DBN Development Bank of Nigeria
RC 1215724
...Financing Sustainable Growth

WORKING PAPER SERIES

217, 2020

Agro-Industrialisation and Financial Intermediation in Nigeria

Forthcoming: African Journal of Economic and Management Studies

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Abstract

The study analyses the role of finance in the agro-industrialisation nexus in Nigeria using annual data on manufacturing value-added, agricultural value-added and volume of finance availed to the agricultural sector from 1981 to 2015. To establish the presence of a long-run relationship, the error correction model and bounds cointegration techniques are employed. Likewise, the model is augmented to test whether the associated relationship between industrial output and agricultural output depends on access to finance by farmers with the inclusion of an interaction term. Some salient contributions to the literature are as follows: (1) agriculture and finance are strong and positive predictors of industrialisation in the long-run; (2) in the short-run, past realisations of industrial output and finance have significant asymmetric effects on industrial output; (3) the explanatory power of agriculture decreases with the growth of the financial system and (4) the long-run results validate the role of finance in the agro-industrialisation nexus. Given these findings, achieving growth in the agricultural sector that will induce desired industrialisation should be prioritised by the government through agencies such as the central bank, financial intermediaries and other stakeholders with a view to making agricultural financing a major concern for sustainable domestic consumption and industrial growth.

***Keywords*:** Agriculture, industrialisation, financial intermediation, cointegration, causality

***JEL codes*:** E44; G18; O13, O14; Q14

1 Introduction

Agriculture and industrialisation are closely inter-woven. Industrialisation spurs economic development, job and wealth creations, increase in output, reduction in prices, diversification of the economy with a feedback effect on agriculture, while agriculture, on the other hand, is one of the platforms on which industrialisation hinges. Efficiency in the agricultural sector can enhance national food security by increasing food supply and effecting lower agricultural produce and product prices, thereby promoting low food inflation, increasing output, generating employment, diversifying the revenue base, boosting foreign exchange earnings and providing input for the industrial sector on a sustainable basis (Central Bank of Nigeria, 2014). In other words, both sectors are necessary for economic growth and development.

Agriculture is conventionally considered as the "backbone" of Nigeria's economy with many assigned roles to perform in the course of achieving economic advancement (Anetor *et al.*, 2016). Among the roles are: the provision of adequate food for the growing population, providing sufficient raw materials to its budding manufacturing sector, constituting the main source of employment, creating a major source of foreign exchange earnings, and providing a market for the products of the industrial sector (Osabohien *et al.*, 2017). However, problems in the agricultural sector began to arise about a decade after independence with increasing short-fall in food supply, rising food prices and declining foreign exchange earnings from agricultural exports, rising food import bills, and declining labour force required in the sector (Obayelu, 2015; Osabuohien, 2016). The situation is further worsened by the aftermath of the civil war, severe droughts in some parts of the country, government fiscal and monetary policies and above all, an "oil boom" which created serious distortions in the economy and accelerated the rate of migration of labour from agriculture (Anthony, 2010; Egwu, 2016).

To stem this declining tide, the federal government embarked on several agriculture promotion measures required to revamp the sector amongst which is the move from rudimentary farming to commercialised farming in the form of large-scale land investments (Osabuohien, 2014), a renewed vigour into research, innovation and development (Federal Ministry of Agriculture, 2016) and the establishment of various agro-financing schemes. Some of the agro-credit schemes are the Nigerian Agricultural and Co-operative Bank (NACB) established in 1972, the Agricultural Credit Guarantee Scheme Fund (ACGSF) in 1977, the Commercial Agriculture Credit Scheme (CACS), Nigerian Agricultural Insurance Corporation (NAIC) in 1987, the Nigerian Agricultural Co-operative and Rural Development Bank (NACRDB) in 2000 and the Agricultural Credit Support Scheme (ACSS) in 2006, just to mention a few (Efobi and Osabuohien, 2011). These schemes complement one another and are special initiatives of both the federal government and the CBN in providing concessionary funding for agriculture such as the ACGSF which is mostly for small scale farmers. It is important to state that the role of financial institutions in the agro-commercialisation agenda is paramount to driving local output, exports, industrialisation, enhancing tradability, increasing global competitiveness and foreign exchange. Given the above, little is known about the agro-industrialisation and financial reform relationship in Nigeria.

This study, therefore, complements the scholarly and policy literature (discussed in Section 2) by exploring the significance of finance in the agro-industrialisation nexus. Understanding such a relationship is pertinent to policy makers for two main reasons. On the one hand, it is important to take stock of how financial and agricultural reforms have affected the industrialisation process of the country. On the other hand, it is also germane to understand if the agricultural and financial sectors are complements or substitutes in the process of industrialisation. Accordingly, the latter helps policy makers in figuring-out why and how changes in the financial and agricultural sectors

affect other industrial sectors like the manufacturing and service sectors. The rest of the paper is structured as follows: section two briefly reviews the literature and gives a synopsis of the country's agro-industrialisation outlook from 1981 to 2015, section three details the model and empirical technique, and results are discussed in section four while section five concludes with some policy recommendations.

2 Theoretical Framework, Literature Review and Stylised Facts

2.1 Theoretical Framework

This study situates within the Johnston and Mellor (1961) hypothesis that agriculture plays a major role in industrialisation and hence, aids economic development. The authors asserted the agro-industrialisation nexus by drawing the consumption-production relations from agriculture. Using a closed economy, the seminal paper surmises that increased productivity in the agricultural growth would, concurrently lead to an increase in the income of farmers (rural dwellers), reduced food prices in urban centres, increased savings in rural areas which allows for deployment of capital for the domestic industry and ultimately an expanded domestic markets for industrial goods. However, the view that agricultural development is a precursor to industrialisation has been challenged by numerous researchers and economic historians (Clark, 1999; Allen, 2009). Hence, this nexus remains the subject of intense scholarly debate embroiled in a semblance of chicken-egg analysis such that Gardner and Tsakok (2007) conclude that the causal relationship between agriculture and industrial growth is too complex to be usefully unravelled.

2.2 Brief Literature Review

Some studies have appraised the performances of the various credit schemes on agriculture and the impact of agriculture on economic growth in Nigeria. Efobi and Osabuohien (2011) on the assessment of ACGSF on non-oil exports conclude that the scheme when used for food crops exhibits a long-run positive impact on the non-oil exports value but exhibits a long-run

negative impact on non-oil exports in relation to cash crops. In assessing the agro-credit-productivity nexus in Pakistan's agricultural sector, Hussain and Taqi (2014) conclude that there exists a direct and significant relation between agricultural productivity and finance. Nwankwo (2013) empirically analyzed the impact of NACRDB on agriculture financing and finds that the loan size over the years has significant positive effect on the growth of the economy and concludes that the size of agricultural loan is a good measure for economic growth in Nigeria but that interest rate or cost of loan has over the years indeed negatively impacted significantly on the growth of the economy through the lull on agriculture. Likewise, Chisasa and Makina (2015) obtain similar results in South Africa. The study finds that the relation between agro-finance and agricultural output is positive and significant in the long-run while a negative relationship exists in the short-run. Anthony (2010) on the impact of agro-credit on economic growth finds that increasing credit to the agricultural sector will stimulate economic growth.

Adetiloye (2012) on the assessment of the performance of ACGSF from 1978 to 2006 on food security concludes amongst others that though there are delays in the settlement of guaranteed credits, the scheme has been impactful on the food sector, with the livestock sector having gained more funding although disbursement to cash crops is highly insignificant. Umaru and Zubairu (2012) on the contribution of agriculture and petroleum sectors to economic growth from 1960 to 2010 conclude that despite the neglect of agriculture, the sector contributes a higher percentage to GDP than the petroleum sector. Thus, more funding if channelled to the sector will further boost output and productivity. With respect to examining the role of credit access on farm productivity in Chile's agricultural sector, Reyes *et al.* (2012) show that short-term credit does not affect farm productivity while issues like education and activity levels do. Mbutor *et al.* (2013) on the contribution of finance to agricultural production find that despite the fact that finance aids agricultural production, the relative contribution of finance to total

agricultural production is quite infinitesimal. In the same vein, Obansa and Maduekwe (2013) conclude that domestic financing of agriculture is insufficient to stimulate the required level of output that is needed for economic growth and that external financing will be needed to fill the credit gap. In the same vein, de Castro and Teixeira (2012) conclude that government credit is a positive predictor of agricultural supply in Brazil and that farmers often have financial constraints to obtain agro-inputs. Lastly, Ayeomoni and Aladejana (2016) and Anetor *et al.* (2016)surmise that credit to agricultural sector is a required stimulus for output and economic growth. In summary, most of these studies conclude that funds are still insufficiently disbursed to the agriculture sector, thus making finance a *weak* predictor of agricultural productivity.

2.3 Nigeria's Agro-Industrial and Finance Outlook

Analysing the performance of the agriculture sector which is a key driver of economic growth shows a very dismal past and current performances as it contributed a miserly 0.82 percentage points to the real GDP in the second quarter of 2015 (Central Bank of Nigeria, 2015). These poor showings are not unconnected to the fact that the sector is financially distanced away from by financial intermediaries. To boost lending, the CBN often adopts moral suasion to encourage the deposit money banks (DMBs) to support targeted lending to the real sector including agriculture, solid minerals and small and medium enterprises (SMEs) sub-sectors of the Nigerian economy. The agricultural sector has witnessed the lowest funding despite efforts by government and monetary authorities (Central Bank of Nigeria, 2015, 2016a). In particular, the CBN's Monetary Policy Committee (MPC) stressed the need for the fiscal authorities to complement the Bank's low interest rate policy orientation by properly coordinating its borrowing activities (and rates) with the Bank in order to push the common objective of stimulating banking system credit delivery at low interest rates to the key sectors of the Nigerian economy (Central Bank of Nigeria, 2015, 2016a). Documentary evidence

reveals that even with "harsh" lending rates, DMBs are still averse to lending to farmers (access is only about 6%) while the insurance sector's supportive gesture in agriculture is less than 3% as measured by farmers enrolled and cropping area covered (Central Bank of Nigeria, 2016b; Federal Ministry of Agriculture, 2016).

Using data from World Bank (2016), World Development Indicators and Central Bank of Nigeria Statistical Bulletin (2015) and with manufacturing value-added as the proxy for industrialisation, it can be inferred that Nigeria's economy is still agrarian in nature as most of the agricultural output are not channelled towards industrial use. This may be attributable to high domestic consumption, poor or inadequate preservatives and storage facilities and infrastructures, among others (Osabohien *et al.*, 2017). From Figure 1, it shows that agricultural output has constantly trended above industrial output.

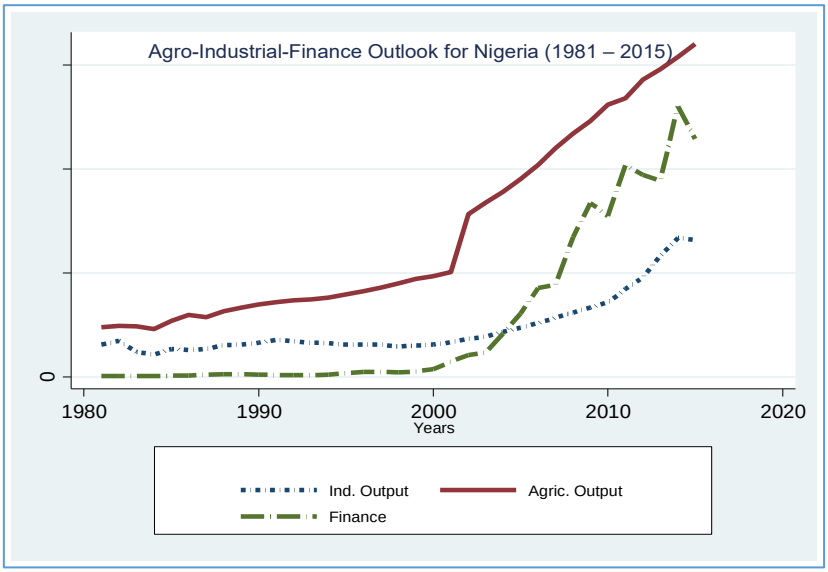

Figure 1: Agro-Industrial-Finance Outlook for Nigeria (1981 – 2015)
Source: Authors' Computation using data from WDI (World Bank, 2016) and CBN (2015)

The percentage contribution of agriculture to industrial value-added declined from 64.44% in 1981 to 46.54% in 1989. It further declined to 31.85% in 1999 dipping further to 25.72% in 2007. It rose stealthily to 43.38% in 2014 but dipped again to 41.19% in 2015. This shows that the economy has been unable to convert most of its agricultural stock for industrial use hence

leading to high importation of finished and semi-finished products to satisfy both domestic and industrial use. Also, the contribution of finance to agricultural growth was initially dismal but increased slightly overtime. From a paltry ₦36 million in 1981 it increased to ₦129.3 million in 1989, contributing a mere 3.88% to the growth in agriculture. From 1990 to 1999, the figure increased from ₦98.4million to ₦246million (5.22%) and further increased substantially from ₦361million in 2000 to ₦11.44billion in 2015 (a contribution of 71.5%) as a result of various government interventionists programmes to stimulate the agrarian sector. Again, the 7-year averages of the three variables are shown in Figure 2. Relative to industrial output and finance allotment, agricultural output witnessed the highest growth within the period under review.

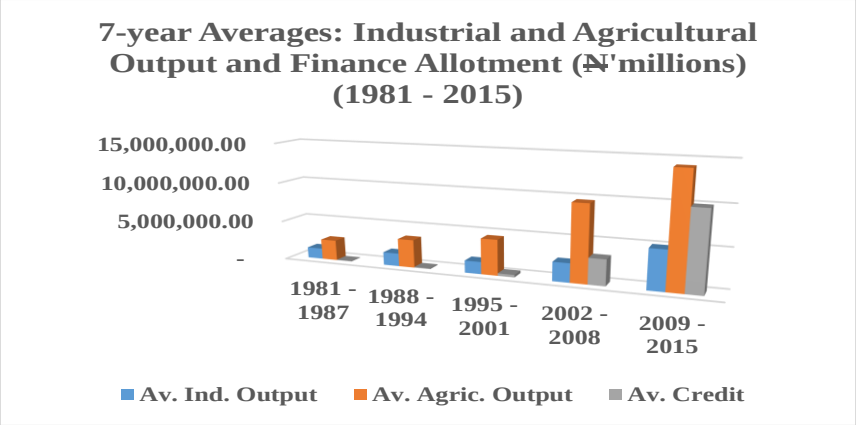

Figure 2: 7-year averages of Industrial and Agricultural Output and Finance Allotment
Source: Authors' Computation from WDI (2016) and CBN (2015)

Consequently, for any economy to witness a substantial growth in industrial output, it is imperative that the agricultural sector be developed as a feed-in channel for industrial production (Central Bank of Nigeria, 2014; Ayeomoni and Aladejana, 2016; Egwu, 2016). Be that as it may, it is also relevant that finance for investment in agriculture be made available to both subsistence and mechanised farmers. It is obvious that without finance, not only agriculture but industrial growth will be stunted. Shown in table 1 are the 7-year averages and their respective contributory percentages.

[Table 1 here]

The foregoing reveals that increasing finance to the agricultural sector is crucial in increasing the sector's performance and therefore contributing meaningfully to industrial output. Consequently, to realise Nigeria's desire for industrialisation, it is imperative for the agricultural sector to be developed, and one of the factors for agricultural development is access to finance by farmers.

3 Method of Analysis

3.1 The Empirical Model

The study uses the autoregressive distributed lag (ARDL)[1] model framework due to its advantages in comparison with other previous and traditional cointegration methods. Firstly, the order of integration of the variables is of no importance or consequence. In order words, the need to test the variables for unit root is to ascertain that none is integrated of order 2. Also, its acceptance stems from the fact that cointegration of nonstationary variables is equivalent to an error-correction (EC) process, and the ARDL model has a re-parameterisation in EC form (Engle and Granger, 1987; Hassler and Wolters, 2006). That is, the existence of a long-run and cointegrating relationship can be tested based on the EC representation. A bounds testing procedure is likewise available to draw conclusive inference without knowing whether the variables are integrated of order zero or one respectively (Pesaran *et al.*, 2001). Lastly, the ARDL model is relatively more efficient in the case of small and finite sample data sizes, and by applying the ARDL technique the long-run unbiased estimates of the model are obtained (Harris and Sollis, 2003; Belloumi, 2014; Kripfganz and Schneider, 2016). Thus, following Kripfganz and Schneider (2016), the log-level ARDL $(p, q, \dots, q)$ baseline model is specified as:

$$lnind_t = \varphi_{0i} + \sum_{i=1}^{p} \delta_i \, lnind_{t-i} + \sum_{i=0}^{q} \beta_i \, \boldsymbol{X}'_{t-i} + \varepsilon_t \qquad [1]$$

where $lnind_t$ and the variables in $\boldsymbol{X}'$ are allowed to be purely $I(0)$ or $I(1)$ or co-integrated; β and δ are coefficients; φ is the constant; $i = 1, \dots, 4; p, q$ are

[1]The optimal lag length for the model is 1 obtained from the choice of Bayesian information criterion (BIC).

optimal lag orders;ε_t is an unobservable zero mean white noise vector process (serially uncorrelated or independent). To show the role of finance in the agro-industrialisation nexus, an interaction term, *agr×fin*, is added to the regression model which greatly expands the understanding of the relationship between agricultural output and finance vis-à-vis the channels through which they impact on industrialisation. Thus, the hypothesis is to test whether the associated relationship between industrial output and agricultural output depends on access to finance by farmers. Thus, model 1 is modified as:

$$lnind_t = full\ model + \sum_{i=0}^{q} \sigma_i\ agr \times fin_t + \varepsilon_t \qquad [2]$$

Lastly, following Belloumi (2014), the long- and short-run causality (once long-run cointegration is ascertained using bounds testing approach) are ascertained by conducting the Granger-causality test in order to understand the direction of causality. The short-run dynamic parameters are obtained by estimating an error correction model associated with the long-run estimates. The *t*-statistic on the explanatory variables determines the short-run causal effect between the variables and indicate that there is Granger-causality, while the *t*-statistic on coefficient of the lagged error-correction term represents the long-run causal relationship.

3.2 The Data and Summary Statistics

The study uses annual time-series data from 1981 to 2015 on three variables. The data on manufacturing value-added (local currency units), agricultural value-added (local currency units) and finance availed to agricultural sector are obtained from the World Development Indicators (World Bank, 2017) and the Central Bank of Nigeria's Statistical Bulletin (2015), respectively. The justifications for these variables are provided such that in line with theory, agriculture is an input for industrial growth. It plays an important role in supplying food and export earnings (Dercon and Gollin, 2014). Hence, a positive coefficient is expected. Ditto for finance which is a requirement for

industrial expansion (Adeleye *et al.*, 2018). Table 2 details the summary statistics and correlation matrix of the variables.

[Table 2 here]

Extracts from the data shows that the lowest industrial output of ₦1.06billion was recorded in 1984 while those for agriculture (₦2.3billion) and finance (N24.6million) were also in 1984. Likewise, the highest industrial output of ₦6.7billion was recorded in 2014, agriculture (₦16billion) and finance (N12.99billion) were recorded in 2015 and 2014 respectively. In addition, the correlation matrix shows a positive association between the variables, indicating that agriculture is a likely predictor of industrial output and likewise finance is a likely determinant of agricultural output. However, there is the need to subject these findings to scientific testing to spur a conclusive debate on the issue.

4 Results and Discussions

4.1 Unit Root Test

Given that the order of integration is irrelevant under the ARDL model, but with the increase in time period of analysis, it is important to test the variables for unit root to be certain that none is integrated of order two, *I* (2), by applying the Dickey-Fuller Generalised Least Squares (DF-GLS) and the Phillips-Perron (PP) unit root tests. The results displayed in Table 3 show that all the variables are *I* (1) series.

[Table 3 here]

4.2 Cointegration Test

Cointegration analysis begins with testing for the existence of a long-run equilibrium relationship between industrial output, agricultural output and finance within a multivariate framework using the bounds testing approach. This involves investigating the existence of a long-run relationship following the unrestricted error-correction model (UECM):

$$\Delta lnind_t = \varphi_{0i} + \sum_{i=1}^{p} \rho_i \, \Delta lnind_{t-i} + \sum_{i=0}^{q1} \emptyset_i \, \Delta lnagr_{t-i} + \sum_{i=0}^{q2} \vartheta_i \, \Delta fin_{t-i}$$
$$+\partial_1 lnind_{t-i} + \partial_2 lnagr_{t-i} + \partial_3 fin_{t-i} + \varepsilon_t \qquad [3]$$

where Δ is the difference operator. The *F* test is used to determine whether a long-run relationship exists between the variables through testing the significance of the lagged levels of the variables. The null hypothesis of no cointegration (i.e.$\partial_1 = \partial_2 = \partial_3 = 0$) against the alternative hypothesis of a cointegrating relationship (i.e. $\partial_1 \neq \partial_2 \neq \partial_3 \neq 0$).This hypothesis can be examined using the standard *F*-statistic which has a non-standard distribution and which depends upon: (1) whether variables included in the ARDL model are stationary or nonstationary, (2) the number of regressors and (3) whether the ARDL model contains an intercept and/or a trend. If the estimated *F*-statistic is higher than the upper bound of the critical values, then the null hypothesis of no cointegration is rejected. Alternatively, if the estimated *F*-statistic is lower than the lower bound of critical values, the null hypothesis of no cointegration cannot be rejected. However, due to our small sample size (35 observations), the critical values as given by Narayan (2005) are used. The results for both model specifications are shown in panels A and B of Table 4.

[Table 4 here]

The results from the bounds test evidence cointegration among the variables. The *F*-statistics are14.23 (for model 1) and 15.49 (for model 2) which are higher than the critical values at 1% level, thus the null hypothesis of no cointegration is rejected.

4.3 Error Correction Model Results

Having established cointegration, the next step is to analyse the long-run relationships and short-run dynamics using the error correction representation in determining both long- and short-run Granger causalities, respectively. The baseline model is re-specified as:

$$\Delta lnind_t = \alpha_0 - \gamma(lnind_{t-i} - \theta \boldsymbol{X}_t) + \sum_{i=1}^{p-1} \omega_{indi} \Delta lnind_{t-i} + \sum_{i=0}^{q-1} \omega_{Xi} \Delta \boldsymbol{X}_{t-i} + \boldsymbol{\varepsilon}_t \quad [4]$$

where, $\gamma = 1 - \sum_{j=1}^{p} \delta_i$ is the speed of adjustment coefficient; $\theta = \frac{\sum_{j=0}^{q} \beta_j}{\alpha}$ is the long-run coefficient.

Equation 4 states that $\Delta\, lnind$ depends on its lag, the differenced explanatory variables and on the equilibrium error term. If the latter is positive, then the model is out of equilibrium (there will be no convergence in the long run). Since γ is expected to be negative, how quickly equilibrium is restored is contingent on its absolute value. Also, if the coefficient is above -2 (that is within the unit circle), then the model is dynamically stable. The optimal lag orders for each variable for the error correction representation are as obtained from the Bayesian Information Criteria (BIC). The results attained by normalising industrial output in the long run are reported in Table 5.

The coefficient on the lagged error-correction term (-0.49) is statistically significant at the 1% level and suggests that convergence to equilibrium is rapid. It implies that a deviation from the equilibrium level of industrial output during the current period will be corrected by 50 per cent in the next period.

[Table 5 here]

Furthermore, the estimated coefficients of the long-run relationship are significant for agricultural output (0.17) and finance (0.10). Both variables are strong predictors of industrial growth suggesting that a 10 percent increase in agricultural output is associated with 1.7 percent increase in industrial output, on average, *ceteris paribus*; while a 10 percent increase in agro-credit leads to a 1 percentage point increase, on average, *ceteris paribus*. This result is consistent with other studies evidencing that growth in agriculture will significantly contribute to industrialisation in Nigeria (Adetiloye, 2012; Umaru and Zubairu, 2012; Ayeomoni and Aladejana, 2016), and those that find a

positive effect of finance on agriculture in the long-run (Mbutor *et al.*, 2013; Anetor *et al.*, 2016; Egwu, 2016). Hence, these outcomes are in line with *a priori* expectations because in the long run, it is expected that increased agricultural output and more financial intermediation will boost industrial production. For the short-run analysis, the past realisations of industrial output and finance have significant asymmetric effects. Findings show that the first and third lags of industrial output are positive and statistically significant at the 5% and 1% level, respectively. It implies that a percentage change in the past realisations of industrial output is associated with a 0.29 and 0.43 percentage increase in current level of industrial output, on average, *ceteris paribus*. Conversely, the coefficients of the finance variable are negatively signed and significant at the 1% level. Relative interpretations show that a percentage point increase in finance results in -0.04 and -0.05 percentage points decline in industrial output in the short run, on average, *ceteris paribus*. These findings are also intuitive in the sense that, it is expected that past industrial output levels will most likely influence its current level while the impact of financial intermediation may not be felt positively in the short run. In other words, this is indicative of the inadequacy of finance required to spur considerable agricultural output required to stimulate industrialisation vis-à-vis poor industrial infrastructures in Nigeria. Also, the accessibility of finance by small-landowners and commercial farmers are often hampered by the high lending rates charged by financial intermediaries (Central Bank of Nigeria, 2016a).

Furthermore, from the results displayed in Table 5, long- and short-run Granger causalities can be inferred within the error-correction mechanism (ECM). That is, the existence of a cointegrating relationship among the variables suggests that there exists a Granger causality in one direction. For instance, a long-run causal relationship is deduced from (1) the *t*-statistic of the error-correction term and (2) the *t*-statistics of the long-run coefficients. To be exact, in the long-run both agricultural output and finance Granger-cause industrial output and each evidences a unidirectional causality to industrial output. The

combination of the statistical significance of these *t*-statistics also suggests a strong causal relationship. Similarly, short-run causal analysis is construed from the *t*-statistics of the short-run coefficients which shows a unidirectional Granger causality from the regressors to the outcome variable.

Lastly, adding an interaction term to the model drastically changes the interpretation of the coefficient of agricultural output and shows that the relationship between the variables may not be linear. If there is no interaction term, the coefficient of agriculture will be interpreted as its unique impact on industrialisation. Since the interaction indicates that the effect of agriculture on industrialisation is different for different values of finance, the unique effect of agriculture on industrialisation is not limited to the coefficient of the latter, but also depends on the values of the finance and the interaction term.

Shown in Table 6, the coefficient of the interaction term (-0.08) is negative and statistically significant at the 10% level corroborating the less-contributory role of finance on agriculture and by inference on industrialisation in the short-run. This implies that the positive role of the agricultural sector on industrialisation reduces as the financial systems matures. Accordingly, with financial development, more resources (or deposits) mobilised by financial institutions could be allocated to the funding of other industrial sectors like manufacturing and servicing. The coefficient of adjustment (-0.53) shows that equilibrium from current shocks is restored within the next period by 53%, while in the long-run, agriculture is not significant. Finance on the other hand is significant both in the long- and short-runs, though with different signs. In addition, the inclusion of an interaction term beclouds the causal relationships as it will be somewhat impossible to separate the causal relationship of agricultural output on industrialisation from that of finance on industrialisation.

[Table 6 here]

4.4 Post-estimation Checks

The results in Table 7 detail the post-estimation checks for both models which give no evidence of higher-order autocorrelation, heteroscedasticity and conditional heteroscedasticity. The residuals are normally distributed, and evidence of omitted variables is rejected at the 1% level for both models.

[Table 7 here]

Furthermore, the test for long-run parameter stability is conducted using the stability test proposed by Pesaran and Pesaran (1997) which requires estimating an error-correction model using ordinary least squares and applying the cumulative sum of recursive residuals square (CUSUMSQ) test to assess the parameter constancy (see Figure 2). There is no evidence of long-run parameter instability.

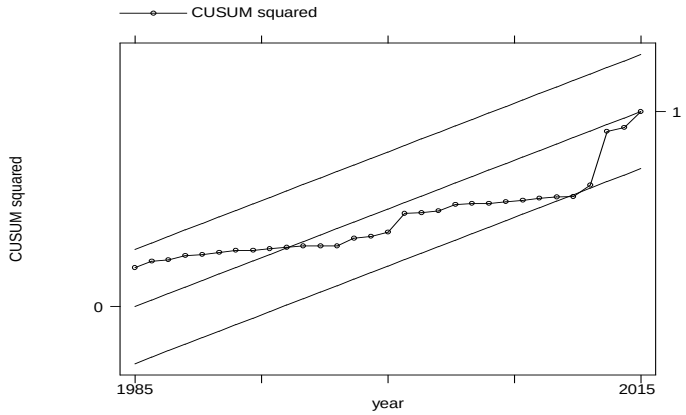

Fig. 3: Plot of CUSUMSQ for Model 1 Stability at 5% level of Significance
Source: Authors'

5 Conclusion

The study analysed the role of finance in the agro-industrialisation nexus in Nigeria using time series data from 1981 to 2015. Among others, the results revealed that agriculture is a positive predictor of industrialisation only in the long-run with its explanatory power dampened by the less-contributory role of finance in the short-run. However, findings reveal that in the short and long run, finance has significant but asymmetric effects on industrialisation. The reasons for this may not be far-fetched.

Firstly, with high lending rates, entrepreneurs, small-landowners and commercial farmers may not be able to access the available funds provided under the various schemes. Secondly, with financial intermediaries continued averseness towards lending to the real sector and in particular, the agricultural sector, the pace of industrialisation in Nigeria will be continually sluggish. Thus, to achieve growth in the sector required for rapid industrialisation, concerted efforts must be made by the federal government, the Central Bank of Nigeria (CBN), financial intermediaries and other stakeholders in making agriculture financing an utmost priority both for the sustainability of domestic consumption and also for industrial growth. It is further recommended that: (1) credit facilities to commercial agricultural enterprises be provided at a very low and single digit interest rate; and (2) the cost of credit to agricultural production be substantially reduced to enable farmers exploit the potentials of the sector. As acknowledged by Central Bank of Nigeria (2015) and enshrined in the newly launched Economic Recovery and Growth Plan-ERGP (Ministry of Budget and National Planning, 2017), sectors such as agriculture and SMEs are essential for rapid generation of productive employment and wealth creation, therefore sufficient funding must be painstakingly encouraged.

Consequently, it is imperative for financial intermediaries to aggressively support the efforts of government at job creation by directing available liquidity into target growth-enhancing sectors of the economy such as agriculture and manufacturing. This is with a view to promoting employment creation through conscious efforts aimed at directing lending to the growth-enhancing sectors of the economy. In conclusion, subject to data availability, given the impact of interest rate and credit defaults in the disbursement of agricultural credit, there is the need to evaluate the effects of these variables on agro-financing. This can be taken up in future research. Moreover, financial access has been established to be constrained by

information asymmetry: adverse selection from bankers and moral hazard from farmers (Asongu *et al.*, 2016; Tchamyou and Asongu, 2017). Hence, assessing the relevance of information sharing offices (public credit registries and private credit bureaus) in the established linkages is another relevant direction for future research.

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Table 1

7-year averages of Agro-Industrial Output and Finance Allotment (₦'m)

7-year Av.	Ind. Output	Agric. Output	% (Ind/Agr.)	Finance	% (Fin./Agr.)
1981 - 1987	1,357,142.86	2,585,714.29	52.49	49,026.00	1.90
1988 - 1994	1,634,285.71	3,541,428.57	46.15	100,082.00	2.83
1995 - 2001	1,542,857.14	4,494,285.71	34.33	311,925.00	6.94
2002 - 2008	2,397,142.86	9,642,857.14	24.86	3,250,932.90	33.71
2009 - 2015	5,001,428.57	14,185,714.29	35.26	9,978,545.00	70.34

Source: Authors' Computation using data from World Bank (2016); CBN (2015)

Table 2

Descriptive Statistics and Correlation Matrix

Variables	*Industrial*	*Agriculture*	*Finance*
Mean	2386571.43	6890000.00	2.74
Standard Deviation	1508813.21	4531186.05	4.04
Minimum	1060000.00	2300000.00	0.03
Maximum	6680000.00	16000000.00	12.99
Industrial Output	1.00		
Agricultural Output	0.91	1.00	
Finance	0.96	0.95	1.00

Source: Authors' computations using data from WDI (World Bank, 2016); CBN (2015)

Table 3

DF-GLS and PP (with trend) Unit Root Tests

Variables	DF-GLS*			PP		
	Level	1st Diff.	Decision	Level	1st Diff.	Decision
Industrial Output	-1.62	-3.70[b]	*I*(1)	0.99	-4.36[a]	*I*(1)
Agricultural Output	-0.90	-4.10[a]	*I*(1)	-1.14	-5.68[a]	*I*(1)
Finance	-0.26	-4.34[a]	*I*(1)	-0.84	-9.12[a]	*I*(1)

Note: [a, b] denote statistical significance at 1% and 5% levels respectively. Estimations are augmented with lag structures obtained from Bayesian Information Criterion (BIC) using the *varsoc* routine in Stata. *Interpolated critical values from Elliot, Rottenberg and Stock (1996).
Source: Authors' computations

Table 4

Bounds Testing Results

Cointegration hypotheses	*F*-statistics
Panel A (model 1)	
$F_{IND.}$(Industrial Output(log)$_t$ | Agriculture Output (log)$_t$ | Finance$_t$)	14.23[a]
Panel B (model 2)	
$F_{IND.}$(Industrial Output(log)$_t$ | Agric. Output (log)$_t$ | Finance$_t$ | Agric*Finance$_t$)	15.49[a]

[a] represents significance at 1% level. The critical values for the *F*-statistics from Narayan (2005) are 5.816 and 5.532 for 3 and 4 restrictions respectively (Case II).
Source: Authors' computations

Table 5

Error Correction Results (Dep. variable: ΔIndustrial Output (log) ARDL (*4 0 2*)

Constant	5.80[a] (1.23)
Long-run estimates:	
Agricultural Output, log	0.17[a] (0.06)
Finance	0.10[a] (0.01)
Adjustment:	-0.49[a] (0.09)
Short-run estimates:	
ΔIndustrial Output_1, log	0.29[b] (0.13)
ΔIndustrial Output_2, log	0.02 (0.09)
ΔIndustrial Output_3, log	0.43[a] (0.09)
ΔFinance	-0.04[a] (0.01)
ΔFinance_1	-0.05[a] (0.01)
No. of Obs.	31
R-Squared	0.80

Note: Numbers in parentheses are White heteroscedasticity consistent standard errors. Statistical significance: [a,b]indicate 1% and 5% levels respectively. The variables lag length *(4 0 2)* are Stata-generated using the "*matrix list e(lags)*" routine. Δ is the difference operator.
Source: Authors' computations

Table 6

Error Correction Results (Dep. variable: ∆Industrial Output (log) ARDL (*4 0 4*)

Constant	6.73[a] (1.17)
Long-run estimates:	
Agricultural Output, log	0.10 (0.08)
Finance	2.77[c] (1.50)
Adjustment:	-0.53[a] (0.09)
Short-run estimates:	
∆Industrial Output_1, log	0.29[b] (0.12)
∆Industrial Output_2, log	0.03 (0.08
∆Industrial Output_3, log	0.46[a] (0.08)
∆Finance	-0.07[a] (0.02)
∆Finance_1	-0.10[a] (0.03)
∆Finance_2	-0.07[b] (0.03)
∆Finance_3	-0.06[b] (0.02)
Agriculture×Finance, log	-0.08[c] (0.04)
No. of Obs.	31
R-Squared	0.87

Note: Numbers in parentheses are White heteroscedasticity-consistent standard errors. Statistical significance: [a,b,c]indicate 1%, 5% and 10% levels respectively. The variables lag length *(4 0 4)* are Stata-generated using the "*matrix list e(lags)*" routine. ∆ is the difference operator.
Source: Authors' computations

Table 7

Diagnostic Tests Results*

Specification	Stat./*p*-values	Remarks
Breusch-Godfrey (autocorrelation)	0.17/0.27	No higher-order autocorrelation
Breusch-Pagan (heteroscedasticity)	0.88/0.11	No heteroscedasticity
ARCH LM	0.28/0.53	No conditional heteroscedasticity
Ramsey RESET (omitted variables)	0.05/0.08	No omitted variables @ 1% level
Jarque-Bera (normality)	0.81/0.72	Evidence of normality

*The *p*-values x/y indicates results of models 1 and 2. The *d*-statistics used for Durbin-Watson.
Source: Authors' computations