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# Relationship of agricultural production and agricultural credit guarantee scheme fund in nigeria: a causality analysis.

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**ABSTRACT**

This study was carried out to examine the causality of agricultural production and the Agricultural Credit Guarantee Scheme Fund(ACGSF) in Nigeria. ADF unit root test, unrestricted VAR and granger causality test were employed in the analysis of the dataset and result showed that there is no causality between agricultural production and value of agricultural credit guaranteed but a unidirectional causality from agricultural production to the number of agricultural credit guaranteed existed. This implies that we can better predict the outcome of agricultural production in Nigeria using the past values of the number of agricultural credit guaranteed.

**KEYWORDS:** Agricultural production; Credit; Guarantee; Causality.

## 1. INTRODUCTION

Agriculture employs nearly three-quarters of Nigeria's work force, as is the case in most of sub-Saharan Africa (SSA) and it is the principal source of food and livelihood in Nigeria, making it a critical component of programs that seek to reduce poverty and attain food security in Nigeria[1].Nigeria has a highly diversified agro-ecological condition which makes it possible for the production of a wide range of agricultural products. Blessed with abundant land and water resources, Nigeria's agricultural sector has a high potential for growth, but this potential is not being realized as productivity is low and basically stagnant[2]. Low as access to credit has been identified as one of the sector wide contraints to agricultural productivity in Nigeria[1]. [3]also emphasized that Nigerian agriculture is largely subsistence and access to adequate funds have been a major bottleneck. Therefore, credit is a vital component of agricultural production in Nigeria and this has been stressed by [4], who opined that Agricultural credit is an effective instrument for counter-cyclical agricultural output, non-oil export and GDP stabilization in the Nigerian economy.In view of the importance of credit to agricultural production, the Agricultural Credit Guarantee Scheme Fund(ACGSF) was set up with the sole purpose of providing guarantee in respect of loans granted by any bank for agricultural purposes. Despite the contribution made by Agricultural Credit Guarantee Scheme Fund(ACGSF) from its inception in 1978 to 2011, there exists dearth of information on the causal relationship between agricultural production and the number as well as the value of credit guaranteed by agricultural credit guarantee scheme fund in Nigeria. Therefore, this study was designed to provide empirical information on the presence and direction of causality between agricultural production and the number as well as the value of credit guaranteed by agricultural credit guarantee scheme fund in Nigeria from its inception in 1978 to 2011.

## 2. METHODOLOGY

***2.1 Data Description***

Times series data on index of agricultural production, value of credit guaranteed by purpose from agricultural credit guarantee scheme fund and number of credit guaranteed by purpose from agricultural credit guarantee scheme fund were obtained from various issues of the annual statistical bulletin of the Central bank of Nigeria[5], [6]. The data are comprehensive in covering the inception of the agricultural credit guarantee scheme fund(1978) to 2011.

***2.2 Analytical Framework***

The pairwise granger causality test proposed by [7]and popularized by [8] was used to examine the presence and direction of relationship between agricultural production and agricultural credit guarantee scheme fund in Nigeria. Testing causality, in the Granger sense, involves using F-tests to test whether lagged information on a variable Y provides any statistically significant information about a variable X in the presence of lagged X. If not, then "Y does not Granger-cause X." In order to carry out the granger causality test, the time series properties of the variables under study are explored in order to overcome the problem of spurious regression and therefore, the stationarity or non stationarity of the variables must be established. In view of this, unit root test developed by [9] was used to determine whether the series for the variables are stationary or not. The model of the Augmented Dickey Fuller(ADF) with the constant term and trend is as follows:

$$\Delta Y_t = a_1 + a_2 t + \beta Y_{t-1} \sum_{i=1}^{n} \gamma_i \Delta Y_{t-1} + \varepsilon_t$$

The null hypothesis($H_O : \beta = 0$) of the ADF test indicates that the series is not stationary and the alternative hypothesis($H_O: \beta < 0$) indicates that the series is stationary. If the absolute value of calculated ADF statistic($\tau$)is higher than the absolute value of the critical values, we cannot reject the hypothesis which shows that series is stationary. However, if this value is lower than critical value, time series is not stationary[10]. The Granger causality test assumes that the information relevant to the prediction of the respective variables, X and Y, is contained solely in the time series data on these variables. The test involves estimating the following pair of regressions:

$$X_t = \beta_0 + \sum_{i=1}^{n} \beta_i X_{t-i} + \sum_{j=1}^{n} \alpha_i Y_{t-j} + \mu_{1t}$$

$$Y_t = \gamma_0 + \sum_{i=1}^{n} \gamma_i Y_{t-i} + \sum_{j=1}^{n} \delta_i X_{t-j} + \mu_{2t}$$

where it is assumed that the disturbances $\mu_{1t}$ and $\mu_{2t}$are uncorrelated.Thus there is unidirectional causality from $X$ to $Y$ if $\alpha_i \neq 0$ and $\delta_i = 0$. Similarly, there is unidirectional causality from $Y$ to $X$ if $\delta_i \neq 0$ and $\alpha_i = 0$. The causality is considered as mutual(bilateral causality) if $\delta_i \neq 0$ and $\alpha_i \neq 0$. Finally, there is no link between $X$ and $Y$ (independence) if $\delta_i = 0$ and $\alpha_i = 0$. The steps involved in implementing the Granger causality test are as follows[11].

1. Regress current $X$ on all lagged $X$ terms and other variables, if any, but do not include the lagged $Y$variables in this regression.This is the restricted regression. From this regression, obtain the restricted residual sum of squares($RSS_R$).
2. Run the regression including the lagged $Y$ terms. This is the unrestricted regression. From this regression, obtain the unrestricted residual sum of squares $RSS_{UR}$.
3. The null hypothesis is $H_0: \alpha_i = 0$, that is, lagged $Y$ terms do not belong in the regression.
4. To test this hypothesis, we apply the F test given as:

$$F = \frac{RSS_R - RSS_{UR}}{RSS_{UR}} \frac{m}{(n-k)}$$

which follows the F distribution with m and (n− k) df. In the present case m is equal to the number of lagged $Y$ terms and k is the number of parameters estimated in the unrestricted regression.

5. If the computed F value exceeds the critical F value at the chosen level of significance, we reject the null hypothesis, in which case the lagged terms belong in the regression. This is another way of saying that $Y$ Granger causes $X$.

6. Steps 1 to 5 can be repeated to test whether $X$ Granger causes $Y$ .

### *2.3 Model Specification*

In order to examine the presence and direction of relationship between agricultural production and agricultural credit guarantee scheme fund in Nigeria, the data on agricultural production was given by the Index of Agricultural Production(IAP) and the data on agricultural credit guarantee scheme fund was given by the Value of Agricultural Credit Guaranteed(VACG) and the Number of Agricultural Credit Guaranteed(NACG). Therefore, the relationship between agricultural production and agricultural credit guarantee scheme fund in Nigeria is examined using two models given explicitly as:

1. Index of Agricultural Production(IAP) and Value of Agricultural Credit Guaranteed(VACG)

$$IAP_t = \beta_0 + \sum_{i=1}^{n} \beta_i IAP_{t-i} + \sum_{j=1}^{n} \alpha_i VACG_{t-j} + \mu_{1t}$$

$$VACG_t = \gamma_0 + \sum_{i=1}^{n} \gamma_i VACG_{t-i} + \sum_{j=1}^{n} \delta_i IAP_{t-j} + \mu_{2t}$$

2. Index of Agricultural Production(IAP) and Number of Agricultural Credit Guaranteed(NACG)

$$AGP_t = \beta_0 + \sum_{i=1}^{n} \beta_i AGP_{t-i} + \sum_{j=1}^{n} \alpha_i NACG_{t-j} + \mu_{1t}$$

$$NACG_t = \gamma_0 + \sum_{i=1}^{n} \gamma_i NACG_{t-i} + \sum_{j=1}^{n} \delta_i AGP_{t-j} + \mu_{2t}$$

The statistical analysis of the dataset on index of agricultural production, value of agricultural credit guaranteed and number of agricultural credit guaranteed was performed using E Views version 7.2.

## 3. RESULTS AND DISCUSSION

### *3.1 ADF Unit Root Test*

The decision rule for establishing the stationarity of IAP, VACG and NACG was based on an ADF test with critical value of 3.5578 at 5% level of significance. The result of the ADF test as shown in Table 1 strongly support the hypothesis that IAP and VACG are non stationary at level form(integrated at order one) while NACG is stationary at level form(integrated of order zero). The order of integration of IAP and VACG implies that IAP and VACG would have to be differenced once to attain stationarity and therefore, IAP and VACG were differenced once to ensure their stationarity. One immediate conclusion from this analysis is that any dynamic specification of the model in levels of the series is likely to be inappropriate and may be plagued by problems of spurious regression[12]. Since the ADF test is very sensitive to the number of lags included in the regression, the Schwarz Information Criteria(SC) was used in order to find an appropriate number of lags.

**Table 1: Augmented Dickey Fuller Unit Root Test Result**

| **Variable** | ADF Statistic($\tau$) (Levels) | Remarks | ADF Statistic($\tau$) (First Difference) | Remarks |
|---|---|---|---|---|
| lnIAP | -1.0898 | non stationary | -5.3246 | Stationary |
| lnVACG | -1.9075 | non stationary | - 6.1411 | stationary |
| lnNACG | -6.7483 | stationary | – | – |

**NB**: Test critical values at $p < 0.05$ = -3.5578, ln = natural logarithm

***3.2 Granger Causality Test***

The granger causality test is known to be sensitive to the choice of optimal lag length([13], [14], [15])Prior to the granger causality test, an optimal lag length was chosen using Final prediction error(FPE), Akaike information criterion(AIC), Schwarz information criterion(SC), and Hannan-Quinn information criterion(HQ) from an unrestricted Vector Autoregression(VAR) comprising the underlying variables under study. The optimal lag length was found to be one(1) as shown in Table 2. The result of the granger causality test as shown in Table 3 indicates independence and therefore, neither of the variables was significant in predicting the outcome of the other. This implies that the value of agricultural credit guaranteed by the agricultural credit guarantee scheme fund in Nigeria form its inception to 2011 was not significant in influencing the outcome of agricultural production in Nigeria and this could be attributed to the guaranteeing of limited amount of credit by the scheme and also to the incidence of loan diversion by farmers who accessed credit from the scheme. However, the number of agricultural credit guaranteed by the agricultural credit guarantee scheme fund in Nigeria was found to be significant in influencing the outcome of agricultural production in Nigeria as indicated by a unidirectional causality running from lnNACG to lnIAPshown in Table 4 and therefore, we can better predict index of agricultural production by considering the lagged values of the number of agricultural credit guaranteed rather than merely the lagged values of the index of agricultural production. It is worth noting that granger causality does not reveal whether a relationship is positive or negative([16], [17]) and therefore, an inference cannot be made about whether the relationship between agricultural production and agricultural credit guarantee scheme fund is positive or negative. However, access to agricultural credit has been positively linked to agricultural productivity in several studies[1].

**Table 2:VAR Lag Order Selection Criteria Result**

| Lag | FPE | AIC | SC | HQ |
|---|---|---|---|---|
| 0 | 0.065063 | 5.781150 | 5.922594 | 5.825449 |
| 1 | 1.54e-05* | -2.570854* | -2.005076* | -2.393659* |
| 2 | 2.16e-05 | -2.260467 | -1.270356 | -1.950376 |
| 3 | 1.98e-05 | -2.403284 | -0.988840 | -1.960298 |
| 4 | 2.24e-05 | -2.397857 | -0.559080 | -1.821975 |
| 5 | 2.82e-05 | -2.376517 | -2.376517 | -1.667739 |

NB: FPE = Final prediction error, AIC = Akaike information criterion,
SC = Schwarz information criterion, HQ = Hannan-Quinn information criterion

**Table 3: Pairwise Granger Causality Test Result Between Index of Agricultural Production and Value of Agricultural Credit Guaranteed.**

| Direction of Causality | No. of Lags | F value | Decision |
|---|---|---|---|
| lnIAP → lnVACG | 1 | 0.35320 | Accept |
| lnVACG → lnIAP | 1 | 0.04103 | Accept |

NB:ln = natural logarithm, → = does not granger cause

**Table 4: Pairwise Granger Causality Test Result Between Index of Agricultural Production and Number of Agricultural Credit Guaranteed.**

| Direction of Causality | No. of Lags | F value | Decision |
|---|---|---|---|
| lnIAP → lnNACG | 1 | 0.20129 | Accept |
| lnNACG → lnIAP | 1 | 7.37979 | Reject |

NB: ln = natural logarithm, → = does not granger cause

**4. CONCLUSION**

Time series data on index of agricultural production, value of agricultural credit guaranteed and number of agricultural credit guaranteed by ACGSF were employed in examining the presence and direction of causality between agricultural production and agricultural credit guarantee scheme fund in Nigeria. Pairwise granger causality test was used to examine the causality between agricultural production and agricultural credit guarantee scheme fund but prior to the causality test, augmented dickey fuller test was used to establish the stationarity of the time series data and unrestricted vector autoregression(VAR) was used to produce Final prediction error(FPE), Akaike information criterion(AIC), Schwarz information criterion(SC), and Hannan-Quinn information criterion(HQ) for determining optimal lag length to be used in the granger causality test. Unidirectional causality from the number of agricultural credit to the index of agricultural production was observed from the granger causality test and no causality was observed between index of agricultural production and value of agricultural credit guaranteed. The absence of causality was attributed to the limited value of loans guaranteed by ACGSF and the incidence of loan diversion by farmers. Therefore, it is recommended that the value of loans guaranteed by ACGSF should be increased so that farmers can have access to more funds for expanding their agricultural production and also effective mechanism should be put in place to avoid the diversion of loans by farmers to uses other than agricultural production.

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