynamics of the fishery system on one hand, and the role of social, cultural, institutional and political aspect on the other [1]. This is imperative for attaining sustainable sufficiency and it is based on an understanding of the outcomes of previous policy interventions. Investigation into the outcomes of past intervention is the basis for supply response analysis. Supply response analysis seeks to determine long run and short run responsiveness of production to price and policy factors.

The Nigerian fisheries sector provides means of livelihood to 26.5 million people. Its contribution to agricultural sector proportion of the GDP is 4%. Nigerian fish exports include mainly shrimps (86%) while her imports include mainly canned, stock, frozen fish. Foreign exchange from shrimps between 1993 and 2002 was 275.85million Naira, while the import bill stood at 2.18 million Naira for the same period [2]. The exchange rate at this period ranged between 1USD=22 Naira and 1USD=122 Naira.

In 1971 demand for fish was 463,593 metric ton while the supply was 409,537 metric ton. In 1975 the demand rose to 580,422 metric ton while the supply was 466,236 metric tons. By 2007, the demand was estimated at 2.66 million tons while domestic production was 0.6354 million tons. The percentage of demand met by domestic supply was 88.3%, 80.3% and 23.9% in 1971, 1980 and 2007 respectively, showing a scenario of steady rise in deficit. The resulting massive importation has brought pressure to bear on her hard earned foreign reserves. According to [3] Fish is one of the topmost 4 items of food import in Nigeria, gulping 105 billion 2005 (1USD=132.15 Naira).

The Nigerian fisheries sector exists in a paradox. Nigeria has enormous resources for fish production: A continental shell area of 37,934 Km^2, coastal area length of 853 Km, an exclusive zone of 210,900 Km^2 [4], inland water surface area of 14 million ha and 1.7 million ha of land available for aquaculture [5], with an existing pond area of 60,000 ha conferring on aquaculture an estimated potential of 2.5 million metric tons [6].

Despite these potentials, the demand–supply gap has persisted. The demand-supply gap for fish protein in 2007 was partly augmented by importation of about 740,000 tons of frozen fish valued at 594.4 million USA Dollars [6]. Furthermore, the sector's contribution to entire GDP is a paltry 1%. Again, the sector exists with a lot of trade imbalances [2], leading to the loss of huge amount of foreign exchange. For instance, while total import as at 2007 was 0.74 million metric tons valued at USD 594.4 million, total shrimp export at same period was 0.005 million metric tons valued at USD38.3 million [6]. As at 2007, 1USD=125.83 Naira.

Due to the foregoing, policy makers have overtime, applied varying degrees of incentives to spur production. These strategies are based on the prevailing policy era. This macroeconomic policy era dictated by the prevailing political climate. The era before the structural adjustments programme (SAP) i.e (1960-1985) witnessed mild policy intervention like provision of inputs and extension services and provision of loan among others [7]. The SAP era however witnessed a drastic policy environment including trade liberalization and commercialization [8]. One of the key aims of the policy was to provide opportunities for farmers to take advantage of the world prices. It was envisaged that dealing directly with consumers in the international market (instead of through the marketing boards) will enhance the competitiveness and production capacities of Nigerian agricultural producers.

The response of fish production to previous policies needs to be understood. This concept is important in that if the production of the commodity is econometrically elastic to a policy variable, it implies that such a variable is important in influencing production outcomes. Works on supply responses in Nigeria have so far been biased towards the crop sub-sector of agriculture [9-13]. A Study by [14] on supply response of agricultural commodities including the fisheries sector was captured within Nerlovian adjustment framework which has long been faulted [15]. The study by [14] is also outdated- i.e it was conducted over 15 years ago. There is therefore the need to conduct an up-to-date study to examine the long run and short run responsiveness of the fisheries sector to price and policy variables bearing in mind recent econometric developments. The aim is to present policy makers with empirical evidence of the viability of previous fisheries related policies.

2. LITERATURE REVIEW

Supply response modeling has its underpinning in the theory of the firm. The commonly used approach for analyzing the firm's problem from the output perspective assumes that optimization has already been made in the input space and that the firm uses the least cost combination for the production of any level of output.

The least cost approach is plausible because producers will want to produce a given output with minimum cost outlay rather they try to directly optimize production in the output space by equating marginal factor productivity to marginal factor cost [15]. This is because, farmers are only aware of what they pay for input and generally do not have an idea of the marginal productivities of inputs. From the theory of firm, a profit maximizing firm produces output up to a point where it equates its marginal revenue to its marginal cost. Since producers are generally price takers, profit maximization behavior equates marginal cost to price. As such, a firm's supply function is simply its cost function.

Therefore supply can be expressed as the inverse of the Mc function. This implies that since the producer is a price taker in agriculture, he must pay attention to the prevailing price in his production plan [16]. A key conclusion from the theory of the firm therefore is that price is the most important determinant of supply.

Supply response in agriculture owes much to the serial work of Marc Nerlove in the United States, see [17]. Nerlovian model has been criticized for it obvious econometric defects [18] but has been applied to Nigerian agriculture [11,13,14]. Alternatives to the Nerlovian model have been applied [10,12,15].

Such alternative models are based on cointegration and error correction. Based on the Augmented Dickey fuller test, [12] has applied this methodology to the responsiveness of sorghum production in Nigeria. A possible problem with this cointegration analysis in this framework is reverse causality which, if not taken care of, could lead to biased elasticity estimates. This is always the case with single equation time series estimation.

This problem led to the employment of a more recent cointegration technique. The most widely used method of the single equation approach to cointegration is the Engel-Granger 2 step procedure. This procedure has been applied to the Cameroonian rice industry [19]. This procedure however ignores the short run dynamics in the process of estimating the cointegration vector, leading to bias in the long run relationship.

To mitigate the above [20], proposed an Autoregressive Distributive Lag (ARDL) model. The shortcoming with this model is that the parameter estimates are only asymptotically efficient when weak exogeneity of regressors is assumed. But reasons are that prices, as has been shown in [15] may not be weakly exogenous. In addition, this ARDL framework assumes the existence of only one cointegrating equation. This casts doubt on the efficiency of the estimates in the event where there is more than one cointegrating equation.

The Johansen estimation procedure succeeds in correcting this shortcoming but it creates another estimation problem by assuming that the order of cointegration is the same for all variables and known with certainty. This assumption is also common to the Engel Granger procedure and it is problematic because the unit root test has a low power in prescribing the order of cointegration with certainty. This approach was applied by [21] in their investigation of agricultural responses to price and exchange rate in Nigeria and [22] in an analysis of rubber supply response in Nigeria.

An ARDL method to cointegration which tackles some of the above issues has been proposed by [23]. Its ability lies in the following properties: first, it captures the both the short run and long run dynamics when testing for the existence of cointegration. Second, it permits the estimation of cointegration even when variables are not integrated in the same order, thereby eliminating the need for cointegration test. Third, it offers straightforward test for existence of a single (unique) cointegrating vector rather than assuming that there is only one. Four, it takes into account the possibility of reverse causality thus ensuring the validity of parameters estimated. This procedure has been applied by [15] to Zimbabwean agriculture and [10] to Nigerian rice production.

3. METHODOLOGY

Empirically, the relationship between fish supply and its determinants is modeled in implicit form as

$$Qfsh_t = f(X_i), \qquad (1)$$

where (X_i) represents the independent variables Explicitly, this relationship is defined as

$$Qfsh_t = \alpha + \beta_1 prcfsh_t + \beta_2 prcmt_t + \beta_3 exr_t + \beta_4 lon_t + \beta_5 Area + \beta_6 temp_t + \beta_7 SAP + e_t \ldots\ldots(2)$$

Where: $Qfsh_t$ is the quantity of fish produced in year t (tons), $prcfsh_t$ is the real price of fish per kg (₦), $prcmt_t$ represents the real average price of livestock (meat)per kg (₦) while exr_t is the exchange rate (relative to the American dollar i.e. (₦/USD). lon_t stands for the volume of loan granted to the fishery subsector ('000 ₦), Area is the area of fishing activities proxied by number of artisanal fishermen, $temp_t$ represents average yearly temperature (°C) while SAP is a dummy for SAP (0 in period1, 1 in period II and 2 in period III); α =the intercept, β_i are the coefficients of the regressors and e_t is the disturbance term. Data were sourced from FAO, Central Bank of Nigeria, National Bureau of Statistics, Federal Department of Fisheries and the Nigerian Meteorological Agency. This data were obtained in their raw forms but analysed in their natural logarithm state.

The dummy variable SAP was included to capture the effect of institutional/market reforms during the structural adjustment programme era. It was also include to serve as proxy for data on infrastructural development, technological advance, resources mobilized for research and extension as data on these variables are hard to obtain in a third world country [10].

This study adopted the Pesaran et al. [23] approach to the bounds testing procedure by a general VAR in the order of p as in equation 3.

$$G_t = \alpha + \beta t + \sum_{i=1}^{p} \pi\, G_{t-1} + e \qquad (3)$$

Where t is time=1,2,3…..T

Where G is the dependent variable, α is the vector of intercept, β is the coefficient of trend variable, π is the coefficient of the lagged form of the dependent variable Pesaran et al. [23] further derived vector equilibrium correction model by differencing the dependent variable and introducing another independent variable by simply differencing G_{t-1}.

$$\Delta G_t = \alpha + \beta t + \sum_{i=1}^{p} \pi\, G_{t-1} + \psi \Delta G_{t-1} + e \ldots\ldots\ldots\ldots (4)$$

Where Δ is the difference operator (as in $\Delta G_t = G_{t+1} - G_t$) and ψ is the coefficient of the differenced lagged form of the dependent variable while π and ψ contain the long run multiplier and the short run dynamics coefficients of the VECM. Based on the assumption of a unique cointegrating relationship among the variables, the VECM is modeled as shown in equation 5.

$$\Delta G_t = \alpha + \beta t + \pi G_{t-1} + \Omega X_{t-1} + \sum_{i=1}^{p} \psi \Delta G_{t-1} + \sum_{i=1}^{p-1} \sigma \Delta X_{t-1} + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(5)$$

Where Ω and ϬΩ are the coefficients of lagged and differenced lag form of the explanatory variables X_i respectively and all other parameters are as previously defined. Based on the above, the conditional VECM for the study was specified as shown in equation 6.

$$\Delta LnQfsh_t = \alpha + \acute{\omega}_1 LnQfsh_{t-1} + \acute{\omega}_2 Lnprcfsh_{t-1} + \acute{\omega}_3 Lnprcmt_{t-1} + \acute{\omega}_4 Lnexr_{t-1} + \acute{\omega}_5 Lnlon_{t-1} + \acute{\omega}_6 LnArea_{t-1} + \acute{\omega}_7 Lntemp_{t-1} + \acute{\omega}_8 SAP + \sum_{i=1}^{q} \varpi_1 \Delta LnQfsh_{t-1} + \sum_{i=1}^{q} \varpi_2 \Delta Lnprcfsh_{t-1} + \sum_{i=1}^{q} \varpi_3 \Delta Lnprcmt_{t-1} + \sum_{i=1}^{q} \varpi_4 \Delta Lnexr_{t-1} + \sum_{i=1}^{q} \varpi_5 \Delta Lnlon_{t-1} + \sum_{i=1}^{q} \varpi_6 \Delta LnArea_{t-1} + \sum_{i=1}^{q} \varpi_7 Lntemp_{t-1} + \sum_{i=1}^{q} \varpi_8 \Delta SAP_{t-1} \ldots\ldots\ldots\ldots\ldots \qquad (6)$$

Where all other variables are as defined, $\acute{\omega}_i$ and ϖ_i are vectors of the long run multipliers and the short run dynamics coefficients respectively and Ln represents the natural logarithm.

The first step in testing the cointegration relationship between fish supply and its explanatory variables was to estimate equation 6. All independent variables are also in turn used as the dependent variables to estimate other equations in which cases Qfsh is used as one of the independent variables. The null hypothesis is stated as:

$$H_o = \acute{\omega}_2 = \acute{\omega}_3 = \acute{\omega}_4 = \acute{\omega}_5 = \acute{\omega}_6 = \acute{\omega}_7 = \acute{\omega}_8 = 0 \ldots \qquad (7)$$

The F ratio estimates obtained from the equations were compared with the critical values provided by Pesaran et al. [23] for case of intercept without trend; for K=7, where K= number of regressors+1. Then, based on the existence of a unique long run relationship found among the variables of interest when the $QFsh_t$ was the dependent variable, the long run (static) model for fish output equation (2) was estimated. Following the extraction of the residuals, the ECM was cast in the ARDL frame work to estimate the short run elasticities.

In the last step, the short run elasticities associated with the long run estimates were obtained by including the error term in an ECM cast in the ARDL (1,2,0,1,0,0,0,1) frame work in equation 8 to estimate the short run elasticities. The lag lengths (figures in parentheses above) in the ARDL model were selected based on the Schwarz Byersian Criterion SBC and imply that the independent variables Quantity of fish, Price of fish, Price of meat, Exchange rate, Loan, Area, Temperature and the SAP dummy had lag lengths of 1,2,0,1,0,0,0 and 1 respectively. A maximum of 2 lag lengths was selected as in the case of arable crops since it should not take more than 2 years for the effects of the variables to be felt on fish supply.

$$\Delta LnQfsh_t = \alpha + \sum_{i=1}^{q}.\varpi_1 \Delta LnQfsh_{t-1} + \sum_{i=1}^{p}.\varpi_2 \Delta Lnprcfsh_{t-1} + \sum_{i=1}^{p}.\varpi_3 \Delta Lnprcmt_{t-1} + \sum_{i=1}^{p}.\varpi_4 \Delta Lnexr_{t-1} + \sum_{i=1}^{p}.\varpi_5 Lnlon_{t-1} + \sum_{i=1}^{p}.\varpi_6 \Delta LnArea_{t-1} + \sum_{i=1}^{p}.\varpi_7 \Delta Lntemp_{t-1} + \varpi_8 SAP + \lambda ECT_{t-1} \ldots\ldots\ldots\ldots\ldots \quad (8)$$

Where the coefficients are the short run dynamics elasticities of the models convergence to long run equilibrium, ECT_{t-1} is one period lagged error correction term and λ is the speed of adjustment. The coefficient measures the speed of adjustment to attain equilibrium in the event of shocks to the system. The Eviews 7 statistical package was used in the estimation.

4. RESULTS AND DISCUSSION

The result of unit root test using Augmented Dickey-Fuller test reported in Table 1 shows that the variables are a mixture of I(0) and I(1). This justifies the used of the ARDL.

The F statistic of 5.38 when output is the dependent variable exceeds the upper bound at 1% (Table 2) hence the null hypothesis of no cointegration is rejected. In addition, based on its uniqueness as the only F ration that exceeds the upper critical value, it is further concluded that there is a unique cointegrating equation among the variable.

Based on the cointegrating relationship, an ARDL (1,2,0,1,0,0,0,1) was estimated. The lag length selection was based on SIC. The diagnostics tests of Durbin-Watson, LM, all rule out the possibility of autocorrelation in the model while the ARCH also ruled out the presence of heteroskedasticity in the model. Similarly, the stability tests using Cumulative Sum of error (CUSUM) and Cumulative Sum of error squared (CUSUMQ) in Figs. 3 and 4 respectively attest to the stability of the model as they show that the residuals are within the 5% bounds. The F ratios were also statistically significant in both cases at 1% level of error. The result is presented on Table 3. The coefficient of lagged value of the dependent variable indicates that supply adjusted positively to previous supply. Parameter estimates of lagged dependent variable by [15,10] and [22] were insignificant.

Table 1. Results for unit root tests of variables

Variable	Lag	t-statistics	99% critical value	Lag	t- statistics	99% critical value	Conclusion
Fsh	0	-0.73	3.62	0	-5.59	3.62	I(1)
Prcfsh	0	-0.56	3.62	0	-7.00	3.62	I(1)
Prcmt	1	-2.05	3.62	0	-3.76	3.62	I(1)
Exr	0	-0.06	3.62	0	-5.09	3.62	I(1)
Ln	0	-1.15	3.62	0	-5.32	3.62	I(1)
Area	0	-1.18	3.62	0	-7.22	3.62	I(1)
Temp	0	-5.43	3.62				I(0)

Source: Data analysis, 2014

Table 2. Bounds testing results for cointegration of variables

Dependent variable	Output	Price	Livestock price	Exchange rate	Loan	Fishermen
F-statistic	5.38***	2.41	3.55	1.81	2.14	4.16

1% critical values: lower bound I(0) =2.96 and upper bound (I(0))=4.26; Source: Data analysis, 2014
Source: Data analysis, 2014

Table 3. Short run and long run supply responsiveness of Nigerian fisheries sector

Variable	Short run		Long run	
	Elasticity	t-value	Elasticity	t-value
QFsh(-1)	0.256	2.169**		
Pricfsh			-0.106	0.958
Prcfsh(-1)	-0.160	-1.135		
Prcfsh(-2)	0.280	2.081**		
Prcmt	-0.032	-0.275	0.06	0.865
Exr			0.027	0.370
Exr(-1)	0.001	0.015		
Ln	0.022	2.560**	0.017	1.710***
Area	0.625	6.156*	1.062	9.218*
Temp	0.276	3.405*	0.308	1.769***
SAP			-0.519	-2.108**
SAP(-1)	-0.102	-0.515		
Ecm(-1)	0.549	3.636*		
Constant	-0.026	-0.729	-1.117	-0.811
Adj.R^2	0.57		0.799	
F	5.75*		23.2*	
D.W	2.11		1.88	
	LM=0.65(0.53)			
	ARCH=0.24(0.62)			

*Source, survey Data, 2014. Note: *, ** and *** = sig @1%, 5% and 10% respectively*

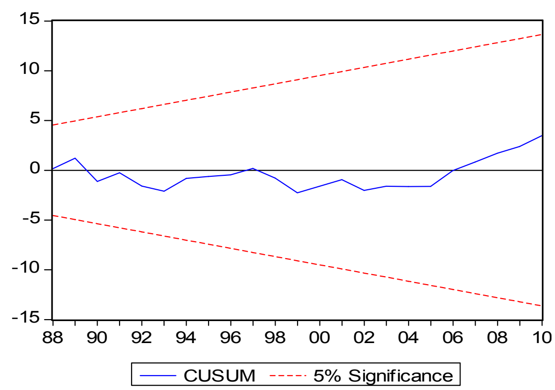

Fig. 3. CUSUM plot of residuals

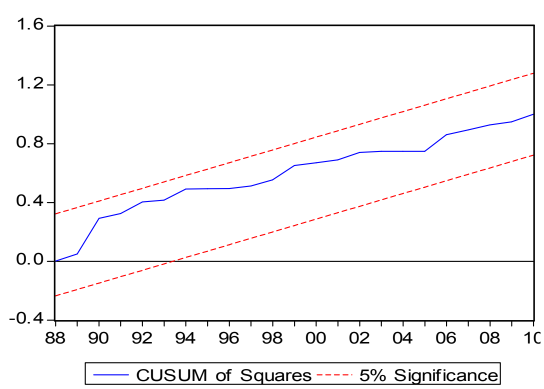

Fig. 4. CUMUQ plot of residuals

The long run elasticities for price is inelastic and compared unfavourably with those found elsewhere. It is lower than the 0.4 long run respectively by [14]. Others studies like [15] and [10] and [13] found higher inelastic coefficients for commodity price variables. The discrepancies in the findings agree with the assertion in literature that supply responses vary across commodity and region. The negative sign found for the elasticity of price implies that prices in the sector are adaptive. This is to say that prices are fixed after harvesting. Coefficient of the price variable lagged by two indicates that fish output responds to price of the last 2 years. This response was also inelastic based on the small elasticity estimates. This short term elasticity compares well with those of [10,11]; compares poorly with the findings of [14], and [15,12,22], but is similar to that found in [19]. Although [10] inferred from inelasticity to own price variable that farmers are irresponsive to price, it should be noted that they actually are as canvassed by [15], [21] and [12]. The assertion by these scholars is valid since farmers are assumed to be rational people seeking to meet profit maximization objective.

This finding further reinforces the assertion that price incentives are necessary but not sufficient to elicit supply response even in the short run and that the influence of price varies across commodities and regions. However, a negative elasticity has been found for the same variable [21]. In order to elicit supply response in the desired magnitude and direction, reforms must be comprehensive, taking into account the factors that may hamper supply response.

The estimated long run coefficient of volume of loan advanced to the sector was positively signed and significant. The low elasticity estimate however implies that the subsector total output is irresponsive to loan on the long run. This low elasticity may not be unconnected with the fact that government over the years have favoured aquaculture sector in the disbursement of loans more than the artisanal subsector that provides the bulk of fish supply. This situation may have masked the influence of loan on the output of the fisheries sector. In the short run volume of loans advanced to the fisheries sector also influenced the output of the sector positively although the elasticity (0.02) is low. Much higher elasticity (0.7440) has been found by [12] for government expenditure on agriculture while [19] found a moderately higher elasticity (0.11) for the same variable.

The long run elasticity estimate for “Area” proxied by the number of fishermen succinctly captures the influence of the artisanal subsector on the entire sector as the variable is mainly related to the artisanal subsector. The relationship reflects the level of responsiveness of the entire sector were the artisanal sector to be fully invigorated. The long run elasticity estimate of 1.1 implies that the sector is responsive to increase in number of fishermen (or area). The estimate shows that an increase in area by 10% will prompt an 11% increase in fish output on the long run. Long run elasticities for area by [10] for rice production in Nigeria and [15] for aggregate agricultural production in Zimbabwe is less than unity. This also suggests that supply responsive varies across region and commodity. It is however important to note that available fishermen are not technically efficient and that their resources have also not been optimally applied [24,25]. Merely increasing the number of fishermen without concomitant increase in their efficiency may therefore not be a right policy tool. Short run elasticity for “Area” was inelastic although it was positively related to fish supply. This elasticity is higher than those found in [10] and [15] whose estimates were insignificant and lower than that found in the error correction model adopted by [12].

Temperature was found to be an important determinant of fish supply in the long run. Temperature increase has been reported to favour agricultural production. Scientists have however hinted that this favourable disposition of climate change will be short-lived beyond a particular temperature at which agricultural production will begin to respond negatively. The short run coefficient estimate compares favourably with that of Ogazi [10] but is lower than the finding of [15] and [12]. These findings however contrast in signs with that of [26].

The error correction term is negatively signed as expected and highly significant. The error correction term of 0.549 implies that about 55% of any distortion in the long run equilibrium is restored within a year. This is close to those found in [12] and [10], higher than those in [11] and [22] but lower than that found in [15] and [21].

5. CONCLUSION

Elasticity estimates of the price and policy variables indicate that relying on the price to spur fish production in Nigeria production is somewhat a blunt instrument in eliciting supply response. The same conclusion is true of the policy variables captured in this study. Increasing the number of fishermen however holds some promise for future fish production. This prospect can however only be realized through increased production efficiency. Owing to the widening supply demand gap and the profound macroeconomic problems effect it may continue to have, a policy mix that will better elicit much supply response should be put in place in tandem with price variables. Such a policy mix has to be comprehensive, consistent and pragmatic and should address factors that may inhibit supply responsiveness. For instance, such a policy mix must include robust financing policy, input and marketing policies as well as protectionist external trade policy. Also, in spite of the positive relationship between number of fish producers and output, training and provision of better crafts and gears may better elicit supply response than merely increasing the number of fishing personnel.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Food and Agriculture Organisation. Fish as Food: Projections to 2020. Biennial meeting of International Institute for Fisheries Economists and Trade; 2002.
2. Akande GR, Ezenwa BN, Ajodo EO. Repositioning the Nigerian agricultural sector for export: Prospects and challenges. Proceedings of National workshop organised by Agricultural and Rural Development Management Institute (ARMTI) and Networkfor Poverty Alleviation and Sustainable Human Development, Ilorin, Nigeria; 2004.
3. Binuomote SO, Odeniyi KA, Farayola CO. Econometric estimation of rice import demand Nigeria (1970 2008): An application of Autoregressive Distributed Lags (ARDL) modeling approach to cointegration. Con. J. Ag Ec. 2011;6(2).
4. Ibeun MO, Anderson KL, Thiery C, editors. Information for responsible fisheries: Libraries as Mediators: Proceedings of the 31st Annual Conference, Rome, Italy; 2006.
5. FAO, The state of world fisheries and aquaculture, Rome; 2006.
6. Federal Department of Fisheries. Fisheries statistics of Nigeria. Federal Ministry of Agriculture and Water resources, Abuja, Nigeria; 2008.
7. Evboumwan GO, Momah AP, Sere-Ejembi AA, Sodipo JA , Bada A. Self sufficiency in the fishery subsector: Challenges and prospects in Lagos state. Research and Statistics Department, Central Bank of Nigeria, Lagos; 2005.
8. Idachaba FS. Good intentions are not enough: Collection of essays on Government and Nigerian Agriculture, University press, Ibadan. 2006a;1.
9. Philips DO, Abalu GO. Price expectation formation and revision in the Nerlovian framework with application to Nigerian farmers. J. Agri. Eco. 1987;38(7).
10. Ogazi CG. Rice output supply response to the changes in real prices in Nigeria: An autoregressive distributed lag model approach. J. Sust. Dev. in Afri. 2009;11(4).
11. Rahji MAY, Ilemobayo OO, Fakayode SB. Rice production response to policy initiatives in Nig. Agri. J. 2008;3(3).
12. Oni TO. Response of cotton output supply to price and non price incentives in Nigeria. Monograph No. 13, Nigerian Institute for Social and Economic Research, Ibadan; 2000.
13. Idachaba FS, Estimation of sales elasticity of marketing boards in: Good intentions are not enough: Collection of essays on government and Nigerian Agriculture. University Press, Ibadan. 2006b;2.
14. Kwanashie M, Ajilima I, Garba A. The Nigerian economy: Response of agriculture to adjustment policies. AERC Research Paper 78, African Economic Research Consortium. Nairobi, Kenya; 1998.
15. Muchapondwa E. Supply response of Zimbabwean agriculture 1970- 1999. Afri. J. of Agri. Res. 2009;3(1).
16. Penson JB, Capps O, Rosson CP. Introduction to agricultural economics. Prentice-Hall inc. New Jersey-USA; 1995.
17. Nerlove M. The dynamics of supply: Estimation of farmers response to price. Johns Hopkin, Baltimore; 1958.
18. Mckay A, Morrisey O, Vaillant C. Aggregate supply response in Tanzanian agriculture. The J. Int. Trade & Eco. Dev. 1999;8(1).
19. Molua LE. Response of rice yields in Cameroon: Some implications for agricultural price policy. Libyan Agri. Res. Ce. J. Int. 2010;1(3).
20. Banerjee A, Dolado JJ, Mestre R, Error correction mechanism test for cointegration in a single equation framework. J. Time Series Anal. 1998; 19(3).
21. Obayelu AE, Salau AS. Agricultural response to price and exchange rate in Nigeria: Application of cointegration and vector error correction model. J. Agri. Sci. 2010;1(2).
22. Mesike CS, Okoh RN, Inoni OE. Supply response of rubber farmers in Nigeria: An application of the vector error correction model. Agri. J. 2010;5(3).
23. Pesaran MH, Shin Y, Smith R. Bounds testing approaches to the analysis of level relationships. J. of Ap Eco. 2001;16.
24. Ekunwe PA, Emokaro CO. Technical efficiency of catfish farmers in Kaduna, Nigeria. J. Ap. Sci. Res. 2009;5(7).

25. USAID WESTAFRICA, West African fisheries profile Nigeria. Accessed on WIKIPEDIA; 2008.
26. Ayinde OE, Muchie M, Olatunji GB. Effect of climate change on agricultural productivity in Nigeria: A cointegration model approach. J. of Human Ecol. 2011;35(3).

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