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Does Agriculture have an Impact on Economic Growth? Empirical Evidence from the Gambia

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Abstract

The present study aims to answer the question, 'Does agriculture have an impact on economic growth in the Gambia? The secondary source of data covering the time series period 1980 to 2017 is employed. It opines that agriculture is one of the variable techniques of economic growth in developing countries like the Gambia. The methods of analysis used were Error correction model and Auto regressive distributed lag model (ARDL) to estimate the economic growth. The study found a significant positive effect of agriculture on economic growth in both the short- run and long-run, reaffirming the sector's importance in the economy. The impact of agriculture to economic growth is further affirmed from a causality test which showed that agriculture growth Granger-causes GDP growth and GDP growth also Granger causes agriculture growth. The study concludes that agriculture have a positive impact on economic growth. I recommend that, the government and policy makers should embark on diversification and enhance more allocation in terms of budgeting and policy changes in the agricultural sector.

Key Words: Economic Growth, Gross Domestic Product and Agriculture.

1. Introduction

The Republic of the Gambia is one of the smallest countries in Sub Saharan Africa, surrounded by Senegal on three (3) sides and bounded on the Atlantic Ocean. The Population has grown to about 36% to 2 million people since 2003. It has a total land size of 11, 300 square kilometers. The Gambia is ranked 175th out of 188 nations in the Human Development index ranking. The Gambia is classified as a low income, food deficiency country, almost one out of every three Gambian is vulnerable to food insecurity and about one tenth of the population is food insecure. Economic indicators pointed out that since 2013 poverty level in the Gambia has increase and 48.6% of the population live on less than $1.25 per day. As of year ended 2017, the Gambia has an urban population of 73.5% and a female population of 49.7%, with a GDP of US$ 915 Million and a Total debt burden of 120%.

The main Economic activity of the Gambia is Agriculture but declined throughout the 1990's due to several factors including poor rainfall, lack of marketing infrastructure, lack of access to credits for women and youths and limited resource base. Agriculture has contracted to about 8.4% between 2013 and 2014, but the sector has been growing steadily, contributing about 33% of GDP in 2017. Gambian agriculture has been mainly characterized by subsistence production of food crops, comprising cereals (rice, millets, maze, sorghum etc.), semi intensive cash crop production (groundnut, cotton, sesame and horticulture) and the key fruits produced include mangoes and cashews. These are the main crops, while Rice is the staple. Mixed farming is generally practice by farmers, despite crops accounts for a greater portion of production. The Gambia have a food sufficiency ratio of 50%, with little diversification, mainly subsistence rain- feed agriculture. 40% of foreign exchange earnings and 75% of household income are provided by the crop sub-sector. Domestic cereal production caters for only 60% of needs and the population relies heavily on imported food. The retail price of rice has almost doubled for the past decades. In 2017 the Gambia's GDP grow to an estimated 5.1% mainly driven primarily by Agriculture and the service sectors.

The Gambia is one of the largest consumers of rice in the region. Since local production accounts for a small fraction of the amount consumed, most of the rice consumed is, therefore, imported. Given the high growth rate of the population (about 3% per annum), the demand for imported rice will remain strong, unless domestic production is encouraged. Increasing International food prices and low domestic production are leading to higher inflationary pressure on the national food market, decreasing the purchasing power of the consumers (Rural and Urban).

Livestock production is predominantly traditional i.e. a low intensive system of husbandry is used. Currently livestock population is estimated at around 300, 000 cattle's, 140- 150, 000 sheep's and 200, 000- 230, 000 goats. The poultry population is consists of 500, 000 broilers, 18, 500 commercial layers and 550, 000 local chickens (FAO Country data).

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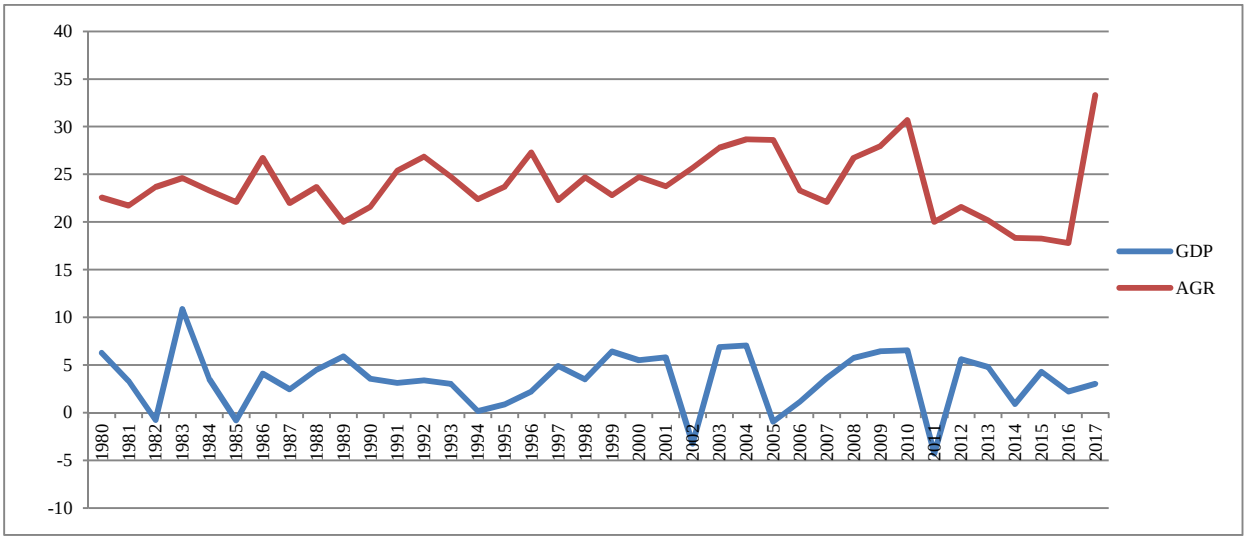
Figure 1: The Growth of GDP and Agriculture from 1980 to 2017 (% growth rates)



1.1. Research Questions:

The research seeks to answer the following primary questions.

1. To measure the impact of agricultural productivity on economic growth.
2. To what extend will agriculture affect the growth of the Gambia's Economy?
3. Is there a long run relationship between agriculture and economic growth?
4. What action(s) can be recommended to hasten achievement of agricultural Productivity?

1.2. Objectives of the Study:

The Main objectives of the study are as given below:

1. To check the level of significance of agricultural productivity.
2. To measure impact of agriculture productivity on the Gambia's economy.
3. To measure the long and short- run behaviour of agricultural production, and its impact on the growth of the Gambia's economy.
4. Recommend the major indicators and actions that must be taken to speed up agricultural productivity for the economic growth and prosperity in the Gambia.

1.3. Significance and Scope of Study:

Assessing and determining the significance of agriculture on the sustainable development of the Gambia, this will aid in informing policymakers on effective policies, given agricultural productivity, which can be implemented to pursue a development pathway which is both progressive and sustainable. Agricultural productivity needs to be constantly reviewed against sustainable development for the country to enjoy prosperity that is evenly distributed. Despite agriculture been a major economic activity for the Gambia, it has not been receiving significant attention in the form of heavy investments, to help in achieving food security in the Gambia.

This research is confined to the Gambia and the period ranging from 1980 to 2017 evaluating the annual data on Growth and agricultural productivity.

1.4. Statement of Hypothesis and Decision Rule:

Hypothesis testing is a very important aspect of scientific research. For that reason, the following hypothesis will be tested in line with the indicated objectives of the study:

H0: Agricultural sector investment and agricultural output do not have significant impacts on economic growth in the Gambia.

[1] World Food Program (WFP) & Food and Agricultural Organization (FAO) country data.

H1: Agricultural sector investment and agricultural output have significant impacts on economic growth in the Gambia.

The hypothesis above will be tested on a 5% significance level. If the probability of the t- value is less than the significance level the null hypothesis will be rejected. The null hypothesis will be accepted if otherwise.

2. Literature Review

Before the growth of modern development thinking, development in economic has been often strongly linked with industrialization. This brings in the perception of agriculture, not as a main stimulant of development, but an industrial sector subsidiary, which in the words of Todaro & Smith (2009) was thought to be the dynamic and "leading sector" in any overall strategy of economic development. It was believed that ensuring food surplus and surplus transfer of labour without decline in productivity to the industrial sector is merely the role of agriculture. The Harrod-Domar model (Thorbecke, 1970) and the Lewis's famous two sector model types (Todaro & Smith, 2009) are classical examples of development models that foregrounded industrialization in the process of economic development while pointing out that agriculture is playing only a positive role: providing surplus labour and cheap food.

Evolution of new thinking of development has brought back agriculture to the forefront of development strategies. Due to past experiences and with more theoretical conjectures, "development economists became less concern about the desirability of putting too much pressure on rapid industrialization. They came to realize that far from playing a supporting role in the process of economic development, particularly the agricultural sector and generally the rural economy must play an indispensable part in any overall strategy of economic progress" (Todaro & Smith, 2009).

As long as agriculture may matter in their conception (the supporters of the new paradigm), they still conceived that certain conditions must be simultaneously achieved for any development effort based on and foisted on the new paradigm that will yield the desired result. As Mellor (1998) put it rightly, " an agriculture and employment based strategy of economic development requires at a minimum three basic complementary elements: first, accelerated output growth through technological, institutional, and price incentive changes designed to raise the productivity of small farmers; second, rising domestic demand for agricultural output derived from an employment oriented urban development strategy; and third, diversified, nonagricultural, labour- intensive rural development activities that directly and indirectly support and are supported by the farming community.

Awan el al (2015) did an analysis to measure the involvement of agricultural exports in the development of the economy of Pakistan, estimated the correlation between, Gross Domestic Product, agricultural and nonagricultural exports for Pakistan, the economic variables used are gross domestic product, consumer price index, total labor force, fixed capital formation, agricultural exports and non- agricultural exports. A time series data taken from the period of 19972 to 2008. Data's from the economic survey of Pakistan were taken, international monetary fund, Pakistan bureau of statistics, and state bank of Pakistan. The significance of the relationship of the economic variables were measured using, Ordinary least square, Johansen cointegration, vector error correction and granger causality. Results show that while the agricultural exports have no effect on economic growth, the non-agricultural export has a significant and positive effect on economic growth. Further, there exist bidirectional causality between gross domestic product and nonagricultural exports. It was suggested that structural change in agricultural exports into value added products needs to be taken by the government of Pakistan.

Awokuse et al (2009) try to investigate the dynamic interaction between economic growth and agricultural productivity in general terms, using time series analysis of transition economies in Africa, Asia, and fifteen developing countries. The variables used are real export, agricultural value added per worker, real GDP per capital, population as proxy for labor and gross capital formation per worker as proxy for capital. Data were taken from the World Bank development indicators and international monetary fund for the period 1971 to 2006. The empirical relationship among variables was determined using Auto regressive distributed lag models and co integration. Results show that the most important factor and engine for economic development is agriculture. Empirical evidence supports the investment in to the agricultural sector by both the private and public sectors.

Gardner, 2005 and Chebbi, 2010, have put up a lot of questions regarding the impact of agricultural productivity on economic growth. Lavorel et al. (2013) addressed the question put forward by Gardner (2005) for 85 countries "is agriculture an engine of growth" by investigating causality relationship between gross domestic product (GDP) and agricultural value added per worker. According to them, causality relationship exists between agriculture value added and growth for the developing countries while developed countries remained unclear. The finding further buttress the assumption that agricultural sector has been an engine of developing economies.

Matahir (2012) took a different stand on his study on the role of agriculture on economic growth and how it interplays with other sectors in the economy. The relationship between agriculture and other sectors of the

Tunis economy was investigated using Time series Johansen co integration. Based on the findings, it was pointed out that, policy makers should see agricultural sectors as pivotal tools when analyzing inter- sectoral growth policies. Although, the contribution of agricultural sectors to economic growth cannot be overemphasized, it has not benefited to a lager extend from the growth of services and commerce sector of Tunisia.

According to Adegoye and Dittah (1985), the level of income of farmers and people can increase through agricultural output. According to them what makes up the level of agricultural output will vary with the stage of economic development of a country. They further stated that a fully developed economy, most especially in agricultural sector, means increase in export crops production with improvement in the quantity and levels of such export crops. For countries that have started to industrialized, agricultural output will be said to reach the level of growth, if it can provide the needed row- material to the agro- industries.

Reynolds (1975: 2015), revealed that agricultural development enhance economic development by increasing the supply of food need for domestic consumption and releasing the labour need to industrial employment. According to him, agricultural productivity can promote economic development of underdeveloped countries by; increasing the supply of food available for domestic consumption and providing the labour needed for industrial employment, expanding the size of the domestic market for manufacturing sector, increasing domestic savings, and providing the foreign exchange earned through agricultural exports.

Omawale and Rodriquez (1975) opined that agriculture has been assigned by most developing countries as an important role to national development. To them reducing dependence on certain importations can be achieved through agriculture, containing the increase in prices of food, foreign exchange earnings, getting new people in to the labour market, and increasing income on farm at times of severe rural poverty and unemployment.

Johnston and Mellor (1961) stated that agriculture is an active sector in the Economy. Agriculture plays a crucial role in economic growth through production and consumption leakage, in addition to providing food and labour supply. Agriculture can provide the row- material needed for nonagricultural production. On consumption, higher agriculture productivity can increase the income of the rural population, as such creating demand for domestically produced industrial outputs. Moreover, agriculture can provide the needed foreign exchange through the export of agricultural goods, thereby aiding in importation of capital goods.

3. Research Methodology

The research study is focused on the impact of agricultural productivity on the economic development of the Gambia from the period 1980 to 2017. Inferential is used as the analytical approach of this study. The hypotheses highlighted above are tested quantitatively. In this case, econometric techniques will be adopted adequately and an econometric model will be formulated.

3.1. Sources and Types of Data:

The data's used in this are secondary data's (comprising annual time series). The annual data's used were sourced from the World Bank National Accounts Data and OECD National Accounts Data. The series span from 1980 to 2017. Availability of data is the reason for the choice of the time lag. Data was collected for six variables.

3.2. Model Specification:

The dependent variable (Y) is the Gross Domestic Product (GDP), and the independent variable (X), includes the Agriculture value added (AGR), Gross Capital Formation (GCF), which is a proxy for capital, Inflation (INF), Net- Export (NE) and Industry value added (IND). It is however important to note that GCF, INF, NE and IND are not sectors specific to the study but are general aggregates within the Gambian Economy. Using them as a proxy for Economic growth will help in reducing the Stochastic Error Term and make the study more accurate.

The estimated econometric equation to see the impact of agricultural productivity on economic development is as follow:

$$GDP = \beta_0 + \beta_1 AGR + \beta_2 GCF + \beta_3 INF + \beta_4 NE + \beta_5 IND + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where;

β_0 = Intercept

$\beta_1 - \beta_5$ = Coefficients of the independent variables

μ_t = Stochastic Error Term

As we intend to interpret the resulting partial slope coefficient as elasticities and to standardize all the variables, we rewrite the structural form of the equation in to a log form as follows:

$$LGDP = \beta_0 + \beta_1 LAGR + \beta_2 LGCF + \beta_3 LINF + \beta_4 LNE + \beta_5 LIND + \mu_t \ldots\ldots\ldots\ldots (2)$$

Table 1: summarizes the independent and dependent variables in the study.

Variables	Description of the variables	Measuring Unit
Dependent variable		
GDP	Gross Domestic Product	Annual growth (%)
Independent variable		
AGDP	Agriculture value added	Annual growth (%)
GCF	Gross Capital Formation	Annual growth (%)
INF	Inflation rate (CPI)	Annual growth (%)
NE	Net- Exports	Annual growth (%)
IND	Industry value added	Annual growth (%)

3.2.1. Variables Definition and Theoretical Expectations

Theoretical expectations based on economic relationship, show the signs which follow the parameters and it is determined by laid down economic theories. In this study:

Gross Domestic Product (GDP) is the total values of goods and services that are produced domestically in the economy; it takes in to consideration product taxes and subsidies that are not included in the value of the products. The calculations are made without making deduction for depression.

Agriculture value added (AGR) is the share of agricultural output in the total GDP of the total economy. The theoretical expectation between AGR and GDP is positive.

Gross Capital Formation (GCF) Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. GCF has a positive theoretical expectation to GDP.

Inflation rate (INF) Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. It has a negative theoretical expectation with GDP.

Net- Exports (NE) refers to the difference between Exports and Imports. NE has a positive theoretical expectation with GDP.

Industry (IND) Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing, construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. The theoretical expectation between IND and GDP is positive.

Table 2: Theoretical Expectations

Variable/ Co- efficient	AGR	GCF	INF	NE	IND
Expected sign	+ (>0)	+ (>0)	- (<0)	+ (>0)	+ (>0)

Source: Authors Computation (2018)

On **table 2**, the expected sign on Inflation is negative; this is so because inflation has an inverse relation with growth. Higher inflation means devaluation of a nation's currency, which affects exchange rate. According to Olivera- Tanzi effect, increase in the level of inflation will reduce the purchasing power of the people, thereby decreasing the incentive to spend. Since inflation hurts both trade and purchasing power, business revenue will fall. The actual tax revenue gathered by government will fall due to increase operation cost and decrease tax revenue from businesses. This will have a negative effect on GDP. Net Export (NE), have an expected sign on positive provided that exports are higher than imports, the reverse is true.
[2]

Table 3: Summary Statistics of Selected Variables, from 1980- 2017

Variable	Mean	Std. Dev.	Min	Max
GDP (%)	3.46	3.03	- 4.29	10.88
AGR (%)	23.99	3.42	17.79	33.30
GCF (%)	16.57	7.16	4.60	27.80
INF (%)	11.13	22.44	- 5.97	34.03
NE (%)	- 12.09	6.27	- 27.23	- 2.45
IND (%)	12.60	1.28	10.24	14.79

Source: Authors computation using E- views (2018)

[2] World Bank and OECD National Accounts file.

Table 3 gives the characteristic of the variables used in the study. It reveals that Agriculture (AGR) has a mean of 23.99 percent and a standard deviation of 3.42. The table further reveals that the lowest and highest Agriculture growth rates recorded in the Gambia are 17.79 percent and 33.30 percent respectively. On GDP it recorded an average growth rate of 3.46 percent with – 4.29 percent and 10.88 percent as minimum and maximum growth rates respectively.

3.3. Unit Root Tests

Unit root test whether a time series variable possesses a unit root and non-stationary, so a unit root is tested before any action is taken. This study will employ a well know test, the Augmented Dickey Fuller (ADF) by Dickey and Fuller (1981). The hypothesis is that root exists in the specified variable(s) and the null hypothesis is non- stationary.
The ADF is based on the following estimate:

$$\boldsymbol{y_t = \emptyset y_{t-1} + \mu_t \text{ Or } \nabla y_t = (\emptyset - 1) y_{t-1} + \mu_t}. \ldots\ldots\ldots\ldots\ldots\ldots\ldots \textbf{(3)}$$

It then test for

$\boldsymbol{H_0}: \emptyset = 1\ [= (\emptyset - 1) = 0]$ Against $\boldsymbol{H_1}: \emptyset < 1 [= (\emptyset - 1) < 0]$

To produce a better white- noise error term, the ADF add generous lag levels of the change in the dependent variable. Given by:

$$\Delta y_t = \emptyset^* y_{t-1} + \emptyset^*_1 \Delta y_{t-1} + \emptyset^*_2 \Delta y_{t-2} + \cdots \ldots\ldots\ldots + \emptyset^*_{p-1} \Delta y_{t-p} + \mu_t \ldots\ldots\ldots\ldots \textbf{(4)}$$

Where

$\emptyset^* = \emptyset_1 + \emptyset_2 + \emptyset_3 + \cdots \ldots\ldots + \emptyset_{p-1}$ and $= (\emptyset - 1)$ for the case of equation (3) where **p=1**

$\emptyset^* = -(\emptyset_{i+1} + \cdots \ldots\ldots + \emptyset_p)$ and $= -\emptyset_2$ for the case of equation (4) where p=1

Table 4: Augmented Dickey Fuller Test Results

	With Intercept			**Trend and Intercept**		
Variables	At Level	At First Difference	Order of []	At Level	At First Difference	Order of []
GDP	-6.7481	-9.3962	**I(1) at 5%**	-6.6501	-9.2493	**I(0) at 5%**
AGR	3.9081	-6.0859	**I(0) at 5%**	-3.8105	-5.9278	**I(0) at 5%**
GCF	-2.4974	-7.3118	**I(1) at 5%**	-2.5139	-7.3591	**I(1) at 5%**
INF	5.5981	-9.9167	**I(1) at 5%**	-5.8918	-6.5134	**I(1) at 5%**
NE	-1.5379	-6.4846	**I(1) at 5%**	-2.1056	-7.2181	**I(1) at 5%**
IND	-3.0497	-7.8056	**I(0) at 5%**	-4.4776	-6.3189	**I(1) at 5%**
MacKinnon (1996) with constant, no trend 1% Level -3.6268 Test Critical Values : 5% Level -2.9458 10% Level - 2.6115				With constants and trend 1% Level - 4.2349 Test Critical : 5% Level - 3.5403 Values 10% Level - 3.2024		

Source: Authors computation using E- views (2018)

Table 4 shows that there is a mixture of I(0) and I(1) but not any order two. As can be seen from table 4, Gross Capital Formation (GCF), Inflation (INF), Net- Export (NE) and Industry (IND) are integrated at order one (I.e. I(1)) while Gross Domestic Product (GDP) and Agriculture (AGR) are integrated at order zero (I.e. I(0)). That is to say Gross Domestic Product (GDP) and Agriculture (AGR) are stationary in level, whereas Gross Capital Formation (GCF), Inflation (INF), Net- Export (NE) and Industry (IND) are stationary in first difference (trend and intercept). However, with intercept all variables are stationary at first difference except Agriculture (AGR) and Industry (IND). With the ADF all the variables are stationary as the computed t values are greater than the 5% level after first difference. Since all the variables are stationary at first difference, we reject the null hypothesis of non- stationarity at 5% level. However, we fail to reject the null hypothesis at level for GCF and NE (with intercept & with intercept and trend). We conclude that none of the variables in the regression are integrated at order two, which is not wanted in applying ARDL.

3.4. Granger Causality Test

Since the research is interested in finding out the significance of agriculture as a cause of economic growth in the Gambia, and in order to examine the causal relationship we therefore perform a Granger causality test. This method can be used to determine whether one economic variable can determine another or not.

In trying to find out if agriculture have an impact on economic growth, we are interested in the bidirectional causal relationship in order to provide evidence that if agricultural sector growth has caused economic growth and also if economic growth has caused growth in the agricultural sector between 1980 and 2017. We therefore consider two hypotheses:

i. Agriculture (AGR) does not Granger- cause GDP
ii. GDP does not Granger- cause Agriculture(AGR)

The VAR equations are specified as:

$$(agr)_t = \propto + \sum_{i=1}^{m} \beta_y \, (agr)_{t-1} + \sum_{j=1}^{n} y_j \, (gdp)_{t-j} + \mu_t \quad \text{.......................... .... (5)}$$

$$(gdp)_t = \emptyset + \sum_{i=1}^{p} \beta_y \, (agr)_{t-1} + \sum_{j=1}^{\sigma} y_j \, (gdp)_{t-j} + \varphi_t \quad \text{............................... (6)}$$

μ_t and φ_t are the disturbance terms of equations (5) & (6) respectively.

Table 5: Granger causality test between Economic growth and Agricultural growth

F Value			
Hypothesis	**F. stat.**	**F critical**	**Decision**
AGR does not Granger cause GDP	0.5665	0.16 (2, 38)	Reject the null hypothesis
GDP does not Granger cause AGR	0.1396	0.11 (2, 38)	Reject the null hypothesis

********Values in brackets are lower and upper degree of freedom (df) respectively**
Source: Authors computation using E- views (2018)

From Table 5, we find that agriculture (AGR) growth Granger- causes GDP growth (Economic growth) and GDP also Granger causes Agriculture (AGR) growth. The empirical evidence indicates that in the Gambia, the agriculture sector have a significant impact on economic growth and contributes significantly to economic growth. This is consistent with the summarized results in Table 5; agricultural growth has resulted in economic growth. There is also an evidence for casual flow from GDP growth to agriculture, suggesting that if resources from the agriculture are properly utilized for economic growth there can be value added to the sector from the returns of economic growth.

3.5. Model Stability and Diagnostic Testing.

Some diagnostic tests have to be undertaking, in order to check the verifiability of the long run estimated model. We required checking the standard property of the model, as a priority in doing any analysis. In this research a number of diagnostic checking and model stability are carried, which includes Functional Form (Ramsey's RESET), Serial correlation test (Brush & Godfray LM test), Heteroscedasticity test, and Normality (Jaque- Bera test). Furthermore, the stability of the long run estimates has been tested by applying the cumulative sum of recursive residuals (CUSUM) test. As recommended by Pesaran et al. (2001). Our decision of rejection or acceptance will be base of the p- values associated with the test statistics. That is we reject the null hypothesis if the p- values are lower than the standard 5% significance level.

3.5.1. Co-integration Test

In order for the analysis to have a well-structured model, cointegration test is conducted to ascertain whether a long run relationship exist among the variables or not. For our analysis, we employ the Pesaran et al (2001) Bound test. We compare the F- statistics of the Bound test with the critical value to make our decision. The null hypotheses of no cointegration will be rejected if the F- statistic is higher than the upper bound critical value. If the F- statistic is lower than the lower bound critical value, we will fail to reject the null hypotheses of no cointegration (Kalu et all, 2015).

Table 6: Bound Test for Co-integration

F- statistic		Null Hypothesis: No level of relationship		
Test Statistic	**Value**	**Significance level**	**I(0)**	**I(1)**
F- statistic	8. 1618	10%	2.08	3
K	5	5%	2.39	3.38

Source: Authors computation using E- views (2018)

Since the F- statistic is greater than the upper bound critical value (3.38) and the lower bound critical value (2.39) at the 5% significance level. We therefore reject the null hypothesis of no co- integration amongst the variables. We can conclude that there is co- integration relationship among the variables in long run.

3.5.2. Long Run ARDL Model Estimation

Since the existence of long- run co- integration relationship is confirmed, we can now find out the long run coefficients. ARDL model is given as:

$$Y_t = \beta_0 + \sum_{i=1}^{n} \beta_i \Delta y_{t-i} + \sum_{i=0}^{n} \delta_i \nabla X_{t-i} + \varphi_1 y_{t-1} + \varphi_2 X_{t-1} + \mu_t \ldots\ldots\ldots\ldots \textbf{(7)}$$

The Long Run Model = $\varphi_1 y_{t-1} + \varphi_2 X_{t-1} + \mu_t$ ……. **(7) (I)**

Table 6: Estimated Long Run Coefficients using the ARDL Approach, based on the Akaike Information Criterion.

Dependent variable is GDP 38 observations used for estimation from 1980 to 2017				
Regressors	**Coefficient**	**Standard Error**	**T- statistic**	**Probability**
LAGR	0.5242	0.1491	3.5164	0.6501
LGCF	0.5193	0.1192	4.3547	0.1828
LIND	0.2299	0.4853	0.4738	0.4908
LINF	- 0.0685	0.0282	- 2.4299	0.0454***
LNE	0.6779	0.2243	3.0224	0.1467
C	5.8622	11.1694	0.3379	0.7454

******* indicates significance at 5% which mean rejection of null hypothesis at 5%

Source: Authors computation using E- views (2018)

Table 6, indicated the results of the long run relationship between the variables. It shows that Agriculture (AGR) have a positive impact on the economy in the long run. An increase in Agriculture (AGR) by 1% leads to an increase in GDP growth by 52% which is statistically significant, denoting that holding all other things constant the contribution of Agriculture have an impact on Economic growth in the long- run. The model further shows that all variables except Inflation (INF) have significant impact on GDP at 5% level. Inflation have presented a negative value, indicating that Inflation (INF) have a negative effect on Economic growth, this is why the central bank of the Gambia need to adopt strong monetary policy in order to stabilize inflation rate at a single digit level.

3.5.3. Short Run Error Correction Model

The short run ECM model is estimated, after estimating the long run ARDL model. The error correction model (ECM), shows the speed of adjustment to get to the equilibrium point in the dynamic model. The short run model is given as:

The Short Run Model = $\sum_{i=1}^{n} \beta_i \Delta y_{t-i} + \sum_{i=0}^{n} \delta_i \nabla X_{t-i}$ …….. **(7)(II)**

Table 7: Estimated Short Run Coefficients using the ECM Approach based on the Akaike Information Criterion.

Dependent variable is GDP 38 observations used for estimation from 1980 to 2017				
Regressors	**Coefficient**	**Standard Error**	**T- statistic**	**Probability**
D(LAGR)	0.2389	0.2058	1.1609	0.2837
D(LGCF)	0.1494	0.1679	0.8897	0.4031
D(LIND)	0.4925	0.4166	1.1823	0.2757
D(LINF)	- 0.1051	0.0343	- 3.0673	0.0181***
D(LNE)	0.2755	0.1920	1.4345	0.1946
C	3.7671	8.1694	0.2133	0.5023
ECM(-1)	- 0.2319	0.2405	- 10.3006	0.0000***
R- squared= 0.9115 F- statistic = 2.7441 [0.0831] DW- statistic = 2.4108				

******* indicates significance at 5% which mean rejection of null hypothesis at 5%

Source: Authors computation using E- views (2018)

The Error correction coefficient in Table 7, is estimated at – 0.2319 which is significant, has the correct negative sign, and has a high speed of adjustment to equilibrium. The coefficient of the ECM(-1) of -0.2319 shows that about 23% of disequilibrium in the short run is corrected towards the long run equilibrium per annum, to bring back equilibrium when a shock exist to a steady state relationship.
The coefficient of determination (R- squared) is high denoting that about 91% of variation in GDP is as a result of variations in the independent variables in the model. Furthermore, the F- statistic is robust and the DW statistic does not show autocorrelation.
Similar to the long- run estimate, Agriculture (AGR) is found to have an impact on economic growth. Holding all other conditions constants, in the short run a 1% increase in Agriculture (AGR) will result to 23% increase on GDP, which is statistically significant at the 5% level. All other variables have a significant effect on economic growth in the short run except Inflation (INF), which have a negative relation with GDP.

3.5.4. Diagnostic Tests

Diagnostic tests are done to provide validity to both the short and long run relationship estimates.

Table 8: Diagnostic Tests Results

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ (1) = 1.3509 [0.2451]	F (1, 31) = 1.1427[0.2933]
B: Functional Form	CHSQ (1) = 0.0016 [0.9881]	F (1, 31) = 0.0013[0.9714]
C: Normality	CHSQ (2) = 2.5235 [0.2832]	Not applicable
D: Heteroscedasticity	CHSQ (1) = 0.0305 [0.8614]	F (1, 35) = 0.0289[0.8661]
** the p- values are in brackets A: Brush & Godfray LM test for residual serial correlation B: Ramsey's RESET test for functional form using the square of the fitted values C: Normality test based on kurtosis and skewness of residuals D: Heteroscedasticity test based on the regression of square residuals		

Source: Authors computation using E- views (2018)

A. Since the p- value associated with the CHSQ is more than the standard significant level of 5% (I.e. 0.2451 > 0.05), we therefore reject the null hypothesis of no serial correlation and conclude that the errors in the model are serially correlated.

B. The p- value associated with the CHSQ is greater than the 5% significant level (I.e. 0.9881> 0.05), we cannot reject the null hypothesis for Ramsey's RESET test, as to whether the model suffers from omitted variable bias or not. The null hypothesis is that the model does not suffer from omitted variables, so we accept the hull hypothesis, which means the model is correctly specified.

C. The null hypothesis is that the residuals are normally distributed. We cannot reject the null hypothesis since the p- value associated with the Jaque- Berra normality test is greater than the 5% significance level (I.e. 0.2832> 0.05).

D. Since the p- value associated with the test statistics are greater than the standard 5% significance level (I.e. 0.8614> 0.005), we therefore reject the null hypothesis of heteroscedasticity.

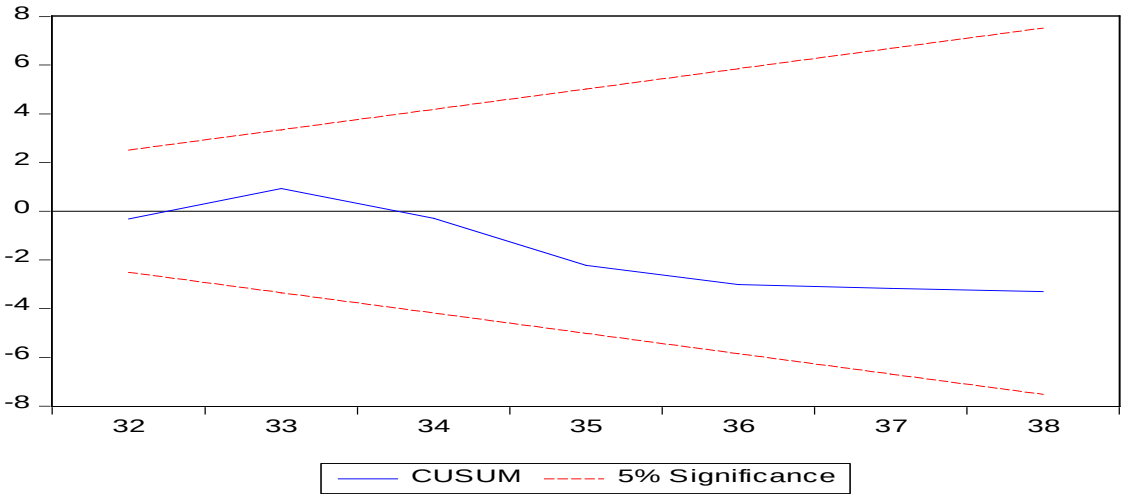
Based on the result of the tests above, it can be concluded that the long run ARDL model estimated in this study passes all the diagnostic tests.

3.5.5. Model Stability

In order to detect the stability of the model for long run and short run relationship, we make use of the cumulative sum of recursive (CUSUM) test. The model is stable if it's within the 5% significant level under the observation period. In order words the model is stable if the blue line is between the red lines.

From **Figure 1** below, the blue line is within the 5% significance level, we can conclude that the long run estimates are stable and there is no structural break. There exist a strong stability in the model in both the long run and short run.

Figure 2: Plot of Cumulative Sum of Recursive Residuals



Source: Authors computation using E- views (2018)

3.6. Test of Hypotheses

In the test of hypothesis, since the probabilities on both the long and short run estimates shows that agricultural sector investment and agricultural output have significant impacts on economic growth of the Gambia, (see table 6 &7), we therefore reject the null hypothesis that agricultural sector investment and agricultural output do not have significant impacts on economic growth in the Gambia.

4. Conclusion and Policy Recommendation

4.1. Conclusion

The main objective of the study is to analyze the impact of agriculture on economic growth, empirical evidence from the Gambia during the period 1980- 2017. Autoregressive Distributed Lag (ARDL) model and Error Correction model (ECM) were applied to determine the long run and short run relationships respectively among the variables. The variables are tested for time series properties using the ADF test for unit root before applying the ARDL model. The model was tested for stability using the diagonal testing technique. The results revealed no evidence of serial correlation, no functional form problem (i.e. the model is correctly specified), there is no evidence of heteroskedasticity problem and the residual is normal distributed.

The empirical results showed that agriculture is found to have a positive impact on economic growth of the Gambia during the periods under study and the impact statistically significant at all the significance levels. A 1% increase in agricultural productivity results in 52% and 24% increase in real GDP in long run and short run, respectively. This shows that agriculture is a viable tool of economic growth in the Gambia. The other variables like Industry (IND), Gross Capital Formation (GCF), and Net- Exports (NE) all have a significant relationship to economic growth of the Gambia both in the long run and the short run. Only Inflation (INF) has shown evidence of an insignificant impact on economic growth.

There are many debates among development economists on the role of agriculture as a precondition for industrialization and economic growth; the impact of agriculture to economic growth was explored. The empirical evidence from this study show that the contribution of agriculture have a positive impact on GDP in the Gambia. We therefore conclude that agriculture is a driver of economic growth in the Gambia and all efforts should be made through increased investment to enhance the value addition of the sector. It is also evident from the finding that in as much as agriculture matter in economic growth, dependence on it alone without simultaneous development of other important sectors such as industrial development (to deliver the needed interdependence) will not bring the needed positive development.

Agriculture productivity will promote industrial productivity and enhance employment opportunities in the Gambia. Increase investment in the agriculture sector will promote industrialization, thereby creating employment opportunities which will narrow down the high unemployment rate in the Gambia, and provide a positive current account balance.

4.2. Policy Recommendation(s)

Based on the findings of this study, the following policy recommendations are forwarded:

- Agriculture should be treated as a priority sector; government should enact policies that will create an enabling environment for agriculture sector growth, attracting foreign direct investments and increase employment in the agricultural sector, thereby reducing the employment rate in the Gambia.
- The government of the Gambia should put in all efforts to reduce interest rates on agricultural loans. This will increase the demand for credit thereby increasing farm capital which will boost agricultural output.
- The government of the Gambia should enact policies to stabilize and reduce the exchange rate regime so as to encourage and create certainty in the minds of potential investors in the agricultural sector.
- Encourage industrial development, agricultural sector output have a positive interaction with industrial output. Therefore, creation of industries will not only promote industrial output, but also stimulate the growth of the agricultural sector. Government should therefore find it worthy to develop the industrial sector of the Gambia and ensure significant integration between the agricultural and industrial sectors of the Gambian economy.
- Rainfall is found to have a positive interaction with agriculture development in the Gambia; the government of the Gambia should adopt a widespread irrigation system and make the system adoptable by the rural farmers. Rainfall is a natural gift and can be only supplemented with an artificial irrigation system. Government should hence make irrigation affordable and popular option for farmers. This is particularly important not only to increase agricultural productivity but also to provide a yearlong food security.

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