# Macroeconomic Implication of Fish Importation in Nigeria: A Fully Modified Ordinary Least Square (Fmols) Approach



# Macroeconomic Implication of Fish Importation in Nigeria: A Fully Modified Ordinary Least Square (Fmols) Approach

**Eseoghene Olaifa[1,*], Evans Osabuohien[2] and Haruna Issahaku[3]**

[1]Department of Economics & Development Studies, Covenant University, Ota, Nigeria.
[2]Department of Economics & Development Studies, Covenant University, Ota, Nigeria.
[3]Department of Economics & Entrepreneurship Development, University for Development Studies, Ghana.

[*]Corresponding author's email: suzie.olaifa@stu.cu.edu.ng; esegift2@yahoo.

**Abstract**. The continuous rise in fish importation had conditioned Nigerian's preference and taste for imported fish developing the fish sub-sector of other economies while crippling the sector in the country. This study therefore, examines the macroeconomic implication for fish importation in Nigeria. The study employed the FMOLS estimation technique to investigate to investigate the long-term effects of fish importation on the Nigerian economy. Major findings revealed a significant but negative macroeconomic effect of fish imports on the overall performance of the economy through an increase in unemployment, depletion of foreign exchange earnings, high consumer inflation and rise in food insecurity in the country. The study recommends an aquatic transformation agenda implementation in attempt to eliminate the demand-supply mismatch in domestic fish production.

**Keywords:** Fish production, importation, captured fishes, aquaculture fishes

## 1. Introduction

Fish consumption is the most reliable source of protein, rich in minerals and as such, fish farming plays an important role in human nutrition, income and standard of living for many developing economies. However, some record showed undernourished people as a result of rising demand due to inadequate fish production in Nigeria and as such Nigeria resorts to fish importation to augment demand deficit [1]. Domestic production of fish is only able to meet a total of 1.12 million metric tons, as such the remaining 2.2 million metric tons is supplied through importation of fish [2]. Nigeria's current population is 187 million people, with an estimated annual per capital fish consumption of 17.5kg, the projected fish demand for Nigeria in 2018 was 3.61 million metric tons [3].

The key objective of this study is to evaluate the macroeconomic implications of fish importation in Nigeria. Through employment, food security, development of enterprise and foreign exchange gains, the fishery sector contributes around 5.40 percent to the nation's Gross Domestic Product. Thus, the sector is essential to the economy of Nigeria [4,5]. Nigerians are considered to have a large taste for fish, with a 3.2 million metric ton yearly demand [6]. With the continual rise in fish

demand, which reached 2.055 million metric tons in 2015, fish importation has become a key source of fish in the country, accounting for more than half of the supply (56.0 percent) [7,8].
In fact, the country has become Africa's largest consumer of fish products, and it is largely reliant on fish imports to fulfill its growing demand. Nigeria recorded USD 1.2 billion of fish import with exports valued at USD284241, 390 million [9]. Nonetheless, there are ongoing attempts to put laws and programs in place to close the gap between fish demand and availability. The correct execution of these initiatives, for example, has resulted in increased growth in Nigeria's aquaculture fisheries. It has grown from 21,700 tons in 1999 to 316,727 metric tons in 2015, making the nation the largest aquaculture producer in Sub-Saharan Africa. Its importance is growing rapidly in Nigeria, with an average annual growth of 20,000 million tons of fish.

## 2. Stylized Facts

There is continuous increase in the trend of economic growth, which is measured by linear real gross domestic output, and the contribution of fish production to the real sector of the economy (see fig 1 below). The trend analysis shows a significant and consistent surge in the fish sub sector from 1997 to 2013 and this correspond to a proportionate increase in real gross domestic output. [10] found significant contribution of fisheries through the agricultural sector to the nation's economy through employment creation as well as providing raw materials to industries that produce animal feed.

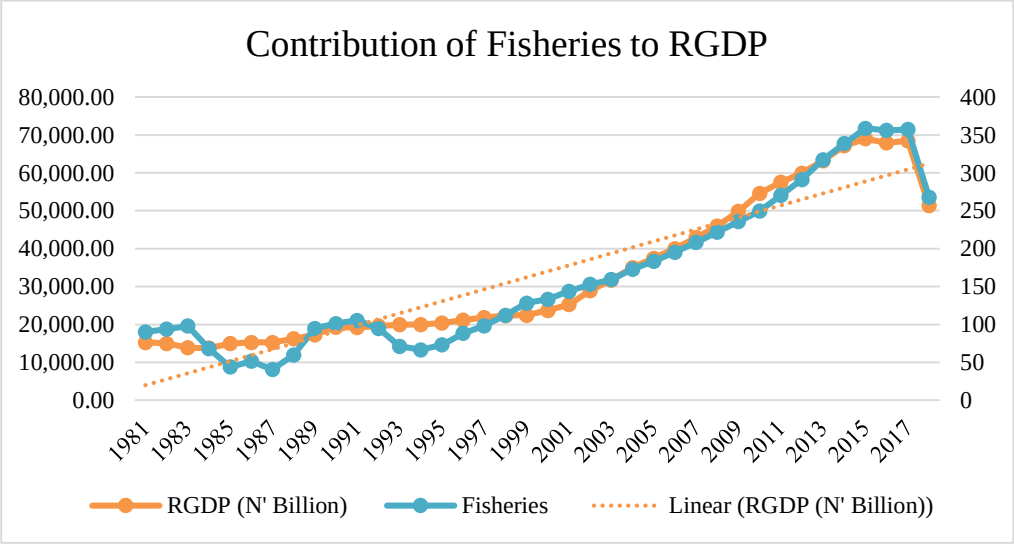


Figure 1. Fisheries Contribution to Nigeria RGDP
Source: CBN statistical bulletin

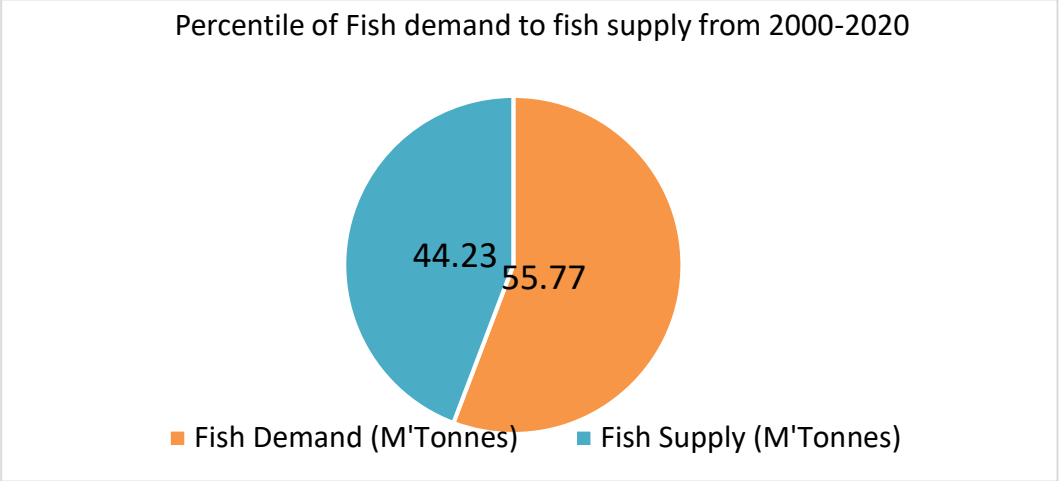


Figure 2. Percentile of Nigeria's fish demand to supply
Source: FAO (2020).

The figure 2 shows an average relationship between Nigeria supply of fish to its demand from the period of 2000-2020. For there to be equilibrium, the demand for fish has to be equal to the supply, but the graph above shows a deficit fish supply of 11.54%. Nigeria total demand for fish from 2000-2020 stood at 24,500,000 metric tonnes while the total supply of fish within the same period stood at 19,430,000 metric tonnes, showing a supply deficit of 5,070,000 metric tonnes. To close the supply-demand gap, [6] opined that, 0.7 metric tons must be imported each year at a cost of $400 million.

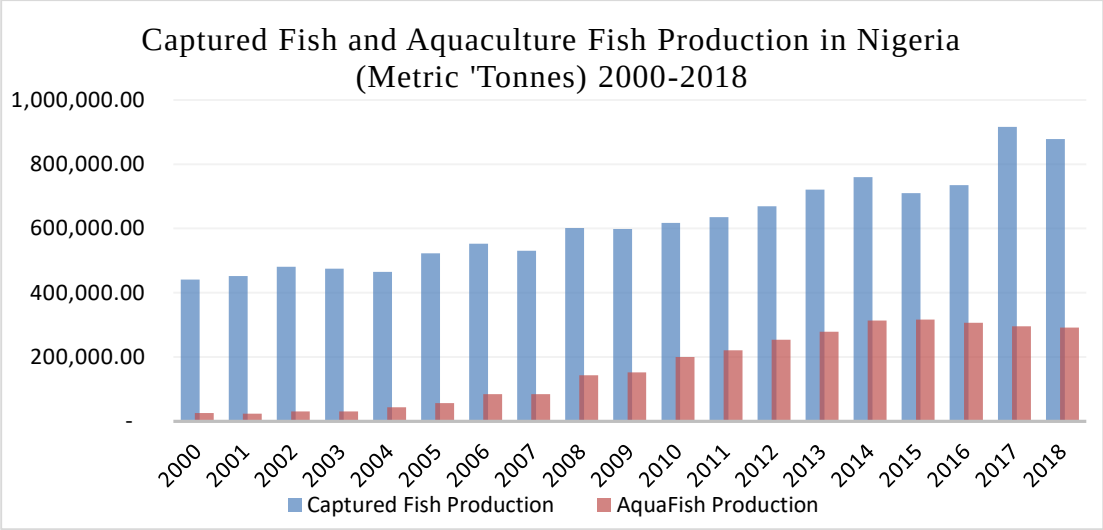


Figure 3. Captured and Aquaculture Fish Production in Nigeria
Source: FAO (2020).

*2.1. Capture Fish and Aquaculture Fish Production*

In 2009, captured fish production was 616,000metric tons and that of aquaculture was 200,000 metric tons as shown in Figure 3 above. Total aquaculture fish production increased from 2008-2015, there was a slight decrease from 2016-2018 due to challenges. There was a geometric increase in aquaculture fish production from year 2000 due of increased public knowledge of the benefits of aquaculture fish ffarms, particularly in the areas of catfish and tilapia production. Rapt attention should be given to aquaculture

to facilitate, more domestic production of fish to meet its rising demand and reduce the huge importation of fish in Nigeria.

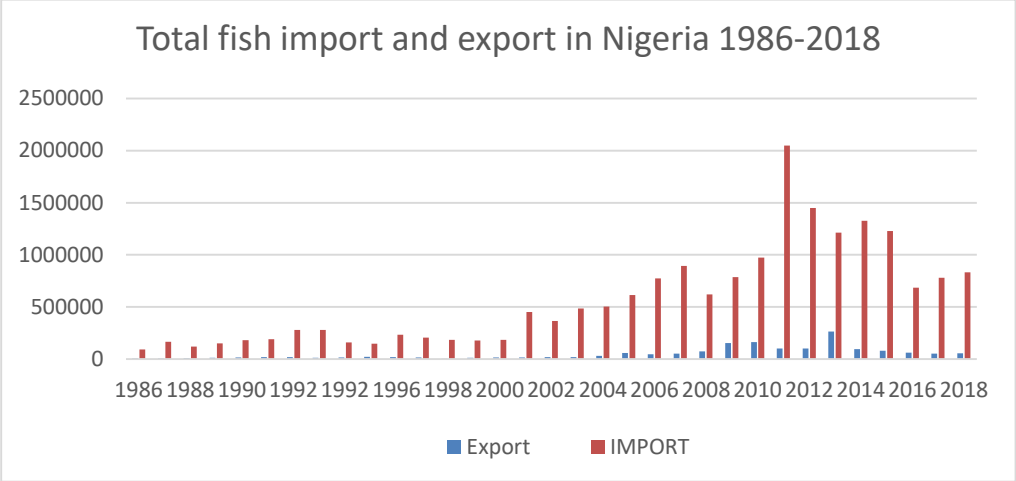


Figure 4. Captured and Aquaculture Fish Production in Nigeria
Source: FAO (2020).

The Figure 4 shows Nigeria Fish import to export in monetary terms. In 2012 Nigeria fish importation stood at $2 billion with it fish importation value at only $100 million showing a huge deficit in demand. Although fish exports value increased from 2004 with a sharp rise in 2013. Most studies have shown that the possibility of bridging the widening demand-supply gap deficit is through aquaculture fish production to cushion the effects of continuous fish importation in Nigeria.

## 3. Review of Related Literature

The cross-border supply of fish to Nigeria supplement the country's domestically produced fish is regarded food importation. In 2015, Nigeria spent over N125 billion on importing about 1.9million fishes in metric tons [9]. Despite the country's abundant aquatic resources, river systems, wetlands, as well as streams, Nigeria spent N97 billion on fish in 2010 [6]. [11] discovered that, according to data, from NBS (National Bureau of Statistics), fish was the second most expensive edible item imported from 2006 to 2010, with an annual average of ₦113.63 billion.

According to relevant data, the value of fish imports is growing, which has been ascribed to the Nigerian population's increasing growth rate, whereas local production of fish is expanding at a declining pace. According to [1], the amount of imported fishes increased between 2000 and 2007, the number of tons climbed from 557,884 to 739, 666, with a foreign exchange value of $241,065.54m in 2000 and $594,373.69m in 2007. The nation has been labelled the world's greatest importer of fish, based on these data [1, 4,12].

## 4. Technique of Estimation

The method of estimation presents the techniques adopted in data analysis, statistical criteria, stationarity test of variables, apriori expectations based on theory, dynamic model specification and the sources of data. Furthermore, the variables logarithms were computed in order to align the time-series data.

### *4.1 Statistical Criteria*

The statistical reliability of the computed parameters was examined using a set of statistical criteria in this study. Among the required criteria are the coefficient of multiple determination (R2), T-statistics, F-statistics, and Durbin–Watson statistics.

#### *4.1.1 Economic Apriori Expectations*

The apriori expectations is to demonstrates that each explanatory variable in the model is equivalent to an economic theory postulation (that is, if the signs are consistent with economic theory postulates). We

anticipate the coefficients to look like this if we use the Fully Modified Least Square approach to estimate our model;

**Table 1. Coefficient Expected sign**

| Coefficient(LRGDP) | Expected Sign |
|---|---|
| $\beta_2$ (LFIMPORT) | - |
| $\beta_3$ (LTFP) | + |
| $\beta_{458}$ (LFM) | + |
| $\beta_5$ (LFEXPORT) | + |

The model in its implicit form is expressed as:

$$RGDP = F(FIMPORT, TFP, FM, FEXPORT) \quad (1)$$

The model assumes a non-linear form, which is further expressed, in its explicit form as:

$$LRGDP_t = A.\ LFIMPORT_t^{\beta 1}.\ LTFP_t^{\beta 2}.\ LFM_t^{\beta 3}.\ LFEXPORT^{\beta 4}.e_t \quad (2)$$

$$LogRGDP_t = \beta_0 + \beta_1 LogFIMPORT_t + \beta_2 LogTFP_t + \beta_3 LogFM_t + \beta_3 LogFEXPORT_t + e_t \quad (3)$$

Where:
RGDP: Real gross domestic product
FIMPORT: Fish import
TFP: Total fish production
FM: Number of fishermen
FEXPORT: Fish export
$B_0$ : Constant term
$\beta_1 - \beta_3$ are parameter estimates or coefficients
$e_t$ : Error term.
t = Time series data from 1986 to 2018.

### *4.2 Sources of Data*

The empirical analysis in this study uses annual data for the thirty-three years (1986–2018). The data was sourced from FAO Statistical Bulletin, World impact fish and NBS Publications for the years under review.

## 5. Estimation and Discussion of Results

### *5.1 Stationarity Test*

In a situation where the time series' mean, variance, and covariance remain constant. no matter where they are measured, the data is stationary. However, if the mean, variance, and auto covariance of a time series are not the same, it is not stationary, regardless of the moment at which it is measured, which is a unit root problem. This means that the study of behaviour of that time series is only possible for the period under consideration. The test is crucial because it shows whether the time series are stationary in the long run as regressing non-stationary series on one another, which can yield spurious regression results. Hence, this study employed the Augmented Dickey Fuller (ADF) stationary test.

#### *5.1.1 Unit Root Test*

At first difference, all the variables were stationary, according to the ADF (Augmented Dickey Fuller) unit root result tests. The ADF unit root test criterion specifies that for stationarity to be established at level, the statistical test value of ADF test should be larger than that of the critical value of Mackinnon at 5% absolute term, and if not, differencing happens using the same criterion.

**Table 2: ADF Unit Root Test and Order of Integration**

| Variables | ADF test Statistic value | 5% Mackinnon critical value | Remark | Order of integration |
|---|---|---|---|---|
| LRGDP | -4.455339 | -2.963972 | Stationary | 1(1) |
| LFIMPORT | -6.833750 | -2.960411 | Stationary | 1(1) |

| | | | | |
|---|---|---|---|---|
| LTFP | -7.965276 | -2.960411 | Stationary | 1(1) |
| LFM | -7.177111 | -2.960411 | Stationary | 1(1) |
| LFEXPORT | -6.735723 | -2.960411 | Stationary | 1(1) |

**Source: Author's computation from EViews 9.0**

The nature of the series was non-stationary at levels 1(0), at first difference it became stationary at 1(1) series. therefore, at order one, all the variables were integrated To put it another way, at first difference, RGDP (real gross domestic product), FIMPORT (fish import), TFP (total fish production), FM (fishermen), and FEXPORT (fish export) were all stable.

***5.1.2 Descriptive Statistics***

Descriptive statistics was used to show a clear picture about the quantitative description of the basic features of a set of data. Descriptive statistics used in the study includes mean, median and mode for measurement of tendency, standard deviation and variance for the measurement of variability, minimum and maximum levels as well as Kurtosis and Skewness.

**Table 3. Descriptive Statistics of Variables**

| Variables | RGDP ($'Billion) | FIMPORT ($'Billion) | TFP (M'Tonnes) | Number FM | ofFEXPORT ($'Billion) |
|---|---|---|---|---|---|
| Mean | 36068.70 | 568391.0 | 592487.0 | 1083715. | 48186.21 |
| Median | 28957.71 | 451517.0 | 505839.0 | 1159476. | 18310.0 |
| Maximum | 69023.93 | 2048244. | 1212475. | 1884139. | 26315.4 |
| Minimum | 15237.99 | 89984.00 | 255499.0 | 274470.0 | 2052.0 |
| Std. Dev. | 18684.34 | 474960.4 | 298443.5 | 532331.5 | 56742.36 |
| Skewness | 0.564253 | 1.229683 | 0.643088 | -0.228532 | 2.095643 |
| Kurtosis | 1.806591 | 4.121432 | 2.126184 | 1.444255 | 7.684765 |
| Jarque-Bera | 3.709405 | 10.04588 | 3.324477 | 3.615219 | 54.33162 |
| Probability | 0.156500 | 0.006585 | 0.189714 | 0.164046 | 0.000000 |
| Sum | 1190267. | 18756904 | 19552070 | 35762580 | 1590145. |
| Sum Sq. Dev. | 1.12E+10 | 7.22E+12 | 2.85E+12 | 9.07E+12 | 1.03E+11 |
| Observations | 33 | 33 | 33 | 33 | 33 |

**Source: Author's calculations based on Eviews 9.0**

Maximum real gross domestic output of Nigeria was ₦69 billion, while its minimum value was ₦15.2 billion. The mean was ₦36 billion with standard deviation of ₦18.7 billion (as shown in Table 2 above). In addition, the importation of fish is estimated at a maximum value of $21million with a minimum value of $9million with its mean value at $5.7 million and standard deviation of $4.8 million. Additionally, the maximum fish exportation value in Nigeria was estimated at $2.6 million, with a minimum value of $2.1 million and mean of $4.8 million with standard deviation of $5.7 million. The maximum value of total fish production is 1.2 million metric tonnes with minimum of 256,000 metric tonnes and mean of 592, 000metric tonnes and standard deviation of 298,000 metric tonnes. The number of fishermen peaked at 1.9 million, minimum of 274, 000 with 1.1 million mean alongside 532,000 standard deviation.

Skewness and Kurtosis were used to perform a normality test. Skewness is a metric that indicates asymmetry and a divergence from the normal distribution. The skewness of the time series of real gross domestic product, fish import, total fish output, and fish export was larger than zero, indicating that the concentration of the variables is to the left side of the mean of each variable's, exhibiting right side extreme values. However, the explanatory variable, total number of fishermen was negatively skewed to the left implying that the variable is focused on the right side of its individual mean exhibiting left side extreme. Furthermore, in distribution analysis, another indicator used as sign of "flattening" or "peakedness" is Kurtosis.

The importation and exportation of fish is a leptokurtic distribution because its kurtosis estimates are greater than three and so it has a sharper distribution than that of a normal distribution with values close to the mean, slow with long tailed [3]. While, real gross domestic product, total fish production and number of fishermen are platytokurtic distribution because their kurtosis estimate is less than three which implies that these variables are fat or short tailed (as shown in Table 2).

### *5.1.3 Co-integration Test*

The presence of cointegration implies that a there is the existence of a long-run association among the model's variables. Co-integration exists between non-stationary variables if their linear combination such as residuals of the co-integration regression is stationary. If a stationary co-integration relationship is established between the variables, spuriousness can be avoided [14]. Co-integration is used to see if the explanatory variables can explain the non-explanatory variable, both in the long run and the short run. However, the Johansen Co-integration Test was used in this investigation. One of the key advantages of applying the multivariate co-integration test, according to [15], is its superiority feature in especially for two or more variable systems. However, unlike two-step residual-based assessment for co-integration advanced by [16] and the bounds testing technique for co-integration suggested by [17], the multivariate Johansen Juselius co-integration method is not sensitive to the dependent variables choice since it presumes that almost all variables are endogenous.

**Co-integration Test Hypothesis**

$H_0 : \gamma = 0$ (No co-integration equation)

$H_1 : \gamma \neq 0$ (Co-integration equation)

**Table 4. Unrestricted Cointegration Rank Test (Trace)**

| **Hypothesized** | | **Trace** | **0'05** | |
|---|---|---|---|---|
| No. of CE(s) | Eigen Value | Statistics | Critical Value | Prob.** |
| None* | 0.752147 | 104.3411 | 69.81889 | 0.0000 |
| At Most 1 | 0.565260 | 61.09857 | 47.85613 | 0.0018 |
| At Most 2 | 0.484178 | 35.27537 | 29.79707 | 0.0106 |
| At Most 3 | 0.365257 | 14.75356 | 15.49471 | 0.0644 |
| At Most 4 | 0.021159 | 0.662976 | 3.841466 | 0.4155 |

Trace test indicates 3 co-integrating equation(s) at 0.5 level

**Source: Author's Calculations based on EViews**

**Table 5: Unrestricted Cointegration Rank Test (Maximum Eigen value)**

| **Hypothesized** | | **Max-Eigen** | **0'05** | |
|---|---|---|---|---|
| No. of CE(s) | Eigen Value | Statistics | Critical Value | Prob.** |
| None* | 0.752147 | 43.24252 | 33.87687 | 0.0029 |
| At Most 1 | 0.565260 | 25.82319 | 27.58434 | 0.0826 |
| At Most 2 | 0.484178 | 20.52181 | 21.13162 | 0.0607 |
| At Most 3 | 0.365257 | 14.09058 | 14.26460 | 0.0532 |
| At Most 4 | 0.021159 | 0.662976 | 3.841466 | 04155 |

Maximum Eigenvalue test indicates 1 co-integrating equation(s) at 0.5 level

**Source: Author's Calculations based on EViews**

Table 4 and 5 test results shows that there is the possibility of rejecting the null hypothesis which says that at 5% level of significance of there is no co-integrating vector. According to the findings, there is a long-term relationship amongst RGDP and GDP (real gross domestic products),FIMPORT, FEXPORTS (fish exports), FM (fishermen) and TFP (total fish production), this is because three co-integrating relationships are revealed by the trace statistics. In addition, the maximum eigenvalue shows one co-integrating relationship between the variables. As a consequence, the presence of co-integrating equations in this study was established by the unconstrained co-integration rank test (Trace) and the

unrestricted co-integration rank test (Max-Eigen). As a result, the predicted parameters in the model have a long-term association.

### *5.2 Results of Fully Modified Ordinary Square (FMOLS)*

FMOLS (Fully Modified Ordinary Least Square) is a valuable tool for describing long-run adjustment processes. Fully Modified Ordinary Least Squares models multiple time series model that determine an independent variable's correction issue in time series data. Co-integrating equation model is another name for FMOLS.

Since Johansen co-integration study demonstrates long-term evidence of a relationship between the dependent and explanatory variables, the FMOLS estimation approach was employed to determine the independent factors' effect on dependent variable in the long run. Table 6 presents the FMOLS results for which the adjusted $R^2$ of 0.973 indicates that fish import and export, total fish production and the number of fishermen jointly explains about 97.3 percent variations in RGDP (real gross domestic products) however 3 percent explain changes in the dependent variables by other variables not captured in the model.

The t-statistics and probability test value of all the explanatory variables discloses that TFP (total fish production), FIMPORT (fish import) and FEXPORT (fish export) are significant at 5 percent level, except number of fishermen (FM) and the dummy variables. Precisely, at the long run a percent increase in fish importation would induce 0.17 percent simultaneous increase in economic growth whereas a percent increase in total fish production will induce 0.59 rise in economic growth. Likewise, a percentage increase in fishermen will and fish exports will induce a 0.002 and 0.08 percent rise in economic growth. The Durbin Watson statistics at 2.75 indicates no presence of serial correlation among the error term since the rule of thumb is greater than 2 (DW > 2).

**Table 6. Fully Modified Ordinary Least Squares (FMOLS) Result Summary**

Dependent Variables: LRGDP

| Variables | Coefficient | Standard error | T statistic | p-value |
|---|---|---|---|---|
| LFIMPORT | 0.166228 | 0.038866 | 4.276971 | 0.0002 |
| LTFP | 0.587147 | 0.065363 | 8.982923 | 0.0000 |
| LFM | 0.002449 | 0.44523 | 0.055000 | 0.9565 |
| LFEXPORT | 0.081223 | 0.022534 | 3.604533 | 0.0012 |
| C | -0.366644 | 0.399822 | -0.917019 | 0.3673 |

**Source: Researcher's computation from eviews**

### *5.3 Granger Causality Tests*

Granger causality concept arises in a situation where two time series data XT and YT become co-integrated, as such they must be stationary in a linear combination. [18]. In order to determine the direction of a causal link between two variables (unidirectional and bidirectional causation), granger causality test is employed. Unidirectional causality states that if variable A causes variable B, then B cannot cause A, whereas bidirectional causality states that if A causes B, then B causes A.

**Table 7. Pairwise granger cause test**

| Null Hypothesis | Obs | F-Statistic | Prob. |
|---|---|---|---|
| RGDP is not granger caused by IMPORT | 32 | 6.63842 | 0.0153 |
| FIMPORT is not granger caused by RGDP | | 3.80519 | 0.0608 |

**Source: Researcher's computation from reviews**

#### *5.3.1 Discussion of Pairwise Granger Causality Test*

The direction of causation between the explanatory variable (fish imports) and the variable that is dependent (RGDP) was captured by the Granger causality test

$H_0$: RGDP is not granger caused by FIMPORT.
$H_1$: FIMPORT is not granger caused by RGDP

Panel A states that "FIMPORT does not granger cause RGDP". We accept the null hypothesis; since the F-statistics and p-value indicates that the coefficient is strongly statistically significant. Indicating that importation of fish does not cause economic growth, because the overdependence and continuous importation of fish to meet its excess demand has a huge negative impact on the nation's currency and distorts the balance of trade affecting the overall performance of the economy. Thus, the importation of fish and economic growth are found to have a unidirectional causal relationship.

## 6. Implication of Findings and Conclusion

Results from this study indicates that fish importation into the country has a detrimental influence on the Nigeria economy far more than the positive influence of fish exports. In fact, the negative effect of food import is twice the positive effect of exports on the long run. In spite of the different agricultural policies and programs by the various levels of government to revamp the agricultural sector, available data on fish production and imports reveal that there is significant shortfall between fish demand and fish production in Nigeria.

This shortfall results in continuous rise in fish importation and if nothing urgent is done specifically for the long run period, there will be adverse effect on economic performance through reduction in number of fish farmers and depletion of foreign exchange reserve for the country. In fact, increase in fish imports contribute to consumers' inflationary pressure due to the incidence of imported inflation. Thus, to curb the macroeconomic effects of fish while bridging the demand-supply gap, the study recommends the implementation of aquaculture transformation agenda to raise the total level of domestic fish production in order to achieve self-sufficiency for shortfall [15]. The promotion of aquaculture is an encouraging pathway to reduce dependence on fish importation. From records captured fisheries still remains a major source of fish, making it important to maintain fish production at sustainable levels can be done through better management of the fishery sector.

## 7. Acknowledgements

The authors are grateful to Covenant University's management for paying the publication fee for this manuscript through her Centre for Research, Innovation, and Discovery (CUCRID).

## References

[1] Udo, Imefon & Umanah, Saviour. (2017). Current status of the Nigerian Aquafeed industry: A review. International *Journal of Innovative Studies on Aquatic Biology and Fisheries. 3 (1), 14-22. DOI: http://dx.doi.org/10.20431/2454-7670.0301003*
[2] Oluwarore, K. (2018), NIGERIA: Importing fish amidst abundant ocean resources, the paradox of a nation, International Centre for Investigative Reporting, Nigeria. https://earthjournalism.net/stories/nigeria-importing-fish-amidst-abundant-ocean- resources-the-paradox-of-a-nation
[3] Federal Department of Fisheries (2018). Fisheries Statistics of Nigeria. Published by Federal Department of Fisheries Fifth Edition 2007-2015
[4] Adebayo, O.O., & Daramola, O.A. (2013). Economic analysis of catfish (Clarias gariepinus) production in Ibadan metropolis.
[5] Adebesin AA. (2013) Fish Production, Poverty Alleviation and Cooperative Success of Eriwe Cooperative Fish Farm at Ijebu-Ode, Ogun State, Nigeria: A project Report submitted to the Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta. 2011. 87p.
[6] Olaoye, O. J. & Ojebiyi, W. G. (2018). Marine Fisheries in Nigeria: A Review. In M. Türkoğlu, U. Önal, & A. Ismen (Eds.), Marine Ecology - Biotic and Abiotic Interactions. IntechOpen.

https://doi.org/10.5772/intechopen.75032
[7] Nakazawa N, Komatsu M, Court B. (2013) Fisheries in Nigeria. Report to the Ministry of Agriculture. Nigerian Government. 2013. 11 p
[8] Food and Agricultural Organisation (2017). Fishery and Aquaculture Statistics. Global Production by Production source 1950-2015 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Retrieved from www.fao.org/fishery/statistics/software/fishstatj/en
[9] Food and Agricultural Organisation (2020). Fishery and Aquaculture Statistics. Global Production by Production source 1950-2018 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Retrieved from www.fao.org/fishery/statistics/software/fishstatj/en
[10] Osagie, C. (2012). Aquaculture as Path to Thriving Agriculture. http://www.thisdaylive.com/articles/aquaculture-as-path-to-thriving-agriculture/124614/
[11] Olaoye OJ, Ojebiyi WG, Opele AI. & Baiyewu AK. (2016) Socioeconomic analysis of small scale fish farmers in Ilaro agricultural extension zone of Ogun State, Nigeria. *Journal of Agriculture, Forestry and Fisheries. 15(2):64-74*
[12] Adewuyi SA, Phillip BB, Ayinde IA, Akerele D. (2010) Analysis of profitability of fish Farming in Ogun State, Nigeria. *Journal of Human Ecology 31(3):179-184*
[13] Gujarati, D.N. (2004). Basic Econometrics, New York, Mc Graw Hill, 3rd Edition
[14] Nkang et al (2007). Investment in cocoa production in Nigeria: a cost and return analysis of three cocoa production management systems in the cross-river state cocoa belt. *Journal of Central European Agriculture, 8(1), 81-90.*
[15] Tang, C, F. (2010) Multivariate Granger Causality and the Dynamic Relationship Between Health Spending, Income, and Health Price in Malaysia. MPRA Paper No. 27298, pgs. 1-14 https://mpra.ub.uni-muenchen.de/27298/
[16] Engle, R.F. and Yoo, B. (1987), Forecasting and Testing in Co-integrated Systems, *Journal Of Econometrics, 35(2).143-159*
[17] Pesaran, M.H., Shin, Y. and Smith, R.J. 2001. "Bounds testing approaches to the analysis of level relationship." *Journal of Applied Economics 16: 289-326*
[18] Granger, C.W. & Newbold, P. (1969) Spurious Regressions in Econometrics. *Journal of Econometrics, 2: 111 – 120.*