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The Impact of Credit Policy Environment on Poultry Production in Nigeria

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A B S T R A C T

The research provided empirical data on the correlation between poultry production index and the credit policy environment in Nigeria. An autoregressive distributed lag (ARDL) bound test approach was employed to establish co-integration between series. The estimated long and short-run models parameters demonstrated stability, best quality, efficiency, and unbiased results. The findings revealed that, in the long run, commercial bank loan to the agricultural sector and domestic credit to the private sector had a significant positive influence on poultry production index. On the other hand, agricultural credit guarantee scheme loans to poultry subunit and lending interest rates exhibited negative relationships. In the short run, the current year coefficient of lending interest rates, the agricultural credit guarantee scheme loans to poultry subunit and domestic credit to the private sector showed significant negative correlation with the poultry production index. However, commercial bank credit to the agricultural sector had a positive effect on poultry production in the short run. The implications of the findings justify the need to increase the commercial bank credit to the agricultural sector and domestic credit to private sector as a strategy to boost poultry production. Additionally, the agricultural credit guarantee scheme fund should be reassessed and modified to align its initial objectives. The lending rate should be deliberately lowered to increase credit access for poultry farmers.

1. INTRODUCTION

The bulk of rural farmers in Nigeria are resource-poor, with low income and savings capacity (Akpan et al., 2011; Akpan et al., 2013, Anderson et al., 2017, Isiorhovoja et al., 2020, Ahamefule et al., 2023). This makes it challenging for most farmers to adopt new technologies that would increase their agricultural efficiency and profitability. Agricultural credit is widely considered to be one of the mediating factors between the adoption of agricultural innovations and the increase in agricultural income among rural farmers in Nigeria (Oladeebo and Oladeebo 2008; Omonona et al., 2008). Farm credit is one of the fundamental components needed for sustainable agricultural production in a less developed economy like Nigeria (Imran et al., 2023). Therefore, the supply and demand for farm credit has become one of the prerequisites required for reducing rural poverty, guaranteeing food self-sufficiency and addressing the Sustainable Development Goals (SDGs) No. 2 in Nigeria (Adedokun 2021, Imran et al., 2023 and Egberi, 2023). Farm

credit is considered an important tool needed to promote rural agricultural production (Mejeha and Ifenkwe, 2007; Nwaru, 2011 and Bolarinwa and Fakoya, 2011). According to several studies, a significant proportion of farmers in developing countries are faced with credit constraints and production inefficiencies (Dorfman and Koop 2005; Hussein and Ohlmer, 2008 and Omonona et al., 2010). Due to the decades-long slow growth rate of the country's economy, there are frequent defaults among farmers and the corresponding reluctance of financial institutions (both formal and informal) to prioritize financing agricultural activities (Umoren et al., 2016; Umoren and Akpan 2021). The central government has recognized the importance of credit in agricultural production, and has responded by initiating agricultural credit policies and creating programs and institutions to enhance credit disbursement to famers. The manifestation of the Agricultural Credit Guarantee Scheme Fund (ACGSF) in 1977 is undeniably one of the successful agricultural credit finance intervention in country (Akpan et al. 2012). The intervention was seen as a palliative measure since official financial institutions paid little attention to agricultural credit financing. Other sources of credit financing introduced by the central government include the Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB) in 1972; the Nigerian Agricultural and Cooperative Bank (NACB) established in 1973 to provide medium and long-term loan to farmers. In 1980s, a rural banking policy was introduced that required Commercial Banks to set branches in the rural communities in order to push banking services closer to the farmers. In 1990, Community Banks were introduced in the country to further advance rural banking services. In addition, the Nigerian Agricultural Insurance Corporation (NAIC) was established in 1987 to insure farm produces against risks (Manyong et al., 2003; Eze et al., 2010; Anetor et al., 2016; Bako 2020).

Poultry businesses/enterprises are one of the sub-sectors of the agricultural economy that require additional financing in addition to the investment funds held by farmers (Akpan et al., 2013 and Akpan et al., 2020). Modern poultry farming requires producers to use modern technology and other resources in managing poultry operations (Udoh et al., 2017). For most Nigerians, it is one of the cheapest or most affordable sources of white meat. The poultry industry is undoubtedly among the most attractive investment opportunities in the agribusiness industry in Nigeria today. The subunit demand resources and necessitates the producer to have control over the environment, nutritional and health needs of the birds to ensure optimal production (Mottet and Tempio, 2017; Attia et al., 2022; Castro et al., 2023). The Nigerian government had previously promoted the development of modern poultry farms by setting up research institutes, hatcheries, and training programs in modern poultry management. In addition, collaboration in poultry production has been promoted through strategic measures such as public-private partnership (PPP), privatization, multilateral cooperation, and commercialization measures. These incentives have led to a sudden influx of people from diverse backgrounds into the poultry industry (Ajala et al., 2021).

Despite the numerous incentives for the country's poultry industry, the majority of Nigerians are experiencing a decline in animal protein intake (Akpan and Udo, 2021; Akpan and Nkanta, 2022; Akpan, 2022). Due to the advantages of poultry farming over other areas of livestock farming, the sub-sector can provide reliable cheap meat sources if resources are utilized appropriately. Therefore, providing cheap and sustainable animal protein to many poor households is the key to promoting poultry production in the country. Due to the capital intensive nature of a modern poultry enterprise and high poverty rate among farmers in Nigeria, it implies that increasing poultry production and its value chain would require exogenous stimulant such as credit. Given the multitude of interventions already implemented in the country, there is an overwhelming need to evaluate the performance of these tools. Again, a lot has happened over the last two decades in the Nigerian macroeconomic environment in which some of these interventions are anchored (Umoren et al., 2016; Umoren et al., 2018; Udoh and Akpan 2019). Therefore, the available information on the relationship between poultry production and credit policy needs to be updated for efficient production. Furthermore, identifying and understanding the relationship between poultry production and credit policy variables would provide policymakers with insights into solving the problem of credit shortage in this subsector.

However, the significance of this relationship has been examined by several authors using different study approaches. For example, Abedullah et al. (2009) and Khan et al., (2018) found a direct correlation between agricultural credit and livestock production in Pakistan. In Nigeria, Olagunju and Babatunde (2011) found a significant positive relationship between poultry farmers' productivity and credit acquisition, while Carrer et al. (2020) pointed out the importance of rural credit policies for the implementation of integrated crop-livestock systems in Brazil. Rahman et al., (2011) established a positive relationship between agricultural credit and livestock production derivatives (milk, meat and eggs) in Bangladesh. Similarly, Shiferaw et al. (2015) identified the positive effect of credit on livestock production in Ethiopia. Similarly, Kuye (2013) pointed out the positive contribution of microcredit to livestock production in the southern region of Nigeria. Furthermore, Orok and Ayim (2017) claimed that ACGSF had a greater

influence on the cereals subsector than the livestock subsector. Still in Nigeria, Abu (2017) and Reuben et al. (2020) found that ACGSF increased the productivity of the livestock subsector from 1981 to 2014. Udoka et al. (2016) and Asekome and Ikojie, (2018); Iliyasu, (2019), in Nigeria, found that lending interest rate influence agricultural investment negatively. Imran et al., (2023) in Pakistan opined that increase access to microcredit has a positive impact on sustainable rural development; social, economic, and environmental development of rural areas. They asserted that increase access to microcredit helps to alleviates rural poverty, reduce unemployment and promote higher productivity among farmers. Salisu and Alamu (2023) asserted that commercial bank loan to agricultural sector and lending interest rate have a positive effect on agricultural output in Nigeria.

From the literature reviewed, most researchers have found a significant relationship between livestock and credit variables. Poultry production as an important component of livestock production is not given due priority in terms of production and credit policy relations in Nigeria. Currently, poultry production enjoys greater acceptance than other components of the livestock subsector among Nigerian youths in all agriculture-based entrepreneurial skills acquisition programs (Akpan et al., 2017). In addition, poultry farming is productive, has a short gestation period, and its by-products are very useful raw materials for the country's agricultural-based industry. Furthermore, Nigeria has a greater comparative advantage in poultry production and consumption than any other component of the livestock sub-sector. Therefore, there is a need to provide useful empirical information on poultry production and its relationship with credit policy variables in order to improve poultry production and invariably animal protein consumption in Nigeria. Therefore, the study specifically sought to establish the empirical relationship between poultry production index and credit policy variables in Nigeria.

2. MATERIAL AND METHODS

Study Area: The study was conducted in Nigeria, located in the tropical zone of West Africa in the gulf of guinea. The country spans between latitudes 4° and 14° north of the equator and longitudes 3° and 15° east. Nigeria is endowed with rich agricultural resources, and the majority of its population is engaged in various forms of agricultural activities. Notable crops produced in Nigeria include; rice,yam, cassava, cowpea, wheat, maize, sorghum, onions, tomatoes, melons and vegetables among others. Aditionally, the country is rich in animal husbandry such as poultry, ruminants; monogastric animals, snail production among others (Federal Ministry of Environment, 2021).

Source of Data: The study used time series data obtained from the Central Bank of Nigeria, World Bank, and Food and Agriculture Organization (FAO), covering the period from from 1991 to 2022.

Theoretical Framework adopted

The study adopted a production theory framework. A production theory focuses on the combination of production inputs to generate the desired quantity of output. Assuming the production variables are time series, a typical long-run production function is represented as in equation one.

$$Y_t = \int (X_{1t}, X_{2t}, X_{3t}) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

The relationship signifies that the output (Y_t) depends on the combination levels of the variable inputs X_{1t}, X_{2t} and X_{3t}. According to several authors (Adjognon et al., 2017; Ullah et al., 2020; Adewale et al., 2022), agricultural credit facilitate the acquisition of agricultural inputs such as land, labour, capital and management. Therefore, the availability of agricultural inputs at any given time depends on the amount of agricultural credit accessible to the farm. This relationship can be expressed mathematically as follows:

$$X_t = \int (M_{1t}, M_{2t}, M_{3t}) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where M_t represents the sources of credit available to agricultural enterprises in period t. By combining equations (1) and (2), the relationship between production (Y_t) and the variables representing sources of credit for agricultural enterprises is given by:

$$Y_t = \int (X_{1t}, X_{2t}, X_{3t}, M_{1t}, M_{2t}, M_{3t}) \dots\dots\dots\dots\dots\dots\dots\dots (3)$$

Equation (3) illustrates that output at period "t" can be expressed as a function of credit variables.

Specification/Analytical Technique

The study employed the Cobb Douglas functional form to examine the contribution of the agricultural credit policy environment to the growth of poultry subunits (proxied by poultry production index) in Nigeria. The specification is implicitly shown in equation (4).

$$\mathrm{POU_t} = \mathrm{f(POG_t, CAG_t, LEN_t, DCP_t)} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

Where,

POU_t = Poultry gross production index (2014-2016 = 100) (%)

POG_t = Guarantee loan for poultry unit/total fund guarantee by Agricultural Credit Guarantee Fund Scheme (%)

CAG_t = Commercial bank credit to agricultural sector/economy GDP (%)

LENt = National lending interest rate (%).

DCP_t= Domestic credit to private sector (% of GDP)

The independent variables were selected from the literature base on the various credit policies implemented by the Nigerian government. For example, the federal government introduced the Agricultural Credit Guarantee Scheme Fund (ACGSF) in 1977. This scheme was specially enunciated to guarantee funds/credit to farmers using the Central Bank of Nigeria (CBN) as the sole guarantor (POG_t). Over the years, the federal government mandated commercial banks to allocate a certain proportion of their total credit and advances to agricultural production (CAG_t). In addition, the CBN has maintained regulated lending rates to moderate the volume of credit in the economy (LENt). Furthermore, the central government has implemented credit policies to incentivize the financial sector to boost private investment in critical sectors (DCP_t).

Relationship between the Credit policies and Poultry Production

The study utilized the Autoregressive Distributed Lag (ARDL) model to analyze the link between the poultry production index and agricultural credit environment policy variables. The ARDL model was chosen to confirm cointegration among specified series (Pesaran and Shin 1999 and Pesaran et al., 2001). Both short- and long-run models of poultry production index were estimated. The ARDL model offers several advantages over other techniques (Engle and Granger (1987) two-stage technique and Johansen and Juselius (1990) cointegration method), including handling series with mixed unit root problems, applicability to stationary series at levels or first differences, efficient for small and finite sample data, and provision of unbiased long run estimates (Harris and Sollis, 2003).

The ARDL model for poultry production index in logarithm form is expressed as follows:

$$\Delta POU_t = \eta_0 + \Phi_1 \sum_{i=1}^{n_1} \Delta POU_{t-i} + \Phi_2 \sum_{i=1}^{n_2} \Delta POG_{t-i} + \Phi_3 \sum_{i=1}^{n_3} \Delta CAG_{t-i} + \Phi_4 \sum_{i=1}^{n_4} \Delta LEN_{t-i} + \Phi_5 \sum_{i=1}^{n_5} \Delta DCP_{t-i} + \Psi_1 POU_{t-i} + \Psi_2 POG_{t-i} + \Psi_3 CAG_{t-i} + \Psi_4 LEN_{t-i} + \Psi_5 DCP_{t-i} + U_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

When using ARDL, the dependent variable forms a vector, implying that equation (5) is equally applied to the remaining independent variables in the model. The coefficients Φ_1 to Φ_5 represent short-run estimates of ARDL while Ψ_1 to Ψ_5 are the long-run coefficients. η_0 represent the drift or constant element and "n" denotes the maximum lag length. U_t is stochastic error term. The ARDL bound test is employed to verify the presence of co-integration among series. If the ARDL bound F-statistic exceeds the upper critical limit at the conventional probability levels (1%, 5%, or 10%) it indicates cointegration, rejecting the null hypothesis of no cointegration. The tested hypothesis is examplified as follows:

$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ (There is no cointegration)

$H_a: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$

If the ARDL bound F-statistic falls below the lower critical limits, the null hypothesis cannot be rejected, suggesting the absence of co-integration among series. When the ARDL bound F-statistic falls between the lower and upper critical limits, the test is interpreted as inconclusive (Pesaran et al., 2001). Upon confirming the presence of co-integration, then the long and short-run (ECM) models are specified.

The long run model is given as:

$$POU_t = \Psi_0 + \Psi_1 POG_t + \Psi_2 CAG_t + \Psi_3 LEN_t + \Psi_4 DCP_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

The short run model (ECM model) specification is:

$$\Delta POU_t = \Phi_0 + \Phi_1 \sum_{i=1}^{q_1} \Delta POU_{t-i} + \Phi_2 \sum_{i=1}^{q_2} \Delta CAG_{t-i} + \Phi_3 \sum_{i=1}^{q_3} \Delta LEN_{t-i} + \Phi_4 \sum_{i=1}^{q_4} \Delta DCP_{t-i} + \Phi_5 \sum_{i=1}^{n_5} \Delta POG_{t-i} + \forall ECM_{t-1} + U_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where $\forall$ represents the error coefficient or the ECM. The estimates capture the short run adjustment speed towards the long-run stability while the rest of the coefficients measure the short-run elasticity or impacts. The stability and reliability of the ECM were tested using RESET, serial correlation, normality, and heteroscedasticity tests. Additionally, cumulative sum (CUSUM) and CUSUMSQ tests were conducted to confirm the reliability of the ECM.

3. RESULTS AND DISCUSSION

The summary of descriptive tests of variables are shown in Table 1. The variability coefficients of variables were all less than 50.00%. The poultry production index exhibited the lowest volatility index of 16.03%, indicating minimal

fluctuations during the study period. The exponential growth rate of variables showed an average annual growth rate. Notably, all variables recorded a single-digit growth rate within in the study time frame. However, the guarantee loan for the poultry sub sector from the Agricultural Credit Guarantee Scheme Fund (POGt) demonstrated an annual exponential growth rate of 4.80%, while the lending interest rate (LENt) recorded a negative annual exponential growth rate of -1.59% per annum.

Table 1. Descriptive tests

Variable	Min	Max	Mean	Std. deviation	CV	Skewness	Exponential growth rate (%)
POU	75.033	127.47	97.135	15.572	0.16031	0.34219	1.40
POG	1.9716	15.004	8.5700	3.7469	0.43721	0.13733	4.80
CAG	15.824	76.661	43.488	19.647	0.45178	0.19264	4.71
LEN	11.483	31.650	18.739	3.7735	0.20137	1.2941	-1.59
DCP	5.2411	19.626	10.446	3.4607	0.33129	0.88032	2.69

Source: Prepared by author

Stationarity test

The ADF and ADF-GLS techniques (Dickey and Fuller, 1979; Elliott et al., 1996) were used to verify the stationarity of series, and the results are presented in Table 2. The results showed that the lending interest rate (LENRt) was stationary at the level, while others series were stationary at the first difference for ADF equation, including constant and trend. However, for the ADF-GLS equation including constant and trend, all specified series were stationary at their first difference. Hence, the result gave a mix of stationarity of the specified variables. The unit root test results justified the use of ARDL model on the specified series.

Table 2. Stationarity tests (ADF and ADF-GLS unit root tests)

Variable	ADF-GLS (with constant and trend)				ADF(with constant and Trend)			
	Lag	Level	1st Diff.	Decision	Lag	Level	1st Diff.	Decision
POU_t	0	-2.3458	-5.8094***	1(1)	0	-2.2570	-5.5997***	1(1)
POG_t	0	-1.2245	-6.1004***	1(1)	0	-1.04384	-5.8848***	1(1)
CAG_t	0	-2.9062	-6.1434***	1(1)	0	-2.9158	-5.9859***	1(1)
LEN_t	0	-3.2602**	-	1(0)	0	-3.1941	-5.7211***	1(1)
DCP_t	0	-2.7776	-4.7252***	1(1)	0	-2.8146	-5.2125***	1(1)
Critical values								
1%		-3.7700	-3.7700			-4.2967	-4.3098	
5%		-3.1900	-3.1900			-3.5684	-3.5742	
10%		-2.8900	-2.8900			-3.2184	-3.2217	

Note: Asterisks ***, ** and * indicate 1%, 5%and 1% level of significant. Variables in log.

The optimum lag length for series

The optimum lag length for series in ARDL model, was determined using information criteria (Akaike information criterion (AIC), Schwarz-Bayes criterion (SBC), and Hannan-Quinn criterion.). The corresponding optimum lag length needed for the estimation of ARDL is shown in Table 3. The result showed that lag 3 is the best lag for the ARDL model. Figure 3 displays 20 computed ARDL models based on AIC criterion.

Table 3. Optimal lag length of series

Lags	Loglik	P(LR)	AIC	BIC	HQC
1	30.40851		-1.950709	-1.607110	-1.859552
2	30.41780	0.89156	-1.868150	-1.475465	-1.763971
3	35.56204	0.00134	-2.213503*	-1.771733*	-2.096301*
4	37.63517	0.04173	-2.302931	-1.8122075	-2.172707
5	38.04123	0.36750	-2.253436	-1.713494	-2.110189

Asterisk level shows optimal lag length.

The ARDL bound test

The ARDL bound test was used to authenticate the presence of cointegration in series. The F-statistic for the selected equation (8.057) is shown in the upper part of Table 4. The result implies that the calculated F-test at the 1% probability level exceed the tabulated or crıtıcal upper bound value of 4.37.

Table 4. ARDL Bound Test (Restricted Constant and No Trend)

Equations	**Lag**	**F-Statistic**	**Decision**
F_{POUt}(POUt | CAGt, DCPt, POGt, LENt)	(3, 1, 3, 0, 3)	8.057329	Co-integration
Critical Values at Bound (at K = 4 and Asymptotic: n = 1000)			
Significant level	Lower (1(0)	Upper 1(0)	
10%	2.20	3.09	
5%	2.56	3.49	
2.5%	2.88	3.87	
1%	3.29	4.37	
Critical Values at Bound (at K = 4 and Finite sample: n = 35)			
10%	2.46	3.46	
5%	2.947	4.088	
1%	4.093	5.532	

Source: Extracted from analysis. Actual sample size (n) =27. Null hypothesis: No level relationship.

The findings imply that a long run equilibrium or stable equation exists for poultry production index. This indicates cointegration between the poultry production index and the specified macroeconomic variables, hence rejecting the null hypothesis. The bound test results infer stability or equilibrium of the long run poultry production index. Furthermore, the short-run or ECM model was generated to capture the short-run dynamics and identify the speed of adjustment in response to the deviation from the long-run equilibrium. After establishing the cointegration of series, the results in Table 5 show the estimates or parameters of the long-run of the ARDL model.

The long run model

The parameters of the long-run model showed that the commercial bank total credit to the agricultural sector (CAGt) has a positive significant association with poultry production (with a significant probability level of 10%). The finding denotes that a unit increase in the commercial bank total credit to the agricultural sector would lead to 0.55% increase in the poultry production index. This means that with every increase in the commercial bank credit to the agricultural sector, poultry production will be increased accordingly. The result reveals the importance of commercial bank credit in poultry production in Nigeria. The finding also implies inelastic relationship between commercial bank credit to agriculture and poultry production. This means that the change in commercial bank credit to the agricultural sector is larger than the change in the gross poultry production index. A similar relationship has been established by Abedullah et al. (2009); Rahman et al. (2011); Olagunju and Babatunde (2011); Kuye (2013); Shiferaw et al. (2015) and Khan et al., (2018).

The result found a positive significant relationship between the domestic credit to the private sector variable and the index of gross poultry production in Nigeria. The finding revealed that, a one percent increase in the domestic credit to the private sector variable would result in a 0.43% increase in poultry production index. Alternatively, the production of poultry in Nigeria could be increased if the private sector received more domestic credit. The finding result is in line with a priori expectation. The country has recently witnessed massive investments in agro-industrial units, particularly poultry feed, agrochemicals and hatchery production, driven mainly by the private sector. The country currently is the largest egg producer and second largest chicken producer in Africa, hence offering enormous potential for private investment. Again, the provision of incentives and the protection of the domestic poultry market (through poultry importation ban) have attracted private investment resulting in a corresponding increase in the subsector's output.

Table 5. The Long- run estimates

Variable	**Coefficient**	**Standard error**	**t-value**	**Prob.**
Constant	7.50557	1.99736	3.75775***	0.0024
CAG_t	0.54794	0.28637	1.91343*	0.0780
DCP_t	0.42752	0.12224	3.49723***	0.0075
POG_t	-0.38968	0.12422	-3.13691***	0.0090
LEN_t	-0.74404	0.28750	-2.58799**	0.0209

Asterisks ***, and ** indicate 1% and 5% level of significance respectively. Variables in log.

The results also showed that the agricultural credit guarantee scheme loan to poultry enterprises/farmers (ACGt) has a negative significant correlation with poultry production index at 1% probability level. This suggests that a unit surge in the guaranteed loan to poultry farmers would reduce the gross poultry production index by 0.39%. The finding contradicts a priori expectation. Several factors could be responsible for this result. Firstly, it could be the timely provision of credit facilities. Since agricultural activities are largely regulated by natural phenomena like rainfall, seasons, etc., timely disbursement of loan is of utmost importance for increasing poultry production. Secondly, the widespread corruption among loan administrators also contributed to this result. For instance, if poultry loan are diverted to unintended beneficiaries, the amount of loans disbursed will be accounted for by the poultry unit. The third factor could be attributed to poor monitoring and evaluation of the agricultural credit guarantee loan process and high default rate, which prevented efficient recycling of the credit process. The finding contradict the empirical reports of Orok and Ayim (2017) and Abu (2017).

The result establishes a negative significant relationship between the poultry production index and the lending interest rate in the long run. Further exposition of the finding revealed that a one percent increase in the lending interest rate would result in 0.74% decline in the gross poultry production index. This means that as lending interest rates rise, poultry production will decrease significantly in the long run. The result align with a priori expectations. For instance, poultry production is known to be very prolific, resource oriented and has a short gestation period. Therefore, poultry farmers/enterprises would swiftly react to an increase in the lending interest rate by reducing production as it will affect resource availability and efficiency. The finding agrees with the reports of Udoka et al. (2016); Asekome and Ikojie, (2018); Iliyasu, (2019), but contradict the submission of Salisu and Alamu (2023).

The short run ARDL model

The estimated parameters of ARDL short run model are presented in Table 6. The parameter or coefficinet of the error correction variable is negative and statistically significant at 1% probability level. This finding affirms the existence of cointegration between the poultry production index and the specified macroeconomic variables. The coefficient of tthe residuals variable (ECM) represents the adjustment speed in the long-run equilibrium following a short-run disturbance or shocks. This shows that annually about 77.69% of the disequilibrium in the short-run model is adjusted towards its long-run equilibrium. The ECM diagnostic tests produced an R2 of 0.976, indicating that the agricultural credit policy variables explained about 97.60% of the total variations in poultry production index in the country.

The empirical result showed that the commercial bank credit disbursed to the agricultural sector at level has a direct short-run influence on poultry production index. The result suggests that a unit increment in commercial bank credit to the agricultural sector will shift the index of gross poultry production by 0.335% in the short run period. The finding means that an increase in the current year commercial bank credit to the agricultural sector would boost current year poultry production. For the current year relationship, increase in efficiency in the financial system and prioritizing agricultural financing could be responsible for the results. However, for the previous 3-year value of commercial bank credit to the agricultural sector, the relationship was reversed. This means that the lag 3 of the commercial bank credit to the agricultural sector is negatively related to the country's current poultry production index. The result could be attributed to the instability in the macroeconomic variables in the last decade and the issue of disease outbreak that rampage the poultry subsector in the previous years. A similar relationship has been established by Abedullah et al. (2009); Rahman et al. (2011); Olagunju and Babatunde (2011); Kuye (2013); Shiferaw et al. (2015) and Khan et al. (2018).

The agricultural credit guarantee loan provided to poultry farmers/enterprises by ACGS had a negative significant correlation with poultry production. This means that if the value of the loan guarantee for poultry beneficiaries in the short run is increased by one percent, the index of poultry production will decrease by 0.054%. The outcome is comparable to that of a long-run relationship. However, the current poultry production index is positively correlated with the agricultural credit guarantee loan to poultry beneficiaries for the previous one and two year's variables. The finding revealed that the slope coefficient of the previous one and two years agricultural credit guarantee loan to poultry beneficiaries has a stimulating impact on the gross poultry production index whereas the current year slope coefficient of agricultural credit guarantee loan had opposite relationship. Orok and Ayim (2017); Abu (2017) have reported similar result.

The previous year 1 and year 2 values of the poultry production indices correlate positively with the current year production index. These results imply that the poultry farmers' current year production index is the response of the previous year's production indices. The finding implies that the current year output of the subsector depends on the performance of the previous year outputs. Hence, stimulating outputs in the subsector through prudent financial system will produce sustainable growth in output in the subsector.

Table 6. The Short - run model (Restricted constant, no trend)

Variable	Coefficient	Standard error	t-value	Probability
D(POU)(-1)	0.78259	0.10908	7.17457***	0.0008
D(POU)(-2)	0.97956	0.08056	12.15940***	0.0001
D(DCP)	-0.01942	0.04448	-0.43674	0.6805
D(DCP)(-1)	-0.02275	0.05094	-0.44658	0.6739
D(DCP)(-2)	-0.21070	0.05335	-3.94958***	0.0109
D(LEN)	-0.34439	0.06641	-5.18571***	0.0035
D(LEN)(-1)	0.40250	0.05228	7.69869***	0.0006
D(LEN)(-2)	0.22898	0.04672	4.90157***	0.0045
D(LEN)(-3)	0.69875	0.06543	10.67960***	0.0001
D(POG)	-0.05444	0.01407	-3.87067**	0.0118
D(POG)(-1)	0.09894	0.01294	7.64814***	0.0006
D(POG)(-2)	0.09958	0.01121	8.88508***	0.0003
D(CAG)	0.33513	0.04632	7.23539***	0.0008
D(CAG)(-1)	0.05651	0.04527	1.24824	0.2672
D(CAG)(-2)	0.05636	0.04101	1.37423	0.2278
D(CAG)(-3)	-0.05452	0.02712	-2.01025*	0.1006
ECM (-1)	**-0.77693**	**0.09585**	-8.10560***	**0.0005**
R-Squared	0.975716	Adjusted R-Squared		0.936862

Source: Obtained from Eview results. Asterisk ***, and ** indicate 1% and 5% probability respectively. Variables in log., difference. ARDL lag length (3, 3, 4, 3, 4) from Akaike info criterion.

The lending interest rate at level is found to have a significant negative correlation with the index of poultry production. For instance, a 10% increase in size of the lending interest rate would leads to a 3.44% decline in the gross poultry production index. The result suggests that in the short run, as lending interest rates rise, poultry production index will decline accordingly. The finding is consistent with the study's expectation, as an increment in the lending interest rate is known to upsurge agricultural risk and limit farmers' capacity to expand production and agricultural investment. However, the coefficients of the previous one, two- and three-year lending interest rate are positively correlated with poultry production index in the country. The results can largely be explained by the misalignment of the national credit policy with agricultural development policy. Other conditions that likely contributed to the results include: high level of inflation, deteriorating value of domestic currency, and the nature of market supply and demand for credit in the economy among others. The negative relationship between the poultry production index and lending interest rate corroborates Udoka et al. (2016); Asekome and Ikojie, (2018) and Iliyasu, (2019).

Furthermore, the finding revealed a negative significant relationship between the value of domestic credit to the private sector in the last two years and poultry production in Nigeria. According to the outcome, there will be a 0.211% drop in the poultry production index, with a 1% rise in domestic credit granted to the private sector. The risky nature of agribusiness, the low returns of the agricultural sector and the reluctance of the private sector as well as banks to invest in agribusinesses in the short run period could help to explain the results.

Diagnostic test of the ECM

From the result presented ın table 7, there is no significant autocorrelation of residuals as shown by the value of Breusch-Godfrey serial correlation (LM test) (3.345). According to Laurenceson and Chai, (2003), the presence of autocorrelation does not affect the short-run parameters. In addition, the null hypothesis was not rejected for RESET test, the Breusch-Pagan test of heteroscadasticity, normality test and the CUSUM tests. This implies that short run model or ECM has structural rigidity, no heteroscedasticity, normally distributed error terms, and is stable within the specified time frame.

Table 7: Diagnostic Statistics

Test	Value	Probability
Ramsey RESET Test	1.136139	0.3193
Normality test (Jarque-Bera)	1.355929	0.5076
Heteroscedasticity (Breusch-Pagan-Godfrey)	1.021700	0.4873
Breusch-Godfry Serial Correlation LM Test	3.345467	0.1722

Note: prepared by authors

Test of the Stability of the ARDL ECM

The plots of the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) obtained from the ARDL-ECM model are shown in Figures 1 and 2, respectively. The results indicate stability of the model estimates. The plots lie within the critical bands of the 5% confidence interval (or 95% probability levels) of parameter stability.

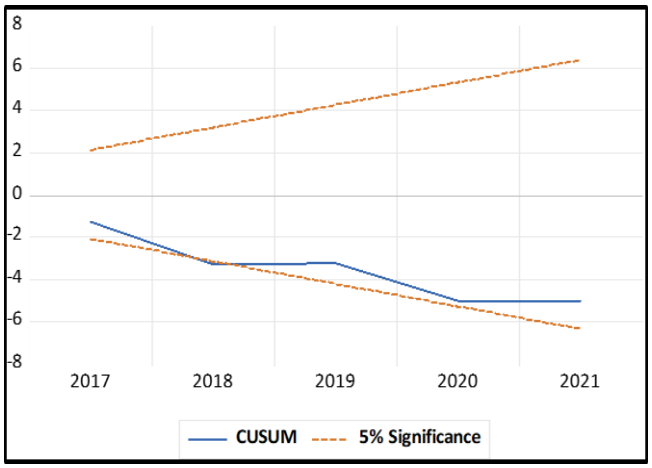

Figure 1. Plot of CUSUM for parameters' stability of ARDL model.

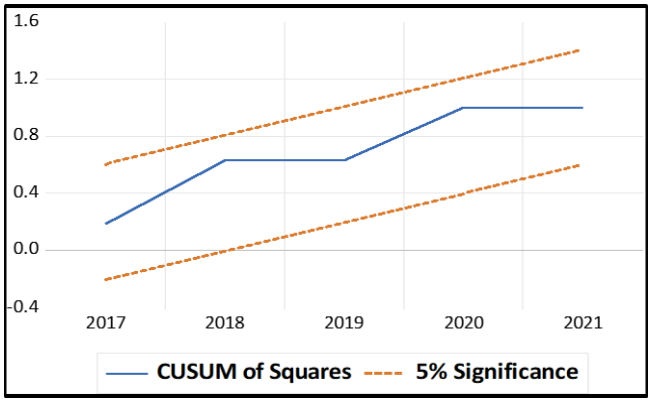

Figure 2. Plot of CUSUMSQ for parameters' stability of ARDL model.

4. CONCLUSION

The analysis identified an empirical correlation between certain agricultural credit policy variables and the poultry production index in Nigeria. The study used secondary information obtained from the World Bank (WB), Food and Agriculture Organization (FAO) and Central Bank of Nigeria (CBN). The unit root of series were determined by ADF and ADF-GLS methods. The results of the unit root showed that one variable was non-stationary at level I(0), but became stationary at the first difference 1(1). The other variables were non-stationary at level, nonetheless they were stationary at their first difference. The cointegration of series was tested by the ARDL bound test, confirming the evidence of the long run equilibrium. After confirming the evidence of cointegration of variables, the parameters of the long run model and ECM or short-run model of the poultry production index were estimated. The parameter of the error correction term was statistically significant at 1% significant level and exhibited appropriate sign. The finding showed that the commercial bank loans to the agricultural sector are positively linked to the poultry production index in the long and short run periods. However, in the short run, the lag 3 of the commercial bank loans to the agricultural sector showed a negative influence on the poultry production index. On the contrary, the agricultural credit guarantee scheme loans allocated to the poultry subunit were negatively correlated with poultry production index in the short and long run periods. In the short-run model, the result was mixed as lags 1 and 2 of the loan guarantee for the poultry unit showed a positive association with poultry production index. The lending interest rate and poultry production index are negatively correlated in both short and long run periods. Again, the results were mixed in the short run model as lags 1, 2 and 3 of the lending rate were found to have a positive association with poultry production index. The relationship between the total domestic credit to the private sector and the poultry production index in the long run was positive, but it was negative in the short run. The summary of findings revealed that the credit policy environment played a significant role in poultry production in Nigeria. Conversely, the results demonstrated the importance of a sound credit policy environment in stimulating growth in the poultry subsector of Nigeria. The findings showed the significant of sustainable credit policy in achieving the Sustainable Development Goal (SDGs) of zero hunger in the nearest future in Nigeria.

Based on these empirical facts and the need to boost poultry production in a sustainable way in Nigeria, it is recommended that the commercial bank credit to the agricultural sector be increased to provide more incentives to poultry farmers/enterprises to increase poultry production. Additionally, the domestic lending to the private sector should be strengthened or increased as a means to surge poultry production in the country. Moreover, the current lending rate in the country should be reduced to improve poultry farmers/enterprises access to farm credit. The Agricultural Credit Guarantee Scheme loans for the poultry sub-sector should be reassessed and monitored to achieve the desired objectives.

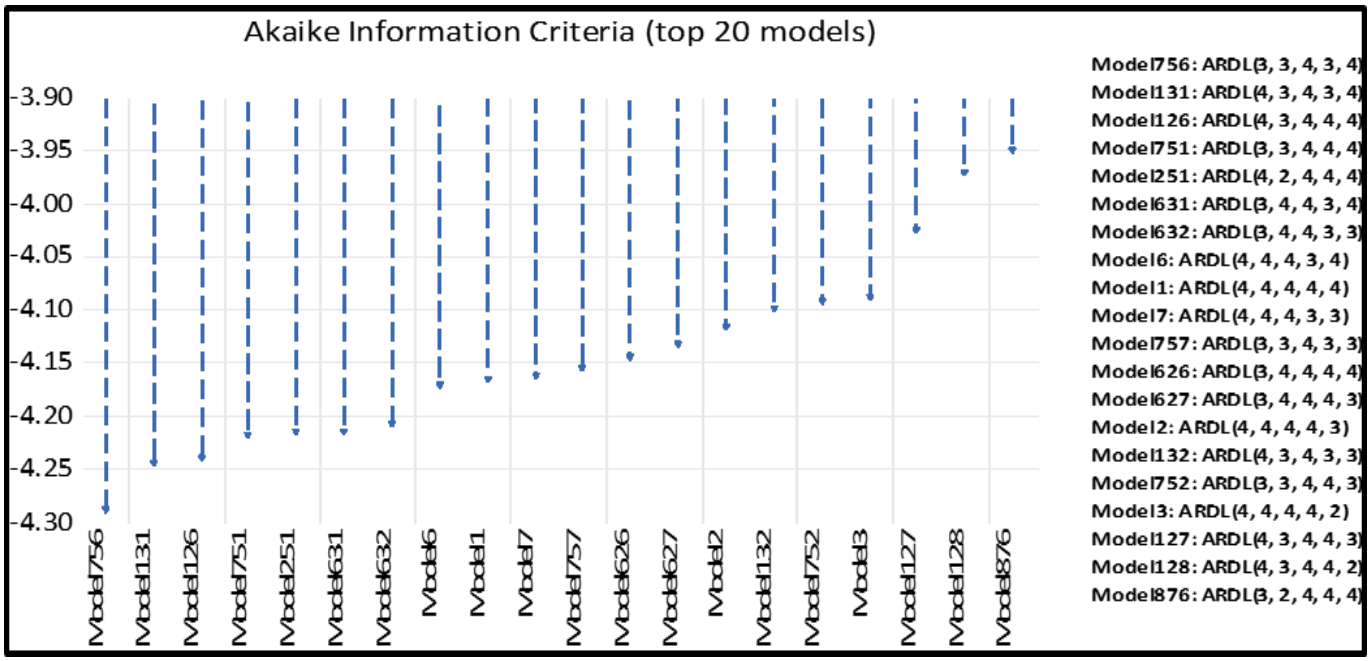

Figure 3. Akaike information criteria graph.

COMPLIANCE WITH ETHICAL STANDARDS

Author Contributions

Authors contributed equally to this paper.

Conflict of Interest

The authors do not have any conflicts of interest to declare.

Ethical Approval

For this type of study, formal consent is not required.

REFERENCES

Abedullah, N. Mahmood, M. K. & S. Kouser, S. (2009). The role of agricultural credit in the growth of livestock sector: a case study of Faisalabad. Pakistan Vet. J., 29(2): 81-84.

Abu, O. (2017). Impact of agricultural credit guarantee scheme fund (ACGSF) on livestock production in Nigeria: evidence from historical data. Journal of Agriculture and Environment, 13(2), 1-11

Adedokun, B. (2021). Nigeria's Food Insecurity and Its Implications on Sustainable Development Goal (SDG) 2 amidst the COVID-19 Era. Journal of Good Governance and Sustainable Development in Africa (JGGSDA), 6(5):18-26. Available at: https://doi.org/10.36758/jggsda/v6n5.2021/2.

Adewale, A. T., Lawal, O. A., Aberu, F., & Toriola, A. K. (2022). Effect of credit to farmers and agricultural productivity in Nigeria. East Asian Journal of Multidisciplinary Research, 1(3), 377-388.

Adjognon, S. G., Liverpool-Tasie, L. O., Reardon, T. A. (2017). Agricultural input credit in Sub-Saharan Africa: Telling myth from facts, Food Policy, Volume 67, Pages 93-105,https://doi.org/10.1016/j.foodpol.2016.09.014.

Ahamefule, B. A., Oke, U. R., Nnamani, N. G. and Ezeugo, K. O. (2023). Financial Savings and Capital Formation among Rural Farmers in Abia State, Nigeria. Nigerian Agricultural Journal, 54(1), 402-408.

Ajala, A. O. Ogunjimi, S. I., Famuwagun, O. S. & Adebimpe, A. T. (2021). Poultry Production in Nigeria: Exploiting Its Potentials for Rural Youth Empowerment and Entrepreneurship. Nigerian Journal of Animal Production, 48(1): 114 - 123. doi.org/10.51791/njap.v48i1.2890·

Akpan, S. B. (2022). Trends in major ruminant meats production and the roles of the macroeconomic environment in Nigeria. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development 22(4), 49 – 62.

Akpan, S. B. & Nkanta, V. S. (2022). Trend Analysis and Macroeconomic Variable Determinants of Egg Production in Nigeria. Journal of Agricultural Production, 3(2), 100-109. https://doi.org/10.56430/japro.1174674.

Akpan, S. B., Offor, O. S. & Archibong, A. E. (2020). Access and demand for credit among small scale agro-based processors in Uyo agricultural zone, Akwa Ibom State, Nigeria. Nigerian Journal of Agriculture, 51(1), 132-141.

Akpan, S. B., Inimfon V. P., Samuel J. U., Edem A. O., & Uwemedimo E. O. (2013). Determinants of Credit Access and Demand among Poultry Farmers in Akwa Ibom State, Nigeria. American Journal of Experimental Agriculture,3 (2): 293-307.

Akpan, S. B., Umoren, A. A. & Okon, U. O. (2017). Youths and off-Farm Economic Employments: A Case Study of Youths in the Rural Areas of Akwa Ibom State, Nigeria. International Journal of Agriculture and Rural Development, 20 (1): 2914-2925.

Akpan, S. B. & Udo, U. J. (2021). Indigenous meat and milk gross production indexes and the dynamic macroeconomic fundamentals in Nigeria: ARDL model approach. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 21(3); 97 – 110.

Akpan, S. B., E. J. Udoh, & A, E. Aya (2011). Analysis of saving determinants among agro-based firm workers in Cross River State, Nigeria: A simultaneous Equation approach. Research on Humanities and Social Sciences, 1(3).1-11.

Akpan, S. B., Inimfon V. P., Samuel J. U., and Uwemedimo E. O. (2013). Determinants of Food Consumption Expenditure among Agro-Based Firms Workers in Southern Nigeria: Simultaneous Equation Approach. Asian Journal of Agricultural Extension, Economics & Sociology, 2(1): 69-84. 10.9734/AJAEES/2013/2919.

Akpan, S. B., Obot D. Akpan. & Ubon A. Essien, (2012). Government Agricultural Credit Policy and Macroeconomic Fundamentals: a case study of Agricultural Credit Scheme Fund (ACGSF) in Nigeria. Public Policy and Administration Research, 2(2), 61-75.

Anderson, A., Marita, C., Musiime, D. & Thiam, M. (2017). National survey and segmentation of smallholder households in Nigeria: Understanding their demand for financial, agricultural, and digital solutions. CGAP Working Paper. Retrieved from https://www.cgap.org/sites/default/files/Working-Paper-Survey+Segmentation-of-Smallholders-Nigeria-Oct-2017.pdf.

Anetor, F. O., Ogbechie, C., Kelikume, I. & Ikpesu, F. (2016). Credit Supply and Agricultural Production in Nigeria: A Vector Autoregressive (VAR) Approach. Journal of Economics and Sustainable Development, 7(2), 131 – 143.

Asekome M. & Ikoje, S. (2018). An Empirical Investigation on Impact of Interest Rates on Agricultural Investment in Nigeria. Journal of Economics and Business 1(1):71-82. DOI: 10.31014/aior.1992.01.01.7. Attia, Y.A.; Rahman, M. T., Hossain, M. J., Basiouni, S., Khafaga, A. F., Shehata, A. A. & Hafez, H. M. (2022). Poultry Production and Sustainability in Developing Countries under the COVID-19 Crisis: Lessons Learned. Animals, 12, 644. https://doi.org/10.3390/ani12050644.

Bako, B. D. (2020). Agricultural credit policy in Nigeria: prospects and challenges. Journal of Agripreneurship and Sustainable Development (JASD), 3(1), 77-85.

Bolarinwa, K.K. & Fakoya, E.O. 2011. Impact of Farm Credit on Farmers Socio-economic Status in Ogun State, Nigeria. J. Soc. Sci. 26(1):67-71.

Carrer, A. J., Maia, A. G., Vinholis, M. B. & Filho, H. M. (2020). Assessing the effectiveness of rural credit policy on the adoption of integrated crop-livestock systems in Brazil. Land Use Policy, Volume 92, 2020.

Castro, F. L. S., Chai, L., Arango, J., Owens, C. M., Smith, P. A., Reichelt, S., DuBois, C. & Menconi, A. (2023). Poultry industry paradigms: connecting the dots. Journal of Applied Poultry Research, 32(1),https://doi.org/10.1016/j.japr.2022.100310.

Dickey, D. A. & Fuller, W. A. (1979). Distribution of the estimators for autorregressive time series with a unit root, Journal of the American Statistical Association, 74, 427-31.

Dorfman, J. H. & Koop, G. (2005). Current developments in productivity and efficiency measurement Journal of econometrics, Elsevier. 2005; 126 (2):233-240.

Egberi, A. E. (2023). Sustainable Development Goals 1 & 2 Compliant: Evaluating Nigeria's Agricultural Policies 2010 - 2019. IRASD Journal of Management, 5(2), 87–95. https://doi.org/10.52131/jom.2023.0501.0109.

Elliot, G., Rothenberg, T. J. & Stock, J. H. (1996). "Efficient tests for an autoregressive unit root". Econometrica, 64, 813-836.

Engle, R. F. & Granger, C. W. J. (1987). "Co-integration and Error Correction: Representation, Estimation, and Testing". Econometrica, 55, 251-276.

Eze, C. C., Lemchi, J. J., Ugochukwu, A. I., Eze, V. C., Awulonu, C. A. & Okon, A. X. (2010). Agricultural financing policies and rural development in Nigeria. The 84th Annual Conference of the Agricultural Economics Society Edinburgh, 29th to 31st March 2010.

Federal Ministry of Environment 2021. https://environment.gov.ng/. retrieved on the 21st of May, 2021.

Harris, R. & Sollis, R. (2003). Applied Time Series Modeling and Forecasting. Wiley, West Sussex.

Hussein H. K. & Ohlmer, B. O. (2008). Influence of Credit Constraint on Production efficiency: The Case of Farm Households in Southern Ethiopia. Department of economics, Swedish University of Agricultural Sciences. Sweden.

Iliyasu, A. S. (2019). An Empirical Analysis of the Impact of Interest Rate on Agriculture in Nigeria. Journal of Economics and Sustainable Development, 10(22), 106-112. DOI: 10.7176/JESD/10-22-19.

Imran, M., U. L. Haq, S. & Ozcatalbas, O. (2023). Role of Microcredit in Sustainable Rural Development. IntechOpen. doi: 10.5772/intechopen.102588.

Isiorhovoja, R. A., Ebewore, S. O. & Nwachi, S. (2020). Farmers' attitude and behavior toward savings in Ika south local government area of delta state, Nigeria. Asian Journal of Agriculture and Rural Development, 10(1), 406-419'112.

Johansen, S. & Juselius, K. (1990). "Maximum likelihood estimation and inference on cointegration with applications to the demand for money". Oxford Bulletin of Economics and Statistics, 52, 169-210.

Khan, K., M.A. Kamal, S. Ramazan, G. Khan, G. Ali & S. Ahmed (2018). Impact of agricultural credit on livestock income: a case study of district lasbela, balochistan . Sarhad Journal of Agriculture, 34(2): 246-250.

Kuye, O. O. (2013). Effects of Micro-Credit on Livestock Production among Smallholder Livestock Farmers in Yakurr LGA, Cross River State, Nigeria. International Journal of Science and Research (IJSR), 5(9), 65 – 68. DOI: 10.21275/20081603.

Mejeha, R. O. & Ifenkwe, G. E. (2007). Density and Microfinance Service Coverage of Rural Banks in Nigeria. International Journal of Agriculture and Rural Development, 10(2):1-6

Mottet, A., & Tempio, G. (2017). Global poultry production: Current state and future outlook and challenges. World's Poultry Science Journal, 73(2), 245-256. https://doi.org/10.1017/S0043933917000071.

Nwaru J. C., Essien U. A. & Onuoha R. E. (2011). Determinants of Informal Credit Demand and Supply among Food Crop Farmers in Akwa Ibom State. Nigeria Journal of Rural and Community Development, 6 (1); 1712-8277.

Oladeebo, J.O. & Oladeebo, O.E. (2008). Determinants of Loan Repayment among Smallholder Farmers in Ogbomoso Agricultural Zone of Oyo State, Nigeria. J. Soc. Sci.; 17(1) 59-62.

Olagunju, F. I. and Babatunde, R.O. (2011). Impact of Credit on Poultry Productivity in South-Western, Nigeria. ARPN Journal of Agricultural and Biological Science, 6(10): 58-65.

Omonona B. T., Lawal J. O. & Oinlana, A. O. (2010). Determinants of Credit Constraint conditions and production efficiency among farming households in south western Nigeria. Contributed paper presented at the joint 3rd African association of agricultural economists (AAAE) and 48th agricultural economists association of South Africa (AEASA) conference, Cape Town, South Africa. September 2010; 19-23.

Omonona, B.T., Akinterinwa, A.T. & Awoyinka, Y.A. (2008). Credit Constraint and Output Supply of Cowan Farmers in Oyo state Nigeria. European Journal of Social Sciences, 6(3):382-390.

Orok, A. B. & Ayim, S. A. (2017). The Impact of Agricultural Credit Guarantee Scheme Fund on Agricultural Sector Development in Nigeria. International Review of Management and Business Research, 6 (3), 1104 – 1116.

Pesaran, M. H. & Y. Shin. (1999). An autoregressive distributed lag modelling approach to cointegration analysis. In Storm, S. (eds), Econometrics and Economic Theory in 20th Century: The Ragnar Frisch Centennial Symposium. Cambridge: Cambridge University Press.

Pesaran, M. H., Y. Shin and R. J. Smith (2001). Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics 16: 289-326.

Rahman, W. M., Jianchao L. & Enjiang C. (2011): "Policies and performances of agricultural/rural credit in Bangladesh: What is the influence on agricultural production?" African Journal of Agricultural Research, 6(31); 6440-6452.

Reuben, J., Nyam, C. M. & Rukwe, D. T. (2020). Agricultural credit guarantee scheme fund and its effect on agricultural output in Nigeria. Review of Agricultural and Applied Economics, 24(2); 102-111. doi: 10.15414/raae.2020.23.02.102-111.

Salisu, T. Q. & Alamu, O. K. (2023). Effect of Bank Lending on Agricultural Output in Nigeria From 1981–2021 (Auto-regressive Distribution Approach). DOI: https://doi.org/10.21203/rs.3.rs-3235799/v1.

Shiferaw, K., Geberemedhin, M. & Legesse, D. (2015). What factors affect households' decision to allocate credit for livestock production? Evidence from Ethiopia. Available online at https://mpra.ub.uni-muenchen.de/69344/MPRA Paper No. 69344, posted 10 Feb 2016 06:12 UTC.

Ullah, A., Mahmood, N., Zeb, A. & Kächele, H. (2020). Factors Determining Farmers' Access to and Sources of Credit: Evidence from the Rain-Fed Zone of Pakistan. Agriculture, 10(12):1-13. https://doi.org/10.3390/agriculture10120586

Udoh, E. J., Akpan, S. B. & Uko, E. F. (2017). Assessment of Sustainable Livelihood Assets of Farming Households in Akwa Ibom State, Nigeria. Journal of Sustainable Development; 10 (4); 83 – 96. doi:10.5539/jsd.v10n4p83.

Udoh, E. J., & S. B. Akpan. (2019). Macroeconomic variables affecting fish production in Nigeria. Asian Journal of Agriculture and Rural Development, 9 (2); 216 – 230.

Udoka, C. O., Mbat, D. O. & Duke, S. B. (2016). The effect of commercial banks' credit on agricultural production in Nigeria. Journal of Finance and Accounting, 4(1), 1-10.

Umoren, A. A. & Akpan, S. B. (2021). "Relationships among Non-Performing Loans, Macroeconomic and Banks' Specific Variables in Nigeria's Economy: ARDL Model Approach." IOSR Journal of Economics and Finance (IOSR-JEF), 12(06); 27-35.

Umoren, A. A., Akpan, S. B. & Udoh, E. J. (2016). Analysis of Empirical Relationship among Agricultural Lending, Agricultural Growth and Non-Performing Loans in Nigerian Banking System. Economy, 3 (2); 94-101.

Umoren, A. A., Eyo, E. O. & Akpan, S. B. (2018). Investigating the nexus between Non- Performing Loans in the Nigerian Banking System and Lending to Micro-Small Medium Enterprises. International Journal of Contemporary Research and Review; 09 (6); 20778 – 20791.

Umoren. A. A., Edet, J. Udoh. &Akpan, S. B. (2016). Analysis of loan default among agricultural credit guarantee Scheme (ACGS) loan beneficiaries in Akwa Ibom State, Nigeria. African Journal of Agricultural Economics and Rural Development.2(2); 121 – 128. DOI: 10.18488/journal.1005/2019.9.2/1005.2.216.230..