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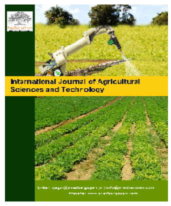

Research Paper

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Impact of Agricultural Sector on Economic Growth in Nigeria

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Abstract

This study examined the impact of agricultural sector on economic growth in Nigeria (1981-2020). The main objective of the study is to examine the impact of agricultural sector on economic growth in Nigeria. The study used multiple regressions. The variables under consideration were real gross domestic product as the dependent variable while crop production, livestock production, forestry production and fish production are the independent variables. The Ordinary Least Square (OLS) technique was used in estimating the relationship between the dependent and independent variables. The research result Crop production and livestock production have significant impacts on economic growth in Nigeria. Forestry production and fish production have no significant impacts on economic growth in Nigeria. All the independent variables have positive relationship with economic growth in Nigeria respectively, which implies that as crop production, livestock production, forestry production, and fish production increases, real gross domestic product increase.There is no causality relationship between crop production and economic growth in Nigeria. There is no causality relationship between livestock production and economic growth in Nigeria. There is a uni-directional causality relationship flowing from forestry production to real gross domestic product, between forestry production and economic growth in Nigeria. There is no causality relationship between fish production and economic growth in Nigeria. Based on the findings of the work, the study recommends that there is the need for the Nigerian government and its citizenry to concentrate their combined efforts towards increasing the productivity capacity of the crops with the aim of promoting food security and economic growth among others.

Keywords: *Agriculture sector, Economic growth, Multiple regressions, Crop production, Livestock production, Forestry production, Fish production*

1. Introduction

1.1. Background to the Study

Agriculture is the keystone of economic growth, and development in the developing countries. Agricultural sector has four major contributions to the development of an economy; product contribution, factor contribution, market contribution and foreign exchange contribution. Agriculture is a source of food and raw materials to the industrial/manufacturing sector. It provides raw materials for industrial use for speeding up industrialization. It involves crop production, livestock production, forestry production, and fishery production, for man’s consumption and use; processing and marketing of

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the agricultural products. These contributions in effect have been the source of gainful employment opportunity, poverty reduction, and improvement of income redistribution.

Furthermore, foreign earnings from exportation of agricultural local materials, helps to reduce the pressure on balance of payment in most African nations. Based on these contributions, agriculture is regarded as the fundamental to the socioeconomic development of a nation (Ahmed, 1993). In low and middle-income countries, the agricultural sector is the largest contributor providing inputs, food, employment opportunities, raw materials for other industries, provision of foreign earnings from the exportation of the surpluses, and more importantly the enormous advantage of the value added in the various production process (Izuchukwu, 2017). Hence, the role of agriculture in improving the social and economic structures of an economy cannot be over-emphasized. Rostow (1960) argued that in the process of economic development, nations pass through several stages, namely: traditional stage, the precondition for take-off, the take off stage, drive to maturity and the high mass consumption stage. Agriculture played crucial roles in the first three stages (Traditional society, pre-conditions for take-off and take-off stages). The agricultural sector has the potential to be the economic springboard from which a country's development can take off. More often, agricultural activities are focused in the less- developed rural areas where there is a critical need for rural transformation, redistribution, poverty alleviation and socioeconomic development.

1.2. Statement of Problem

Agriculture accounted for 30% of the GDP in 2010 (*World Factbook*, January 9, 2012). Nigeria is no longer a major exporter of cocoa, groundnut, rubber and palm products. Cocoa production mostly from obsolete varieties and over-aged trees are stagnant at around 150,000 tons annually. The Central Bank of Nigeria (CBN) *Statistical Bulletin* 2021, shows that there is a decline in groundnut, palm oil and other major export crops production in Nigeria. The decline in agricultural production was largely due to exhorbitant dependence on oil. Because of this backdrop, agriculture has not kept up with the rapid population growth and Nigeria once a large net exporter of for now imports most of its food requirements.

Over 80% of the consumed food in Nigeria is provided by the small-scale farmers. The Nigerian agriculture lacks storage facilities and these have led to so much wastage and high cost of storage. This hinders the availability of source perishable agricultural produce through the year, therefore hindering agricultural development. Another negative factor is dependence on weather, which affects the increase in agricultural produce. Farmers still depend on rainfall only to produce instead of the use of irrigation means that supplies water through-out the year.

1.3. Research Questions

This study shall examine the following research questions:

i. What is the impact of agricultural sector on economic growth in Nigeria?

ii. What is the causality relationship between agricultural sector, and economic growth in Nigeria?

2. Objectives of Study

The broad objective of this study is the examine the impact of agricultural sector on economic growth in Nigeria, while the specific objectives includes:

i. To determine the impact of agricultural sector on economic growth in Nigeria.

ii. To evaluate the causality relationship between agricultural sector and economic growth in Nigeria.

3. Statement of Hypotheses

For the purpose of this study, the following hypotheses are tested;

i. H_0: *Agricultural sector has no significant impact on economic growth in Nigeria.*

ii. H_0: *There is no causality relationship between agricultural sector and economic growth in Nigeria.*

3.1. Scope and Limitations of the Study

This research work focuses on the impact of agricultural output on economic growth in Nigeria between the periods of 1981 to 2020. Temporal unavailability of data on the variables for 2021 limits the scope of this study.

4. Literature Review

4.1. Conceptual Literatures

4.1.1. Concept of Agricultural Sector

Conceptually, agriculture is the production of food, feed, fiber and other goods by the systematic growing and harvesting of plants and animals. It is the science of making use of the land to raise plants and animals. It is the simplification of natures food webs and the rechanneling of energy for human planting and animal consumption (Olorunfemi, 2008). Until the exploitation of oil reserves began in the 1980s, Nigeria's economy was largely dependent on agriculture.

4.1.2. The Concept of Economic Growth

Tadaro (2007) defined the term economic growth as a process by which the productive capacity of the economy is increased over time to bring about raising level of national output and income. Kuznets (1966) on the other hand views economic growth as a long term process wherein the substantial and sustained rise in real national income, total population and real per capita income takes place.

5. Empirical Literature

In the same vein, Izuchukwu (2017) in examining the contribution of the agricultural sector in the Nigerian economic growth found that a positive relationship existed between Gross Domestic Product (GDP) Vis-a-Vis domestic saving, government expenditure on agriculture and foreign direct investment.

Oje-Okoro (2019) made an analysis of the contributions of agricultural sector on the Nigeria economic development multiple regression was used to analyze the data collected. The result indicated a positive relationship between Gross Domestic Product (GDP) vis-à-vis domestic savings, government expenditure on agriculture, and Foreign Direct Investment (FDI). It was also revealed in the study that 81% variations in GDP could be explained by domestic savings, government expenditure on agriculture and FDI.

Aminu and Anono (2019) investigated the contribution of agricultural sector and petroleum sector to the economic growth and development (GDP) of the Nigerian economy between 1980 and 2018 through the application of Augmented Dickey-Fuller technique in testing the unit root property of the series; after which Chow breakpoint test was conducted to test the presence of structural break in the economy. The results of unit root test suggest that all the variables in the model are stationary at first difference and the results of Chow breakpoint test suggest that there is no structural break in the period under review. The results also revealed that agricultural sector is contributing higher than the petroleum sector, though they both possessed a positive impact on the economic growth and development of the economy. A good performance of an economy in terms of per capita growth may therefore be attributed to a well-developed agricultural sector.

According to Onunze (2017) in his work titled "the impact of agricultural development on Nigeria economic growth" using an Ordinal Least Square Regression method of analysis found out that agricultural productivity impacted positively on economic growth from the year 1980-2016. Furthermore, he reiterated from his findings that agricultural development has provided opportunities for economic growth with the year of study.

Oyinbo and Rekwot (2018) provided an empirical relationship between agricultural production and the growth of Nigerian economy with focus on poverty reduction. Time series data were employed in the research at the analysis of the data were done using unit root test, and the bounds (ARDL) testing approach to co-integration. The result of the data analysis indicated that agricultural production was significant in influencing the favorable trend of economic growth in Nigeria.

Ideba *et al.* (2019) investigated the relationship between agricultural public capital expenditure and economic growth in Nigeria over the period 1971 to 2018 using annual data obtained from the Central Bank of Nigeria. The data were analysed using Augmented Dickey- Fuller test, Johansen maximum likelihood test and Granger Causality test. The result of the Johansen co-integration test showed that there exists a long run relationship between all the explanatory variables and the explained variable. The result of parsimonious error correction model showed that agricultural public capital expenditure had a positive impact on economic growth. Also, Granger Causality test showed a unidirectional relationship between agricultural public capital expenditure and agricultural economic growth. This means that agricultural economic growth does not cause expansion of agricultural public capital expenditure; rather it indicates that agricultural public capital expenditure raises the nation's agricultural economic growth.

Tolulope and Chinonso (2019) investigated the contribution of the agriculture sector to economic growth in Nigeria using the growth accounting framework and time series data from 1960 to 2018. With the Granger causality test, they find that the agricultural sector has contributed positively and consistently to economic growth in Nigeria, reaffirming the sector's importance in the economy. However, no reverse relationship was found.

Odetola and Etumnu (2017) investigated the contribution of the agriculture sector to the economic growth in Nigeria using the growth accounting framework and time series data from 1960 to 2015. The study found that the agricultural sector has contributed positively and consistently to the economic growth in Nigeria, reaffirming the sector's importance in the economy. The contribution of agriculture to economic growth is further affirmed from a causality test which showed that agricultural growth Granger-causes GDP growth, however no reverse relationship was found. The resilient nature of the sector is evident in its ability to recover more quickly than other sectors from shocks resulting from disruptive events, e.g., civil war (1967-70) and economic recession (1981-85) periods. The study also found that the crop production subsector contributes the most to agricultural sector growth and that growth in the agriculture sector is overly dependent on growth of the crop production subsector. This indicates the importance of this subsector and probably, lack of attention or investment to the other subsectors.

Ahungwa *et.al*. (2017) studied the trend analysis of the impact of agriculture to GDP between 1960 to 2016, using time series data. The structure shows that the agricultural sector has a superior lead over other sectors between 1960 and 1975 although there was a decline in the agricultural sector's share of GDP. The study revealed a fluctuation between the industrial sectors from 1967 to 1989 period. The regression analysis reveals a positive and significant relationship between the agricultural sector and GDP with the sector accounting 66.4% of the variation in the economy. It also reveals the dominance in the agricultural sector relative to other sectors of the economy.

Olutoye and Olutoye (2017) examined the contribution of agricultural sector to Gross Domestic Product (GDP) between 1990 and 2016. The Ordinary Least Square (OLS) multiple regression method was used to analyze the data. The results revealed a positive cause and effect relationship between agricultural output and GDP in Nigeria. Specifically, the study clearly shows that Agricultural Output has a strong influence on the GDP with an estimated contribution of 30.2% between 1970 and 2000 before the neglect of this sector during the oil boom in the 1970s. In order to improve agriculture, government should see that special incentives are given to farmers and basic infrastructural facilities such as stable electricity, good road networks, and adequate water supply are readily provided.

Omorogiuwa *et al*. (2018) analyzed the historical and current perspective about the development of agriculture in Nigeria, in light of its productivity. The findings of the study proved that an in-depth research on the development of the agricultural sector is essential to its productivity, therefore the agricultural development should start with the empowerment of the poor farmers financially.

5.1. Gap(s) in Literature

From the empirical literatures reviewed, previous researchers such as Izuchukwu (2017), Oje-Okoro (2019), Aminu and Anono (2019), Onunze (2017), Oyinbo and Rekwot (2018), Ideba *et al*. (2019), Tolulope and Chinonso (2019), Odetola and Etumnu (2017), and Olutoye and Olutoye (2017), failed to incorporate, the four agricultural output variables in their respective studies. From Central Bank Nigeria Statistical bulletin, agricultural sector comprises of four sub sectors—crop production, livestock production, forest production and fish production. This study will fill this gap by including these four important agricultural sub-sectors variables.

6. Research Methodology

6.1. Research Design

The research design adopted is the Ex Post Facto. This study applies econometric procedure in estimating the impact of agricultural sector on economic growth in Nigeria. The Ordinary Least Square (OLS) technique is employed in obtaining the numerical estimates of coefficients in different equations. The OLS method is chosen because it possesses some optimal properties; its computational procedure is fairly simple and it is also an essential component of most other estimation techniques.

6.2. Theoretical Framework

This study adopts the Urban Industrial Impact Model. This model was formulated by von Thunen in Germany to explain geographical variations in the intensity of farming systems and in the productivity of labor in an industrializing society. It sees agricultural productivity as a function of urban and industrial stimuli. The model is based on the rationale that input and product markets are more effective in areas of rapid urban-industrial development.

6.3. Model Specification

This study shall build a multiple regression model and make use of econometrics procedure in estimating the relationship between agricultural sector and economic growth in Nigeria.

The functional form of the model is specified as:

$RGDP = f(CPRD, LPRD, FPRD, FSPRD)$

The mathematical form of the model is specified as:

$RGDP_t = \beta_0 + \beta_1 CPRD_t + \beta_2 LPRD_t + \beta_3 FPRD_t + \beta_4 FSPRD_t$

The econometric form of the model is specified as:

$RGDP_t = \beta_0 + \beta_1 CPRD_t + \beta_2 LPRD_t + \beta_3 FPRD_t + \beta_4 FSPRD_t + \mu_t$

where

RGDP = Real Gross Domestic product

f = Functional relationship

CPRD = Crop production

LPRD = Livestock production

FPRD = Forestry production

FSPRD = Fish production

β_0 = Constant

β_1, β_2, β_3, β_4 are the relative slope coefficient

μ_t = Stochastic or error term

Method of Evaluation: The estimated result was evaluated subject to the following tests:

- Preliminary Test
- Economic Test of Significance (A Priori Test)
- Statistical Test of Significance (First Order Test)
- Econometric Test of Significance (Second Order Test)

6.4. Preliminary Tests

Stationary (Unit Root) Test: The importance of this test cannot be over emphasized since the data to be used in the estimation are time-series data. In order not to run a spurious regression, it is worthwhile to carry out a stationary test to make sure that all the variables are mean reverting, that is, they have constant mean, constant variance and constant covariance. In other words, that they are stationary. The Augmented Dickey-Fuller (ADF) test would be used for this analysis since it adjusts for serial correlation.

Decision Rule: If the ADF test statistic is greater than the MacKinnon critical value at 5% (all in absolute term), the variable is said to be stationary. Otherwise it is non stationary.

Co-integration Test: Econometrically speaking, two variables will be co-integrated if they have a long-term, or equilibrium relationship between them. Co-integration can be thought of as a pre-test to avoid spurious regressions situations (Granger, 1986). As recommended by Gujarati (2004), the ADF test statistic will be employed on the residual.

Decision Rule: If the ADF test statistic is greater than the critical value at 5%, then the variables are co-integrated (values are checked in absolute term).

6.5. Error Correction Model (ECM)

The ECM will be used and Ordinary Least Squares (OLS) technique of estimation will be employed in obtaining the numerical estimates of coefficients in different equations. The OLS method of estimation is chosen because its computational procedure is simple in addition to being an essential component of most other estimation techniques. This technique has also been adopted by many other researchers and has yielded optimal results.

If there exist a long run relationship (co-integration) among the time series variables, the Error correction model will be estimated to know the rate at which the dependent variable returns to equilibrium to the independent variable after some levels of variations, that is to derive the numerical value of the magnitude of the short run dynamics or disequilibrium. Error correction model is a sound approach useful for estimating both short-term and long-term effects of one time series on another. The term error-correction relates to the fact that last-periods deviation from long-run equilibrium, the error, influences its short-run dynamics.

In conducting ECM, the expected sign of the speed of adjustment should be negative. A positive ECM implies a model misspecification or an indication of structural changes and will not give us the rate of these change in the variables.

6.6. Economic Test of Significance (A Priori Test)

These are determined by the principles of economic theory and refer to the sign and size of the parameters of economic relationship.

The expected signs for the parameters associated with the various variables are shown in Table 1:

Table 1: A priori Expectation

Variables	**Expected Signs**
CPRD	+ve
LPRD	+ve
FPRD	+ve
FSPRD	+ve

6.7. Statistical Test of Significance (First Order Test)

These are determined by the statistical theory and aimed at evaluating the statistical reliability of the estimates of the parameters of the model, the most widely used statistical criteria is the square of correlation coefficient (coefficient of determination R^2), *t*-Test and *F*-Test of significance.

6.8. Test for Goodness of Fit

The coefficient of multiple determinations (R^2) is used to determine the proportion of variation dependent variable that is attributable to variation in explanatory variable. The value of R^2 ranges between 1 and 0 (i.e., $0<R^2<1$). The closer to 1 the better the fit, otherwise the worse the fit.

6.9. t-Test of Significance

The student *t*-ratio will be used to test the individual statistical significance of the regression co-efficient. A two-tail test is conducted at 5% level of significance and n-k degree of freedom (df), where n is the number of observation and *K* is the number of parameter(s) estimated.

Decision Rule: The computed (t*) will be compared with the critical *t*-value ($t_{0.025}$). If $t^*>t_{0.025}$, the H_0 will be rejected and H_1 will be accepted. Otherwise, H_0 is accepted and H_1 rejected.

6.10. f-Test of Significance

f-test statistics is used to test the overall statistical significance of the independent variables. A one-tail test will be conducted at 5% level of significance and (V_1/V_2) degrees of freedom. Where;

V_1= degree of freedom (df) for the numerator: $V_1 = k–1$.

V_2= degree of freedom (df) for the denominator: $V_2 = n–k$.

Decision Rule: If the computed *f*-ratio(f*) is compared with the critical *f*-ratio ($f_{0.05}$). If $f^*>f_{0.05}$, we will reject the null hypothesis and accept the alternative, otherwise, the alternative hypothesis H_1 will be rejected and null hypothesis H_0 be accepted.

7. Econometric Test of Significance (Second Order Test)

Autocorrelation Test: The aim of this test is to examine whether the errors corresponding to different observations are serially correlated or not. Uncorrelated errors are desirable. The Durbin – Watson (D-W) statistics at 5% will be used to test for the presence of autocorrelation problem. The region of no autocorrelation remains:

du< d* < (4-du)

where

du = Upper Durbin – Watson

d* = Computed Durbin-Watson

Decision Rule: If the computed value of Durbin-Watson lies within the no autocorrelation region, it means there is no presence of autocorrelation problem. But if the Durbin-Watson computed value lies outside the regions there is the presence of autocorrelation problem. If it occurs, to avoid the spurious regression associated with it, we will employ the Durbin Watson Autocorrelation Correction to remove its influence in the model.

Normality Test: This study will carry out a normality test to check if the residuals, a proxy for stochastic error term follows normal distribution or not. Symbolically, $u_i \sim N(0, \delta^2)$. The normality test that would be used in this study is Jarque-Bera (JB) test of normality.

Decision Rule: If JBtab(2)df is greater than JBcal in absolute values then the residual is normally distributed

Granger Causality Test: Although regression analysis deals with the dependence of one variable on the other, it does not necessarily imply causation. In other words, the existence of a relationship between variables does not prove causality or the direction of influence (Gujarati, 2004). The essence of causality analysis, using the granger causality test, is to ascertain whether a causal relationship exists between two variables of interest. Here is the Granger specification model:

$$RGDP_t = B_0 + \sum_{i=1}^{i=n} B_1\, CPRD_{t-1} + \sum_{i=2}^{i=n} B_2\, LPRD_{t-2} + \sum_{i=3}^{i=n} B_3\, FPRD_{t-3} + \sum_{i=4}^{i=n} B_4\, FSPRD_{t-4} + \mu$$

$$CPRD_t = B_0 + \sum_{i=1}^{i=n} B_1\, CPRD_{t-1} + \sum_{i=2}^{i=n} B_2\, LPRD_{t-2} + \sum_{i=3}^{i=n} B_3\, FPRD_{t-3} + \sum_{i=4}^{i=n} B_4\, FSPRD_{t-4} + \sum_{i=5}^{i=n} B_5\, RGDP_{t-5} + \mu$$

$$LPRD_t = B_0 + \sum_{i=1}^{i=n} B_1\, LPRD_{t-1} + \sum_{i=2}^{i=n} B_2\, CPRD_{t-2} + \sum_{i=3}^{i=n} B_3\, FPRD_{t-3} + \sum_{i=4}^{i=n} B_4\, FSPRD_{t-4} + \sum_{i=5}^{i=n} B_5\, RGDP_{t-5} + \mu$$

$$FPRD_t = B_o + \sum_{i=1}^{i=n} B_1\, FPRD_{t-1} + \sum_{i=2}^{i=n} B_2\, LPRD_{t-2} + \sum_{i=3}^{i=n} B_3\, CPRD_{t-3} + \sum_{i=4}^{i=n} B_4\, FSPRD_{t-4} + \sum_{i=5}^{i=n} B_5\, RGDP_{t-5} + \mu$$

$$FSPRD_t = B_o + \sum_{i=1}^{i=n} B_1\, FSPRD_{t-1} + \sum_{i=2}^{i=n} B_2\, LPRD_{t-2} + \sum_{i=3}^{i=n} B_3\, FPRD_{t-3} + \sum_{i=4}^{i=n} B_4\, CPRD_{t-4} + \sum_{i=5}^{i=n} B_5\, RGDP_{t-5} + \mu$$

Decision Rule: If computed *f*-value is greater than 5% critical value, then there exist a causal relationship between both variable (values are checked in absolute term).

Data Required and Sources: The data required for this study are secondary time series data on crop production (CPRD), Livestock production (LPRD), forestry production (FPRD), fish production (FSPRD) and Real Gross Domestic Product (RGDP) ranging from 1981-2020. The data are extracted from the 2021 editions of the Central Bank of Nigeria (CBN) statistical bulletin.

Statistical Software Used: This research work employed the 9th version of E-views (econometric views) in carrying out its analysis.

8. Presentation and Analyses of Results

8.1. Unit Root Result

The unit root test was conducted on the variables under consideration. An augmented Dickey Fuller (ADF) test unit root test was employed for this purpose. The results of the tests are presented in Table 2.

Table 2: Unit Root Test Analyses Result

Variables	ADF Test Statistics	5% Critical Value	Order of Integration
LRGDP	-3.347908	-2.941145	I(1)
LCPRD	-4.043416	-2.941145	I(1)
LLPRD	-3.134514	-2.941145	I(1)
LFPRD	-5.268400	-2.948404	I(1)
LFSPRD	-4.959105	-2.941145	I(1)

Source: Author's Computation Using EViews, 9

From the unit root result real gross domestic product (RGDP), crop production (CPRD), livestock production (LPRD), forestry production (FPRD) and fish production (FSPRD) are all stationary at first difference. Hence, judging from the decision rule since the ADF statistics is greater than the 5% level of significance in absolute. Since the entire variables are not stationary at level form, there is a need to conduct a co-integration test to test for the long run relationship of the variables.

8.2. Co-integration Test

The ADF statistics is greater than the 5% level of significance in absolute term that is 5.738076 is greater than -1.950117. This reveal the rejection of the null hypotheses at 5% level of significance based on our decision rule. This implies that there is a co-integrating equations or vectors among the variables of interest (Table 3). Therefore, there is a long run relationship between the variables. That is, the linear combination of these variables cancels out the stochastic trend in the series. This will prevent the generation of spurious (i.e., non-meaningful) regression results.

Table 3: Co-integration Test Result

Null Hypothesis: *ECM has a unit root*
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
	Augmented Dickey-Fuller test statistic	-5.738076	0.0000
Test critical values:	1% level	-2.628961	
	5% level	-1.950117	
	10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ECM)
Method: Least Squares
Date: 02/06/23 Time: 13:03
Sample (adjusted): 1984 2020
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
ECM(-1)	-0.988840	0.172330	-5.738076	0.0000

R-squared	0.476190	Mean dependent var	-0.015703
Adjusted *R*-squared	0.476190	S.D. dependent var	0.296407
S.E. of regression	0.214524	Akaike info criterion	-0.214136
Sum squared resid	1.656738	Schwarz criterion	-0.170598
Log likelihood	4.961514	Hannan-Quinn criter.	-0.198787
Durbin-Watson stat	1.749817		

Source: Author's Computation Using EViews, 9

8.3. Evaluation of Regression/ECM Test Results

In the regression result, the variables are real gross domestic product (RDGP) as the dependent variable, while crop productions (CPRD), livestock production (LPRD), forestry production (FPRD) and fish production (FSPRD) are the independent variables. The constant term (β_0) is estimated at 0.130372 this means that the model passes through the point 0.130372, if the independent variables are zero; real gross domestic product would be 0.130372. The estimated coefficient for crop production (CPRD) is 0.115681 this means that holding other variables constant, a unit increase in crop production will lead to a 0.115681 increase in real gross domestic product. The estimated coefficient for livestock production (LPRD) is 0.127298 this means that holding other variables constant, a unit increase in livestock production will lead to a 0.127298 increase in real gross domestic product. The estimated coefficient for forestry production (FPRD) is 0.045935 this means that holding other variables constant, a unit increase in forestry production will lead to a 0.045935 increase in real gross domestic product. The estimated coefficient for fish production (FSPRD) is 0.043205 this means that holding other variables constant, a unit increase in fish production will lead to a 0.043205 increase in real gross domestic product. The ECM value is negative and shows that the speed of adjustment to equilibrium after a shock is -0.019296, which shows a low speed of adjustment to equilibrium (Table 4).

8.4. R^2 –Result and Interpretation

The coefficient of determination R^2 from the regression result, the R^2 is given as 0.703129 this implies that 70.31% of the variation in real gross domestic product is caused by the variations in crop production, livestock production, forestry production, and fish production. This implies that 29.69% of the variations in real gross domestic product is been explained by variations in other macroeconomic variables besides the independent variables under consideration in this study.

Table 4: The Regression Analysis /ECM Test Result

Dependent Variable: D(LRGDP)
Method: Least Squares
Date: 02/06/23 Time: 13:09
Sample (adjusted): 1984 2020
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	0.130372	0.087317	1.493095	0.1455
D(LCPRD)	0.115681	0.028612	4.043162	0.0003
D(LLPRD)	0.127298	0.038359	3.318595	0.0023
D(LFPRD)	0.045935	0.027036	1.699061	0.0993
D(LFSPRD)	0.043205	0.024540	1.760574	0.0882
ECM(-1)	-0.019296	0.029244	-0.659828	0.5142

R-squared	0.703129	Mean dependent var	0.044097
Adjusted R-squared	0.606860	S.D. dependent var	0.036952
S.E. of regression	0.030764	Akaike info criterion	3.977538
Sum squared resid	0.029339	Schwarz criterion	3.716308
Log likelihood	-79.58445	Hannan-Quinn criter.	3.885442
F-statistic	4.187506	Durbin-Watson stat	1.929714
Prob(F-statistic)	0.005053		

Source: Author's Computation Using EViews, 9

8.5. t-Test Result and Interpretation

The degree of freedom is n-k = 40-5 = 35

From the distribution table, $t_{0.025,35} = 2.042$

The result of the *t*-test is presented in Table 5 and they are evaluated based on the critical value (2.042) and the value of calculated *t*-statistics for each variable.

Table 5: *t*-Test of Significance Analyses Result

Variables	*t*-computed (t*)	*t*-tabulated (ta/2)	Conclusion
CPRD	4.043162	2.042	Significant
LPRD	3.318595	2.042	Significant
FPRD	1.699061	2.042	Insignificant
FSPRD	1.760574	2.042	Insignificant

Note: Significant (Reject H_0; accept H_1), Insignificant (Accept H_0).

From the *t*- test result above, for CPRD, *t** is greater than $t_{a/2}$, therefore the null hypothesis is rejected. Hence, crop production has significant impact on economic growth.

For LPRD, *t** is greater than $t_{a/2}$ therefore the null hypothesis is rejected. Hence, livestock production has significant impact on economic growth.

For FPRD, *t** is less than $t_{a/2}$ therefore we accept the null hypothesis. Hence, forestry production has no significant impact on economic growth.

For FSPRD, t^* is less than $t_{a/2}$ therefore we accept the null hypothesis. Hence, fish production has no significant impact on economic growth.

9. Result and Interpretation of *f*-Test of Significance

The degree of freedom is given as V_1=5-1=4, V_2=40-5=35, df=(4,35). At 5% level of significance and df (4, 35), $f_{0.05}$= 2.92 and F^*=4.187506. Since f^* is greater than $f_{0.05}$, the alternative hypothesis is accepted and it is concluded that the variables crop production, livestock product, forestry production and fish production have joint impact on real gross domestic product. This implies that the entire regression plain is significant.

10. Result and Interpretation of Normality Test

The test was carried-out, to find-out if the residuals are normally distributed. From the normality test result, juldging from the decision rule, since the probability value is greater than 0.05, it means that the residuals are normally distributed (Figure 1).

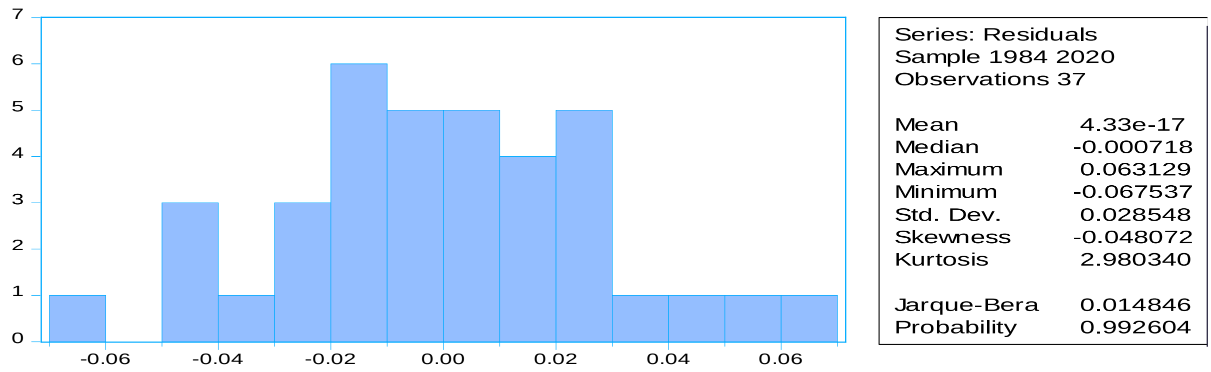

Figure 1: Normality Test Result

Source: Author's Computation Using EViews, 9

11. Result and Interpretation of Granger Causality Test

From the Granger causality test result, juldging from the decision rule. It can be observed that there is no causality relationship between crop production and economic growth in Nigeria. There is no causality relationship between livestock production and economic growth in Nigeria. There is a uni-directional causality relationship flowing from forestry production to real gross domestic product, between forestry production and economic growth in Nigeria. There is no causality relationship between fish production and economic growth in Nigeria (Table 6).

Table 6: Granger Causality Test Result

Pairwise Granger Causality Tests
Date: 02/06/23 Time: 13:12
Sample: 1981 2020
Lags: 2

Null Hypothesis	Obs.	*F*-Statistic	Prob.
LCPRD does not Granger Cause LRGDP	38	2.63287	0.0869
LRGDP does not Granger Cause LCPRD		1.26195	0.2964
LLPRD does not Granger Cause LRGDP	38	2.46140	0.1008
LRGDP does not Granger Cause LLPRD		0.01039	0.9897
LFPRD does not Granger Cause LRGDP	38	4.14069	0.0249
LRGDP does not Granger Cause LFPRD		0.34285	0.7122
LFSPRD does not Granger Cause LRGDP	38	1.85046	0.1731
LRGDP does not Granger Cause LFSPRD		0.46735	0.6307

Source: Author's Computation Using EViews, 9

12. Summary of Findings and Recommendations

12.1. Summary of Findings

This study examined the impact of agricultural sector on economic growth in Nigeria (1981-2020). The focus variables are real gross domestic product (RDGP) as the dependent variable, while crop productions (CPRD), livestock production (LPRD), forestry production (FPRD) and fish production (FSPRD) are the independent variables. The ordinary least squares regression technique and error correction model were used in this model. The findings of the study include:

The results indicate that that crop production and livestock production have significant impacts on economic growth in Nigeria and thus significant variables in determining economic growth in Nigeria respectively. Forestry production and fish production have no significant impacts on economic growth in Nigeria and thus insignificant variables in determining economic growth in Nigeria respectively.

The results show that all the independent variables have positive relationship with economic growth in Nigeria respectively, which implies that as crop production, livestock production, forestry production, and fish production increases, real gross domestic product increases.

The Granger causality test result shows that there is no causality relationship between crop production and economic growth in Nigeria. There is no causality relationship between livestock production and economic growth in Nigeria. There is a uni-directional causality relationship flowing from forestry production to real gross domestic product, between forestry production and economic growth in Nigeria. There is no causality relationship between fish production and economic growth in Nigeria.

12.2. Recommendations

Sequel to the findings of this research, the following recommendations are suggested

There is the need for the Nigerian government and its citizenry to concentrate their combined efforts towards increasing the productivity capacity of the crops with the aim of promoting food security and economic growth.

Government should provide funds to acquire sophisticated farm tools and increase her budgetary allocation to this sector in a consistent manner because of its importance to the national economy, hoping that with proper monitoring of fund, it would contribute more significantly to the economy of the country.

Government should invest in research with the aim of improving livestock and fish breeds in Nigeria.

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Appendix I

Time Series Data On Real Gross Domestic Product, Crop Production, Livestock Production, Forestry Production And Fish Production From 1981-2020 In Nigeria

Year	RGDP	CPRD	LPRD	FPRD	FSPRD
1981	15,258.00	12.82	2.53	1.16	0.55
1982	14,985.08	14.32	3.96	1.17	0.67
1983	13,849.73	16.35	5.19	1.27	0.99
1984	13,779.26	21.50	6.62	1.38	0.87
1985	14,953.91	25.07	7.16	1.47	0.54
1986	15,237.99	25.97	7.39	1.57	0.77
1987	15,263.93	39.66	8.37	1.59	0.66
1988	16,215.37	61.85	8.89	1.86	1.17
1989	17,294.68	71.88	11.79	2.17	2.41
1990	19,305.63	86.93	14.15	2.35	3.21
1991	19,199.06	101.65	15.58	2.44	3.58
1992	19,620.19	153.38	23.03	2.99	4.72
1993	19,927.99	249.20	36.58	3.97	5.59
1994	19,979.12	377.31	54.30	5.98	7.68
1995	20,353.20	670.18	97.20	8.25	14.51
1996	21,177.92	906.89	130.41	10.37	22.84
1997	21,789.10	1,026.29	145.03	12.55	27.59
1998	22,332.87	1,133.39	158.31	15.88	33.46
1999	22,449.41	1,204.70	164.37	19.31	38.59
2000	23,688.28	1,270.63	172.19	24.49	41.10
2001	25,267.54	1,699.69	228.56	29.98	57.20
2002	28,957.71	3,875.46	271.03	36.23	68.81

Appendix I (Cont.)

Year	RGDP	CPRD	LPRD	FPRD	FSPRD
2003	31,709.45	4,161.57	299.22	44.13	81.01
2004	35,020.55	4,419.06	360.80	56.39	99.00
2005	37,474.95	5,372.20	463.42	67.45	129.26
2006	39,995.50	6,723.22	560.25	80.20	149.64
2007	42,922.41	7,654.22	642.28	91.50	163.99
2008	46,012.52	9,039.63	758.84	108.10	193.75
2009	49,856.10	10,419.60	863.40	121.25	221.18
2010	54,612.26	11,683.90	979.56	135.72	249.71
2011	57,511.04	12,484.85	1,115.60	153.05	284.33
2012	59,929.89	14,071.24	1,251.93	170.16	322.67
2013	63,218.72	14,862.32	1,399.48	187.95	366.79
2014	67,152.79	15,812.57	1,573.05	207.74	425.25
2015	69,023.93	17,189.97	1,748.03	222.83	476.14
2016	67,931.24	18,883.08	1,875.78	236.25	528.39
2017	68,490.98	21,096.11	1,974.45	257.21	624.79
2018	69,799.94	24,207.80	2,048.60	272.79	842.11
2019	71,387.83	28,296.93	2,108.95	285.88	1,212.39
2020	70,800.54	26,252.36	2,078.77	279.33	1,027.25
Source: Cbn Statistical Bulletin 2021 Version					

Appendix II

Real Gross Domestic Product (RGDP) Stationarity Test Result

Null Hypothesis: LRGDP has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.404451	0.8983
1% level		-3.615588	
5% level		-2.941145	
10% level		-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP)
Method: Least Squares
Date: 02/06/23 Time: 12:58
Sample (adjusted): 1983 2020
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
LRGDP(-1)	-0.004317	0.010675	-0.404451	0.6883
D(LRGDP(-1))	0.547394	0.145184	3.770348	0.0006
C	0.063147	0.108955	0.579564	0.5659

R-squared	0.292543	Mean dependent var	0.040863
Adjusted *R*-squared	0.252117	S.D. dependent var	0.041544
S.E. of regression	0.035928	Akaike info criterion	-3.738968
Sum squared resid	0.045178	Schwarz criterion	-3.609685
Log likelihood	74.04039	Hannan-Quinn criter.	-3.692970
F-statistic	7.236493	Durbin-Watson stat	1.970902
Prob(*F*-statistic)	0.002343		

Source: Author's Computation Using EViews, 9

Appendix II (Cont.)

Real Gross Domestic Product (RGDP) Stationarity Test Result at First Difference

Null Hypothesis: *D(LRGDP) has a unit root*
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.347908	0.0195
Test critical values:	1% level		-3.615588
	5% level		-2.941145
	10% level		-2.609066

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP,2)
Method: Least Squares
Date: 02/06/23 Time: 12:58
Sample (adjusted): 1983 2020
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
D(LRGDP(-1))	-0.466581	0.139365	-3.347908	0.0019
C	0.019204	0.008075	2.378180	0.0228

R-squared	0.237425	Mean dependent var	0.000258
Adjusted *R*-squared	0.216243	S.D. dependent var	0.040108
S.E. of regression	0.035508	Akaike info criterion	-3.786936
Sum squared resid	0.045389	Schwarz criterion	-3.700748
Log likelihood	73.95179	Hannan-Quinn criter.	-3.756271
F-statistic	11.20849	Durbin-Watson stat	1.942111
Prob(*F*-statistic)	0.001918		

Source: Author's Computation Using EViews, 9

Appendix III

Crop Production (CPRD) Stationarity Test Result

Null Hypothesis: *LCPRD has a unit root*
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.235576	0.1975
Test critical values:	1% level		-3.610453
	5% level		-2.938987
	10% level		-2.607932

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPRD)
Method: Least Squares
Date: 02/06/23 Time: 12:59
Sample (adjusted): 1982 2020
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
LCPRD(-1)	-0.023728	0.010614	-2.235576	0.0315
C	0.360615	0.078547	4.591078	0.0000

R-squared	0.119001	Mean dependent var	0.195500
Adjusted *R*-squared	0.095191	S.D. dependent var	0.175508
S.E. of regression	0.166946	Akaike info criterion	-0.692371
Sum squared resid	1.031228	Schwarz criterion	-0.607060
Log likelihood	15.50123	Hannan-Quinn criter.	-0.661762
F-statistic	4.997799	Durbin-Watson stat	1.422986
Prob(F-statistic)	0.031498		

Source: Author's Computation Using EViews, 9

Appendix III (Cont.)

Crop Production (CPRD) Stationarity Test Result at First Difference

Null Hypothesis: *D(LCPRD) has a unit root*
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.043416	0.0032
Test critical values:	1% level		-3.615588
	5% level		-2.941145
	10% level		-2.609066

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPRD,2)
Method: Least Squares
Date: 02/06/23 Time: 12:59
Sample (adjusted): 1983 2020
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
D(LCPRD(-1))	-0.654131	0.161777	-4.043416	0.0003
C	0.127653	0.042766	2.984944	0.0051

R-squared	0.312311	Mean dependent var	-0.004885
Adjusted R-squared	0.293208	S.D. dependent var	0.201401
S.E. of regression	0.169320	Akaike info criterion	-0.662859
Sum squared resid	1.032091	Schwarz criterion	-0.576670
Log likelihood	14.59432	Hannan-Quinn criter.	-0.632193
F-statistic	16.34921	Durbin-Watson stat	1.845135
Prob(F-statistic)	0.000266		

Source: Author's Computation Using EViews, 9

Appendix IV

Livestock Production (LPRD) Stationarity Test Result

Null Hypothesis: *LLPRD has a unit root*
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.664673	0.0903
Test critical values:	1% level		-3.632900
	5% level		-2.948404
	10% level		-2.612874

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LLPRD)
Method: Least Squares
Date: 02/06/23 Time: 13:00
Sample (adjusted): 1986 2020
Included observations: 35 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
LLPRD(-1)	-0.022676	0.008510	-2.664673	0.0125
D(LLPRD(-1))	0.609041	0.149938	4.061959	0.0003
D(LLPRD(-2))	-0.140875	0.176578	-0.797809	0.4315
D(LLPRD(-3))	0.364810	0.175688	2.076469	0.0468
D(LLPRD(-4))	-0.477350	0.143603	-3.324089	0.0024
C	0.231081	0.063053	3.664872	0.0010

R-squared	0.615305	Mean dependent var	0.162029
Adjusted *R*-squared	0.548978	S.D. dependent var	0.133236
S.E. of regression	0.089479	Akaike info criterion	-1.834818
Sum squared resid	0.232189	Schwarz criterion	-1.568186
Log likelihood	38.10931	Hannan-Quinn criter.	-1.742776
F-statistic	9.276877	Durbin-Watson stat	1.939842
Prob(*F*-statistic)	0.000023		

Source: Author's Computation Using EViews, 9

Appendix IV (Cont.)

Livestock Production (LPRD) Stationarity Test Result at First Difference

Null Hypothesis: *D(LLPRD) has a unit root*
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.134514	0.0323
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LLPRD,2)
Method: Least Squares
Date: 02/06/23 Time: 13:01
Sample (adjusted): 1983 2020
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
*D(LLPR*D(-1))	-0.394427	0.125834	-3.134514	0.0034
C	0.057641	0.027851	2.069657	0.0457

R-squared	0.214406	Mean dependent var	-0.012169
Adjusted *R*-squared	0.192584	S.D. dependent var	0.114720
S.E. of regression	0.103083	Akaike info criterion	-1.655371
Sum squared resid	0.382539	Schwarz criterion	-1.569183
Log likelihood	33.45205	Hannan-Quinn criter.	-1.624706
F-statistic	9.825177	Durbin-Watson stat	1.857884
Prob(*F*-statistic)	0.003418		

Source: Author's Computation Using EViews, 9

Appendix V

Foresry Production (Fprd) Stationarity Test Result

Null Hypothesis: *LFPRD has a unit root*
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.502263	0.1236
Test critical values:	1% level		-3.632900
	5% level		-2.948404
	10% level		-2.612874

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFPRD)
Method: Least Squares
Date: 02/06/23 Time: 13:01
Sample (adjusted): 1986 2020
Included observations: 35 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
LFPRD(-1)	-0.013082	0.005228	-2.502263	0.0182
D(LFPRD(-1))	0.796509	0.167056	4.767921	0.0000
D(LFPRD(-2))	-0.062266	0.217748	-0.285956	0.7769
D(LFPRD(-3))	-0.321463	0.216311	-1.486116	0.1480
D(LFPRD(-4))	0.432203	0.162004	2.667853	0.0124
C	0.065088	0.027862	2.336091	0.0266

R-squared	0.710072	Mean dependent var	0.149918
Adjusted *R*-squared	0.660084	S.D. dependent var	0.091083
S.E. of regression	0.053104	Akaike info criterion	-2.878337
Sum squared resid	0.081780	Schwarz criterion	-2.611706
Log likelihood	56.37090	Hannan-Quinn criter.	-2.786296
F-statistic	14.20496	Durbin-Watson stat	2.017438
Prob(*F*-statistic)	0.000000		

Source: Author's Computation Using EViews, 9

Appendix V (Cont.)

Foresry Production (FPRD) Stationarity Test Result

Null Hypothesis: *D(LFPRD) has a unit root*
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.268400	0.0001
Test critical values:	1% level		-3.632900
	5% level		-2.948404
	10% level		-2.612874

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFPRD,2)
Method: Least Squares
Date: 02/06/23 Time: 13:01
Sample (adjusted): 1986 2020
Included observations: 35 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
D(LFPRD(-1),2)	-1.590316	0.301859	-5.268400	0.0000
D(LFPRD(-1),3)	0.535288	0.233759	2.289914	0.0290
D(LFPRD(-2),3)	0.406361	0.164738	2.466708	0.0194
C	-0.001722	0.009753	-0.176620	0.8610

R-squared	0.578302	Mean dependent var	-0.001433
Adjusted *R*-squared	0.537492	S.D. dependent var	0.084770
S.E. of regression	0.057650	Akaike info criterion	-2.761631
Sum squared resid	0.103030	Schwarz criterion	-2.583877
Log likelihood	52.32854	Hannan-Quinn criter.	-2.700270
F-statistic	14.17077	Durbin-Watson stat	1.879943
Prob(*F*-statistic)	0.000005		

Source: Author's Computation Using EViews, 9

Appendix VI

Fish Production (FSPRD) Unit Root Test Result

Null Hypothesis: *LFSPRD has a unit root*
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.709988	0.8319
Test critical values:	1% level		-3.621023
	5% level		-2.943427
	10% level		-2.610263

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFSPRD)
Method: Least Squares
Date: 02/06/23 Time: 13:02
Sample (adjusted): 1984 2020
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
LFSPRD(-1)	-0.011141	0.015692	-0.709988	0.4827
D(*LFSPRD*(-1))	0.164752	0.178425	0.923371	0.3625
D(*LFSPRD*(-2))	-0.083446	0.179974	-0.463656	0.6459
C	0.210541	0.081374	2.587315	0.0143

R-squared	0.041675	Mean dependent var	0.187694
Adjusted *R*-squared	-0.045445	S.D. dependent var	0.216771
S.E. of regression	0.221642	Akaike info criterion	-0.073699
Sum squared resid	1.621134	Schwarz criterion	0.100455
Log likelihood	5.363425	Hannan-Quinn criter.	-0.012301
F-statistic	0.478360	Durbin-Watson stat	1.762667
Prob(*F*-statistic)	0.699522		

Source: Author's Computation Using EViews, 9

Appendix VI (Cont.)

Fish Production (FSPRD) Unit Root Test Result at First Difference

Null Hypothesis: *D(LFSPRD) has a unit root*
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.959105	0.0002
Test critical values:	1% level		-3.615588
	5% level		-2.941145
	10% level		-2.609066

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFSPRD,2)
Method: Least Squares
Date: 02/06/23 Time: 13:02
Sample (adjusted): 1983 2020
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
D(LFSPRD(-1))	-0.851134	0.171631	-4.959105	0.0000
C	0.162872	0.049486	3.291282	0.0022

R-squared	0.405869	Mean dependent var	-0.009554
Adjusted *R*-squared	0.389366	S.D. dependent var	0.277778
S.E. of regression	0.217064	Akaike info criterion	-0.166053
Sum squared resid	1.696205	Schwarz criterion	-0.079864
Log likelihood	5.154998	Hannan-Quinn criter.	-0.135387
F-statistic	24.59272	Durbin-Watson stat	1.870050
Prob(*F*-statistic)	0.000017		

Source: Author's Computation Using EViews, 9

Appendix VII

Co-integration Test Result

Null Hypothesis: *ECM has a unit root*
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
	Augmented Dickey-Fuller test statistic	-5.738076	0.0000
Test critical values:	1% level	-2.628961	
	5% level	-1.950117	
	10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ECM)
Method: Least Squares
Date: 02/06/23 Time: 13:03
Sample (adjusted): 1984 2020
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
ECM(-1)	-0.988840	0.172330	-5.738076	0.0000

R-squared	0.476190	Mean dependent var	-0.015703
Adjusted *R*-squared	0.476190	S.D. dependent var	0.296407
S.E. of regression	0.214524	Akaike info criterion	-0.214136
Sum squared resid	1.656738	Schwarz criterion	-0.170598
Log likelihood	4.961514	Hannan-Quinn criter.	-0.198787
Durbin-Watson stat	1.749817		

Source: Author's Computation Using EViews, 9

Appendix VIII

Regression/Ecm Test Result

Dependent Variable: *D(LRGDP)*
Method: Least Squares
Date: 02/06/23 Time: 13:09
Sample (adjusted): 1984 2020
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	0.130372	0.087317	1.493095	0.1455
D(LCPRD)	0.115681	0.028612	4.043162	0.0003
D(LLPRD)	0.127298	0.038359	3.318595	0.0023
D(LFPRD)	0.045935	0.027036	1.699061	0.0993
D(LFSPRD)	0.043205	0.024540	1.760574	0.0882
ECM(-1)	-0.019296	0.029244	-0.659828	0.5142

R-squared	0.703129	Mean dependent var	0.044097
Adjusted *R*-squared	0.606860	S.D. dependent var	0.036952
S.E. of regression	0.030764	Akaike info criterion	3.977538
Sum squared resid	0.029339	Schwarz criterion	3.716308
Log likelihood	-79.58445	Hannan-Quinn criter.	3.885442
F-statistic	4.187506	Durbin-Watson stat	1.929714
Prob(*F*-statistic)	0.005053		

Source: Author's Computation Using EViews, 9

Appendix IX

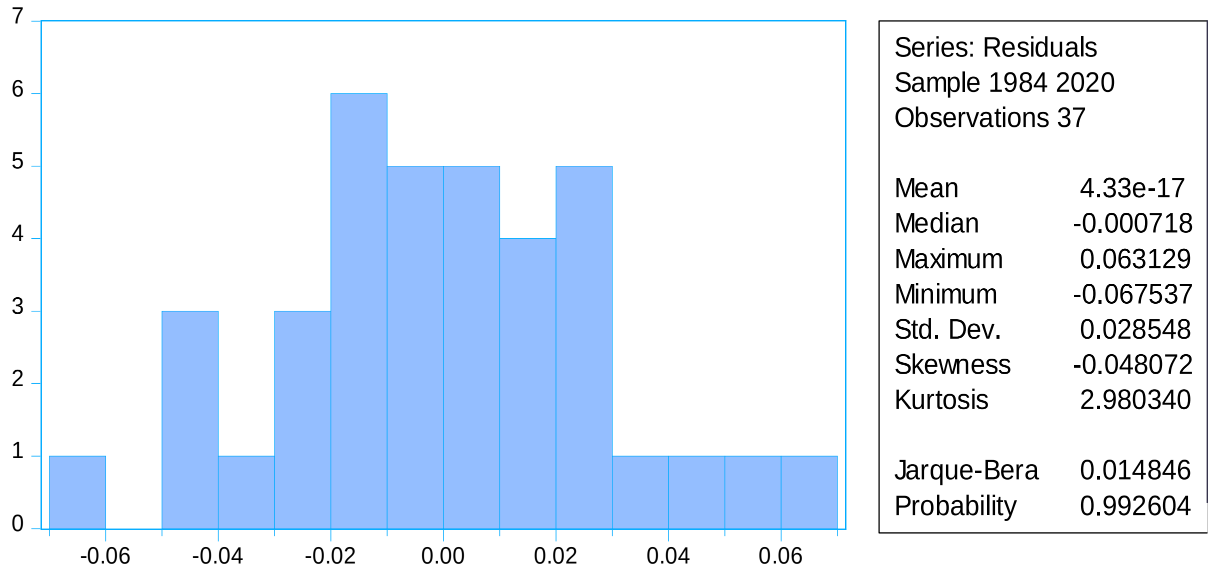

Figure A1: Normality Test Result

Source: Author's Computation Using EViews, 9

Appendix X

Granger Causality Test Result

Pairwise Granger Causality Tests
Date: 02/06/23 Time: 13:12
Sample: 1981 2020
Lags: 2

Null Hypothesis	Obs.	*F*-Statistic	Prob.
LCPRD does not Granger Cause LRGDP	38	2.63287	0.0869
LRGDP does not Granger Cause LCPRD		1.26195	0.2964
LLPRD does not Granger Cause LRGDP	38	2.46140	0.1008
LRGDP does not Granger Cause LLPRD		0.01039	0.9897
LFPRD does not Granger Cause LRGDP	38	4.14069	0.0249
LRGDP does not Granger Cause LFPRD		0.34285	0.7122
LFSPRD does not Granger Cause LRGDP	38	1.85046	0.1731
LRGDP does not Granger Cause LFSPRD		0.46735	0.6307
LLPRD does not Granger Cause LCPRD	38	1.50397	0.2371
LCPRD does not Granger Cause LLPRD		3.72471	0.0348
LFPRD does not Granger Cause LCPRD	38	2.08894	0.1399
LCPRD does not Granger Cause LFPRD		4.02294	0.0273
LFSPRD does not Granger Cause LCPRD	38	0.30788	0.7371
LCPRD does not Granger Cause LFSPRD		7.59564	0.0019
LFPRD does not Granger Cause LLPRD	38	5.99529	0.0060
LLPRD does not Granger Cause LFPRD		1.33180	0.2778
LFSPRD does not Granger Cause LLPRD	38	0.34932	0.7077
LLPRD does not Granger Cause LFSPRD		2.83616	0.0730
LFSPRD does not Granger Cause LFPRD	38	5.18746	0.0110
LFPRD does not Granger Cause LFSPRD		2.81671	0.0742

Source: Author's Computation Using EViews, 9

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