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Causality between Credit to Agriculture and Ginger Production in Nigeria (1991 – 2015)

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Abstract:*The study examined causality between credit to agriculture and ginger production in Nigeria from 1991 to 2015. Primary data for the study were obtained from the website of Food and Agriculture Organisation. Phillips-Perron test, an interpolated Augmented Dickey-Fuller test, suitable for small sample (n < 30), was used to test for unit root. Descriptive statistics were used for preliminary analysis. Pairwise Granger causality test, after generating vector autoregression, was the central model for analysis. The unit root test showed that the variables were stationary at first difference. The descriptive result shows that credit to agriculture (Nm) had a mean of N3,643,961.00 and coefficient of variation (CV) of 1.20, indicating variability by 120% from the mean. Ginger had a mean and coefficient of variation of 185,061.00 mt and 0.91, respectively. The CV indicated that ginger production distribution within the period of study varied by 91% from the mean. The pairwise Granger causality test showed that the F-statistic (15.273)* was statistically significant ($p < 0.01$),*indicating that there was unidirectional causality running from ginger production to credit to agriculture without feedback.It was recommended that fluctuations in credit to agriculture and ginger production in Nigeria should be minimised; allocation of credit to agriculture should focus on viable agricultural commodities such as ginger so that changes in credit to agriculture would be reflected in changes in ginger production.*

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I. Introduction

Ginger (*Zingiberofficinale*) is an herbaceous perennial plant, belonging to the order *Scitamineae* and family *Zingiberaceae*. It is a root crop and a typical herb extensively grown across the world for its pungent aromatic under-ground rhizomes which makes it an important export commodity in world trade[1,2]. In Nigeria, ginger cultivation started in 1927, around the present Southern Kaduna State[3]. It has been noted that ginger has steadily increased in importance as a valuable domestic spice and export crop[4]. At present, the plant is cultivated in different parts of the country[5].

Ginger is usually propagated vegetatively through its rhizome. Nigeria produces an average of 50,000 metric tonnes of fresh weight ginger per annum. About 10 % of the produce is consumed locally as fresh ginger while the remaining 90 % is dried for both local consumption and export. Out of the dried ginger, 20 % is consumed locally for various uses and 80 % exported[4,6]. On the international market, ginger from Nigeria is highly valued for its aroma, pungency, high oil and oleoresin content. In the world market, the major exporting countries are China, India, Nigeria, Jamaica, and Brazil[7].

Given the importance of ginger to the economy, it is important to sustain its production. To do this requires credit availability and rationing in favour of the crop. In Nigeria, agricultural credit is indispensable for three major reasons namely, agriculture is the mainstay of Nigeria's economy contributing at least 70 % to the Gross Domestic Product annually, agricultural sector is dominated by resource-poor and small-scale farmers, and enhanced access to agricultural credit ensures agricultural productivity, poverty reduction and sustained growth of the economy. It has been asserted that if access to agricultural inputs of these farmers is impaired due to capital shortage, production would be hampered, and household and national food security would be in a vulnerable situation[8]. For cash crop such as ginger, there would be disruption in export quantities and earnings would also be distorted. This underscores the relevance of agricultural finance.

Agricultural finance, generally, is required to achieve high and self-sustaining national growth rate, food security and per capita income. Its importance in enhancing the productivity of small-scale farmers is *sine quo non*. Agricultural finance is a functional branch of agricultural economics which is concerned with the acquisition and utilization of funds for the purpose of agricultural production. The concept of agricultural finance has been succinctly captured as the acquisition and utilization of capital (i.e. finance), the factor of production that facilitates the acquisition, procurement and management of the other factors of production namely, land, labour, capital – physical, and entrepreneur(management), in agriculture and which, is not only a

lubricant but the lifeblood of the economy. It cuts across financial management and the financial institutions serving the agricultural sector of the economy. It is the most important factor in economic development. Capital has two concepts – the physical capital which refers to the physical assets (land, buildings, plants, machinery and equipment) used in the production of goods and services either for further or final consumption, and the finance capital which is used not only to procure the physical assets but operate and manage the assets on daily basis to ensure continuous production of goods and services[9].

From a broad perspective, finance is available from two (2) principal sources namely, saving and borrowing. Saving, otherwise known as equity, is the use of own production resource for investments in the production of goods and services; it is that part of the owner's disposable income which is not immediately consumed. It is a direct source of financing in an economy. On the other hand, borrowing is the use of other people's money for investment purposes. Borrowing is an indirect source of financing in an economy. It has been noted that reliance on equity financing is not sustainable. The World Bank[10] also supports the view that equity alone cannot sustain the expected agricultural productivity required to meet the increasing needs of nations. It is therefore imperative to augment equity with borrowing (also known as credit). Thus, credit is the major and most ideal source of adequate financing for agriculture or any other commercial venture or sector of the economy. The institution acknowledged that credit constituted the largest component of its agricultural lending[10]. Subsequently, it emphasised that it is the duty of financial institutions, financial intermediaries between the savings unit and the investing unit, to sustain continuous availability of credit[9].

The reallocation of availability credit among competing sectors and commodities is an important component or function of government policy. This translates to credit rationing when demand exceeds supply of credit. According to 11, credit rationing or credit constraint manifests in the many ways in which some potential borrowers are excluded from the credit market, discouraged, rejected, or limited to loans that are much smaller than what they might have applied for. According to 12, some of the factors that have been found to be significant determinants of credit constraint include age, income, assets, education, occupation, and borrowing experience

Total credit to agriculture is channeled to the investing units through government credit policy instruments or outlets. One of them is Agricultural Credit Guarantee Scheme Fund (ACGSF), established in 1977 to ease the risks of banks in agricultural lending with a view to encouraging the banks to continue to extend credits to that sector of the economy. Another instrument is the Commercial Agricultural Credit Scheme (CACS) which was established in 2009 to address the source of funding agricultural development. Most recently is the Bank of Agriculture (BOA) Ltd of 2011, a metamorphosis of Nigerian Agricultural and Cooperative Bank (NACB) Ltd and Nigerian Agricultural, Cooperative and Rural Development Bank (NACRDB) whose purpose is to provide affordable financial and advisory services to the farm and non-farm enterprises of the national economy, using well-trained and highly motivated staff, backed by appropriate technology, to foster accelerated agricultural and rural development[9,13].

Agricultural credit is the amount of money (cash or kind) that the farmers borrow to meet their production requirements as well as their current consumption needs (Sarker, 2006 in 8). According to 8, agricultural credit refers to borrowed fund required to meet the specific financial needs of farmers which are determined by planting, harvesting and marketing cycles. Agricultural credit, which could be short-term, intermediate-term and long-term loan, have differing characteristic features such as tenor, utilization and collateral requirements.

Short-term credit has tenor of up to one year. Farmers need short-term credit for meeting up the working capital requirements of agricultural production. For instance, they need short-term credit for the purchase of seeds, fertilizers, pesticides, bullocks and other casual expenses. Sometimes, short-term credits are also raised for paying rents, revenue and also meeting the financial requirements of the farm family. 8 stated that short-term credits are provided for seasonal agricultural production activities. The short-term credit is repayable after harvesting and marketing of the commodity for which the credit was provided. An important characteristic of short-term credit is that it is self-liquidating.

The intermediate-term credit has tenor extending from one to five years. Farmers require this credit for the purchase of cattle, implements, improvements in water courses, increase sale and revenue. The credit is obtained on the security of movable implements. Intermediate-term loan is usually amortized (paid back in installments) over the life span of the loan. The loan provides agribusiness with a source of capital that will allow the growth or modernisation without forcing the owners to surrender control of the business.

The duration of long-term credit exceeds five years. The farmers need long-term credit for making improvements of permanent nature on farmland such as sinking of tube wells, reclamation of land, building, purchase of machinery and implements and establishment of agro-based industries. The security for long-term loan is usually a mortgage or claim on the fixed assets of the firm.

Given the globally increased demand for food and biofuel production, agricultural credit has become an indispensable input required to increase agricultural production that will meet up with increased demand. This is

basically due to the axiom that the attainment of high yielding modern agriculture may be a mirage to poor and marginal farmer because it requires huge capital investment. 8 also noted that farmers receive loan mainly for increased agricultural crop production. However, access to credit may not have a direct impact on productivity, but could have a positive and significant indirect impact through its positive influence on agricultural technologies adoption, increased capital for farm investment, hired labor, and improved household welfare through improved health care and better nutrition[14]. Beyond the probability of credit exhibiting impact on productivity or not, it is important to determine the direction of impact. This falls within the purview of causality.

Granger causality measures directional relationship between two variables at a time, *t*. The directional relationship could be birectional or unidirectional. Granger causality determines the capacity of past values of a variable to cause changes in another variable with or without feedback [15]. Granger causality is absent when $f(\mathbf{x}_t | \mathbf{x}_{t-1}, \mathbf{y}_{t-1})$ equals $f(\mathbf{x}_t | \mathbf{x}_{t-1})$. The definition states that in the conditional distribution, lagged values of $\mathbf{y}_t$add no information to explanation of movements of $\mathbf{x}_t$beyond that provided by lagged values of $\mathbf{x}_t$itself. This concept is useful in the construction of forecasting models. Finally, if $\mathbf{x}_t$is weakly exogenous and if $\mathbf{y}_{t-1}$ does not Granger cause $\mathbf{x}_t$, then $\mathbf{x}_t$isstrongly exogenous[16].

The study was guided by theory of duality in economic growth and portfolio theory. The theory of duality in economic growth was derived from the elaboration of Marx's theory of economic by a Russian mathematician, Georg von Charasoff. The theory stated that there is a fundamental dual relationship between the system of prices and the rate of profit on the one hand, and the system of quantities and the rate of growth on the other hand (Charasoff, 1910)[17]. The theory of duality in economic growth presupposed that economic growth and the factors (quantities) that are, to some extent, responsible for the growth, have causal relationship.

Portfolio theory was propounded by Harry Markowitz[18]. The theory stated that a diversified portfolio would maximise risk and maximise returns. The theory concerns itself with the principles governing such allocation of investment capital or credit, which invariably leads to credit rationing or reallocation among commodities. Therefore, the objective of the theory is to elaborate the principles in which the risk can be minimized or spread among commodities to guard against production or market failure.

The analysis of the relationship between finance and economics is replete with mixed results. Available information in literature showed that while King and Levine (1993), Wachtel (2001) and Levine (2005) considered finance an important element of growth, Robinson (1952) and Lucas (1988) viewed it as a minor growth factor, and Lucas (1988) argued that the role of finance has been overstressed[17]. In other words, financial intervention does not cause growth as much as projected. For instance, 19 determined causality between bank's major activities (savings and lending) and economic growth in Pakistan, from 1961 to 2013. The study employed Johansen test of Co-integration and Granger Causality. The results showed that there was no co-integration or causal relationship between GDP growth and Deposits in Banks of Pakistan. However, there was short run and long run causality running from GDP growth to bank's lending (credit) activities.

In 14, the impact of access to credit on agricultural productivity in Nigeria was examined, using the Endogenous Switching Regression Model (ESRM). The first stage of the model revealed that total livestock unit and farm size were positive and statistically significant in determining the farmers' access to credit. The second stage revealed that total livestock unit and farm size were negative and statistically significant in explaining the variations in cassava productivity among the farmers that had access to credit, while household size, farm size, and access to information assets were negative and statistically significant in explaining the variation in cassava productivity among the farmers without access to credit.

Also, in 8, the analysis of agricultural credit in Bangladesh focused on current trend, problems and recommendations. Using descriptive statistics and graphs, the study revealed that, although private commercial banks (domestic and foreign) contributed a significant amount to total agricultural credit from formal sector, their percentage contribution to agricultural credit remained almost stagnant since the time they started to disburse agricultural loan. This study is a pointer to instability in total agricultural credit availability and, hence, allocation to various subsectors.

The work in 20 assessed the demand for credit, credit rationing and the role of microfinance among poor rural communities in Cross River State, Nigeria. The study, which employed probit model, found that the probability of households applying for credit increased with household total income and decreased with a high level of poverty, a high dependency ratio, and dissaving circumstances. The authors concluded that the variables (family size, number of capable laborers, dependency ratio, industrial and commercial activity, marital status of household head (whether married or unmarried), gender of household head, occupation of household head, age of household head, arable land owned, annual average value of livestock, annual average value of crops, household income, loans from MFIs, loans from rotating credit cooperatives, loans from informal sources, household dissaving circumstances, household education, and value of the household residential house) included in the probit model played a significant role in determining the demand for credit and rationing.

The study of 21 applied probit analysis to determine the accessibility of small-scale farmers to formal source of credit in Ogbomosho zone, Oyo State, Nigeria. The study revealed that level of education, membership in a cooperative, contact with an extension agent, and presence of collateral security positively and significantly affected the likelihood of farmers' access to formal credit, while farming experience negatively affected the probability of farmers having access to formal credit.

Liang and Reichert (2006) in 19 found causal relationship between financial sector development and economic growth of developing and advance countries. They concluded that causality run from economic development to financial sector development. Similarly, 22 investigated the effectiveness of financial development in Pakistan. The study found that there was unidirectional causality running from economic development to financial development both in the short run and long run. Real per capita GDP was used as a proxy for economic development while ratio of domestic credit to GDP, total capital formation to GDP, weighted average savings interest rate minus current GDP deflator and GDP deflator were used for financial development.

To evaluate the relevance of credit to agriculture to ginger production in Nigeria, the specific objectives were to analyse credit to agriculture and assess ginger production from 1991 to 2015. It was hypothesised that there is no causality between credit to agriculture and ginger production in Nigeria.

II. Material and Methods

The study used primary data. The data were obtained from the website of the Food and Agriculture Organisation. The study period spanned from 1991 to 2015. The data were subjected to unit root test using the Phillips-Perron test, which is an interpolated Dickey-Fuller that is suitable for small sample (n < 30). The pairwise Granger causality test was then run after generating vector autoregression. The following data sets, including their measurements, were used in the study:

Credit to agriculture	crdagr	₦m
Ginger production	ggmt	mt

Statistical analysis

The study adopted the conventional Granger causality model.

The econometric form of the pairwise Granger causality model is given as:

$$CRDAGR_t = \alpha o + \sum_{i=l}^{p} \alpha_i \, CRDAGR_{t-i} + \sum_{i=l}^{p} \theta_i \, GGMT_{t-i} + \varepsilon_{1t} \quad (1)$$

$$GGMT_t = \beta o + \sum_{i=l}^{p} \beta_i \, GGMT_{t-i} + \sum_{i=l}^{p} \varphi_i \, CGRADR_{t-i} + \varepsilon_{2t} \quad (2)$$

where,

$CRDAGR_t$= agricultural credit in a given year (t),

$GGMT_t$= ginger output in a given year (t),

$CRDAGR_{t-1}$ = agricultural credit in the previous year,

$GGMT_{t-1}$ = ginger output in the previous year,

In this VAR, if the θ_i in equation (1) is significant and $\varphi_i$in equation (2) is not significant, then there exist a unidirectional causality running from GGMT to CRDAGR. The opposite is true when φ_i is significant in equation (2) with θ_i in equation (1) not being significant, i.e., there is a unidirectional causality running from CRDAGR to GGMT. Where both $\varphi_i and \theta_i$are significant in both equation (1) and (2), there exist a bi-directional causality. However, if the two coefficients in the two equations are insignificant, then there is no causality between the two variables.

2.1 Phillips-Perron test for unit root

The result of the unit root test in Table No 1 shows that the test statistics, at first difference, for ggmt (2.690) and crdagr (2.965) were greater than the critical values ggmt (1.950) and crdagr (2.660) respectively, in absolute terms, at 5%. Hence, the null hypotheses that there was unit root were rejected, and the alternative hypotheses accepted that there was no unit root. Based on these statistics, the variables were confirmed to be stationary. In other words, they were stationary at first difference. Since the data were stationary or did not have unit roots, there was justification to proceed to pairwise Granger causality test.

Table No 1: Phillips-Perron Test for Unit Root

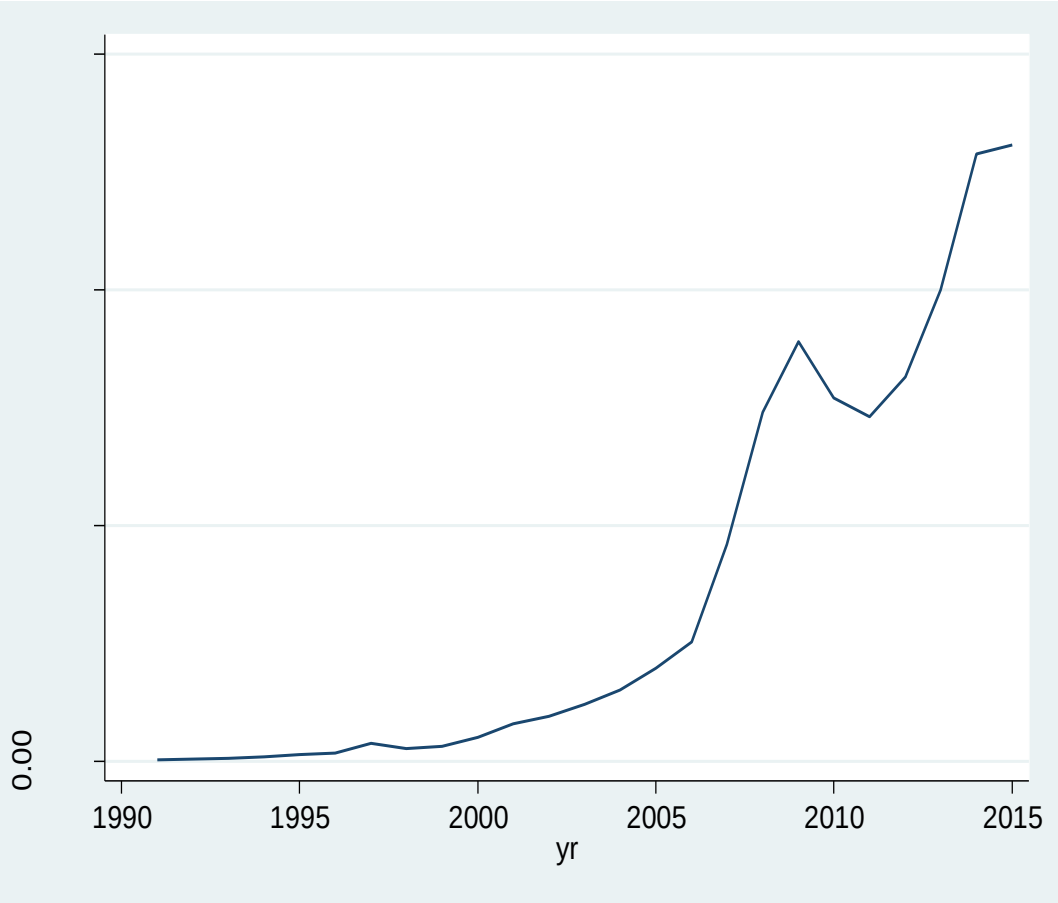
Variable	Test Statistic	Critical Value (5%)	Integration Order
GGMT	2.690	-1.950	I(1)
CRDAGR	2.965	-2.660	I(1)

Source: Computed from Secondary Data using Estata14

2.2 Descriptive Statistics of Variables

The descriptive statistics of variables in the study are presented in Table 2. The result shows that mean credit to agriculture (Nm) was N3,643,961.00. This fluctuation, as graphically depicted in Figure 1, manifested more around 2010 where there was a sharp decline in total credit availability. If credit allocation among agricultural subsectors discriminated against ginger, probably as a result of government policies favouring other commodities, ginger production could be impaired.

Figure 1: Graph of Credit to Agriculture in Nigeria (1991 – 2015)



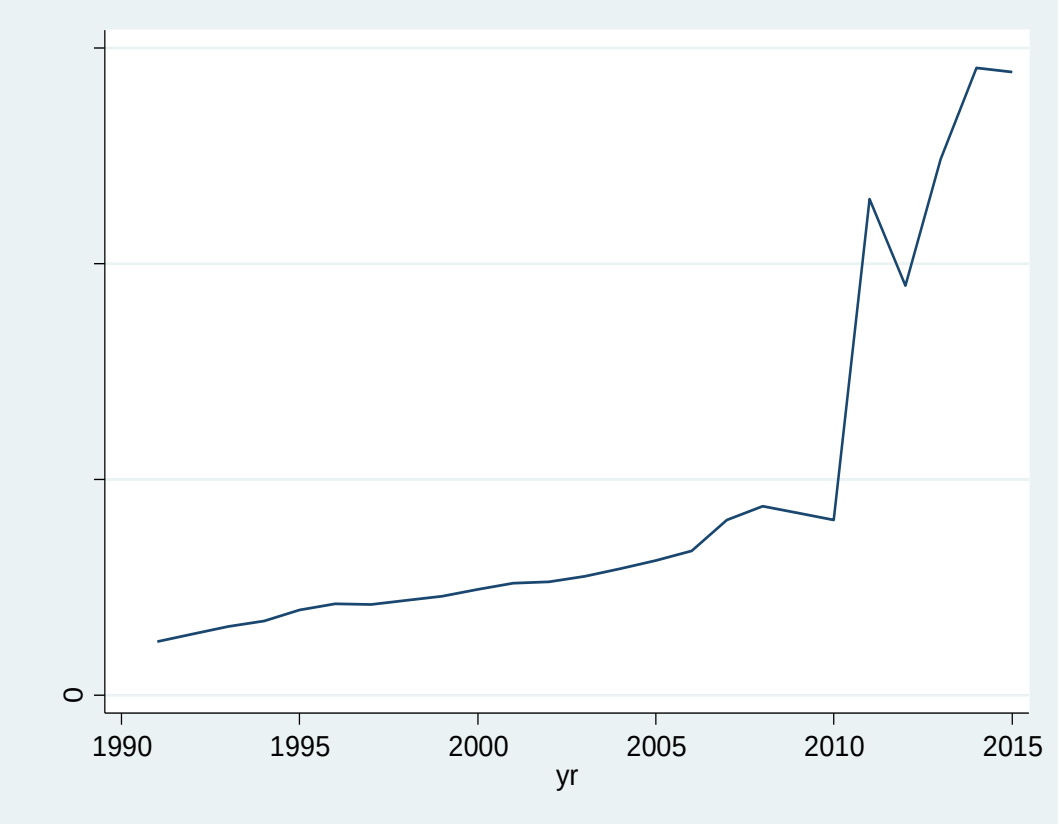
The result in Table No 2 also shows that ginger had a mean and CV of 185,061.00 mt and 0.91, respectively. The fluctuation in ginger production could be a reflection of the high variability in credit to agriculture or reallocation to the ginger subsector. As shown in Figure 2, a sharp rise in ginger production manifested around 2010, in contrast to a sharp decline in credit to agriculture as earlier shown in Figure 1, and until around 2015, instability was witnessed as reflected in the curve.

Table No 2: Descriptive Statistics of Variables

Statistics	Credit to agriculture (Nm)	Ginger production (mt)
Mean	3,643,961.00	185,061.00
Minimum	31,300.00	50,000.00
Maximum	13,100,000.00	581,900.00
Standard deviation	4,361,995.00	167,522.50
Coefficient of variation	1.20	0.91

Source: Computed from Secondary Data using Estata14

Figure 2: Graph of Ginger Production (1991 – 2015)



4.3Pairwise Granger causality test

The result of the pairwise Granger causality test is presented in Table No 3. The result of the first Granger causality test showed that the F-statistic (15.273) was statistically significant ($p < 0.01$). The result of the second test showed that the F-statistic (1.3837) was statistically insignificant ($p > 0.05$).

Table No 3: Pairwise Granger causality test

Equation	Excluded	F	Degree of Freedom	Prob >F
Ggmt	crdagr	15.273	2	0.0001
ggmt	ALL	15.273	2	0.0001
Crdagr	Ggmt	1.3837	2	0.2761
crdagr	ALL	1.3837	2	0.2761

Source: Computed from Secondary Data using Estata14

III. Discussion

The coefficient of variation (CV) of 1.20 indicates variability or dispersion of the data set by 120 % from the mean within the period under investigation. This implies high fluctuation and instability which could create uncertainty in planning for agricultural commodities that are affected by credit. Since ginger farmers may not all the time rely 100 % on equity financing of production activities, this large fluctuation could have adverse effect on ginger production.

The CV for ginger indicated that ginger production distribution within the period of study varied by 91 % from the mean. This is also high and suggestive of instability in ginger productive sector. The result could have far reaching effect for the farmers in terms of farm income, the country in terms of foreign exchange earnings, consumers in terms of sudden adjustment in demand, search for close substitutes and commodity

price, and processors in terms of increased downtime in the industries. The variability could be a reflection of the pattern of credit to agriculture or irregular reallocation to the ginger subsector.

The first result of Granger causality implied that there was Granger causality running from ginger production to credit to agriculture. In other words, changes in ginger production caused changes in credit to agriculture. Viewing credit to agriculture as a portfolio, changes in ginger production should be reflected in credit to agriculture, resulting in reallocation in total agricultural credit to sectors that are responsive to credit.

The implication of the second result of Granger causality test is that there was no Granger causality from credit to agriculture to ginger production. In other words, credit to agriculture did not granger-cause ginger production, or that changes in credit to agriculture was not reflected in changes in ginger production. The possibility is that reallocation in credit to agriculture either did not favour or facilitate ginger production. This is in line with the reservation of 14 that credit access may exhibit impact on productivity.

The overall implication of the result in Table No 3 is that there was granger causality running from ginger production to credit to agriculture without feedback. In other words, there was no dual but uni-directional causality between the variables.

IV. Conclusion and Recommendations

From the foregoing results of data analysis, the study concludes that there is uni-directional causality running from ginger production to credit to agriculture. While changes in ginger production were reflected in changes in credit to agriculture, the reverse was not the case. This implies that ginger production subsisted or thrived irrespective of changes in credit to agriculture within the period of study. The plausible reason could be that ginger rhizome regenerates and tillers especially after the first planting. Hence, production cost does not necessarily rise in the subsequent years, as long as the rhizome remains underground. This is another pointer to the viability of ginger production in Nigeria, rendering it an important commodity for investment.

Based on the findings of the study, the following recommendations are considered apt:

i. Stakeholders in ginger production should minimize fluctuation of output to ease projections in demand and price by consumers and processing industries;
ii. Managers of credit to agriculture in Nigeria should strive to minimize variability in credit availability to enhance effective planning of ginger production;
iii. Allocation of credit to agriculture should focus on viable agricultural commodities such as ginger; and
iv. Changes in credit to agriculture should be reflected in changes in ginger production.

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