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Causal relationship between technologies of cashless policy and agricultural sector output in Nigeria

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Abstract
This study examines the causal relationship between the technologies of cashless policy and agricultural sector output in Nigeria. Ex-post facto research design was employed and the annual time series data for various years were obtained from Central Bank of Nigeria (CBN) statistical bulletin. Unit Root Test, Engle-Granger Co-integration Test, Error Correction Model (ECM) Test and Granger Causality Test were employed in the analyses. In the model, technologies of cashless policy are proxied by Automated Teller Machine Transactions (ATM), Point of Sales Transactions (POS), Mobile Payment Transactions (MPT), while Prime Lending Rate (PLR) and Deposit Rate (DR) were used as control variables. Results of the analyses revealed that the adjusted R-squared value is 91% showing that 91% of the changes that occurred in the agricultural sector output are influenced by the changes in the technologies of cashless policy. ATM and MPT have coefficient value of -0.000328 and -0.003405 respectively with the P-value of 0.3276 and 0.2463 respectively. The POS has coefficient value of 0.010574 and P-value of 0.0478 while the Prob(F-statistic) value is less the 0.005 which indicated that cashless policy technology variables have significant effect on the agricultural sector output in Nigeria. The result of granger causality test showed more support for the existence of supply leading hypothesis hence the study concluded that technologies of cashless policy predicts the agricultural sector output in Nigeria. Based on this, we recommend that the services of ATM, MPT and POS should be upgraded by ensuring availability of power supply, skilled labour, adequate security, reduction of illiteracy rate, organizing of workshops and seminars for both staff and users of the cashless policy technologies in Nigeria.

Keywords: technology, cashless policy, ATM, POS, MPT, agricultural sector output

1. Introduction

1.1 Background of the study

Cashless Policy is the policy of the government to create enabling environment in which money is spent without being physically carried from one place to another. Electronic devices and information technology plays an important role in bringing about sustainable financial improvement and economic development at large. One of the major prerequisites for the economic development of any country according to Ajayi and Ojo, (2006) [4] is to encourage a payment system that is secure, convenient and affordable. Without an optional use of information technology, especially in the banking system, no nation can attain speedy socio-economic development and enhancement. In this regard, developed economies of the world to a large extent are moving away from the payment instruments towards electronic ones, especially payment cards (Humphery, 2004).

Though cashless policy has been criticized in so many ways by different sectors of developing economies, yet experts and government officials have continued to rate the policy high for having positive contributions to economic growth. For instance, the World Bank says that "operating a cashless economic system in Nigeria was strategy for fast-tracking growth in the nation's financial sector (Akhalumh & Ohiokha, 2012) [3]. Some other areas where cashless policy can enhance the quality of life and economy are:

- It makes financial transactions very easy
- Bacteria spread through handling of notes and coins is reduced
- Business transactions are enhanced
- Cost of managing cash is reduced
- It offers multiple payment options and gives immediate notification on all transactions on customer's account.

All these and more may be achieved through the embracement of technologies associated with cashless economy. The adoption and application of new technology is solidly needed for enhancement of economic growth as the major target of cashless policy in Nigeria. Though, at short run, may witness some challenges that if well handled will lead to improvement of the integral units of the economy at long run.

In resent time, the financial sector has introduced a lot of new innovations that have to do with science and technology beyond common man imagination and usage. According to Funke (2018), the payment cards industry, in which Chams Access plays a significant role in the Nigeria market, has extended its frontiers beyond the technology of credit, debit and prepaid cards, as well as Automated Teller Machine (ATM), Point of Sales (POS) terminals and internet banking. The industry is looking at new technology that will further drive business growth with huge revenue potential for participants in the global financial services industry.

Innovation in the application of new technology and

business model is to make payments more secure and convenient for consumers in trending. As such, mobile payments entailing the use of mobile banking apps, SMS/USSD based transaction payment and near field communication (NFC) mobile payments are on the rise in both developing and developed markets with non-financial institutions joining the payments value chain using technology infrastructure that facilitate financial transactions.

In developing nation like Nigeria, most of these cashless policy technologies have not gone down well with the people. Hence, the target of the government to ensure cashless economy seems to be defeated. This may be attributed to nonchalant attitude of people towards the policy, high rate of illiteracy, low quality nature of the technologies, government and political issues and influence, financial institutions approach, inadequacy of other resources, the technicalities involved etc.

1.2 Statement of the problem

The output of the Nigerian agricultural sector has been declining continuously not minding the increase in financial policies and technologies of cashless policies in particular that are targeting the enhancement of the various sectors of the economy.

The argument is therefore, whether technologies of cashless policy and agricultural sector output in Nigeria follow the "supply leading hypothesis," "demand following", feedback" or "neutral hypothesis". Empirical evidence reveals that the issues of direction of causality between finance and growth remains unsettled between the four leading causal hypotheses.

Hence, the empirical findings of different scholars support different causality hypotheses. However, the core problem of the study is to examine the relationship between cashless policy technologies and agricultural sector output in Nigeria.

1.3 Objectives of the Study

The main objective of the study is to examine the relationship between technologies of cashless policy and agricultural sector output in Nigeria. The specific objectives are to

1. Examine the causal relationship between Automated Teller Machine transaction (ATM) and Agricultural Sector Output in Nigeria.
2. Determine the causal relationship between Point of Sales transaction (POS) and Agricultural Sector Output in Nigeria.
3. Ascertain the causal relationship between Mobile Payment transaction (MPT) and Agricultural Sector Output in Nigeria.

2. Review of Related Literature

2.1 Conceptual Framework

Cashless Economy is an economy where economic activities and transacting can take place without necessarily carrying of physical cash as a means of exchange of transaction but rather with the use of some electronic gadgets or near money payment of goods and services.

Some of the benefits of cashless Nigeria economy includes:-

- Reduction in money laundering.
- Check on terrorist financing.
- Effectiveness of monetary policy.
- Creation of job opportunities in the financial sector.
- Increased provision of evidence against bribe givers and takers, especially the civil servants and politicians.
- Growth in the real sector of the economy and increase in savings mobilizations (Sebru, Afonja, Akande, & Adeyinke, 2015) [35].

The primary aim of cashless policy is to drive economic development and modernization of Nigeria's payment system in line with vision 2020 goals of being among the top 20 economies by 2020. The cashless economy policy initiative of the Central Bank of Nigeria (CBN) is a move to enhance the financial system but in long-run sustainability of the policy will be a function of endorsement and compliance by end-users (Tajudeen, 2013) [36].

The Cashless Policy has to be achieved through the advanced use of information technology facilities like internet, ATM, POS to made easy fund transfer, thereby bringing down the time wasted in bank(s) and facilitates other banking transaction. The customers instead of staying the whole day in the bank for transaction can channel their time resource to more productive activities while the financial transactions can be done through mobile or electronic banking. Echekoba and Ezu, (2012), in a research carried out in Nigeria, found out that 68.2% of the respondents complained about very long queues in the bank, 28.9% complained of bad attitude of teller officers (cashiers) while 2.8% complained of long distance of bank locations to their home or work places. Thus, the introduction of cashless policy will curb most of the mishaps identified in the financial system and will go a long way in improving the economic growth.

Developing countries of the world are moving away from the use of paper payment instruments towards electronic one especially payment cards. Some aspects of the functioning of the cashless economy are enhanced by e-finance, e-money, e-brothering and e-exchanges. These are referring to how transactions and payments are affected in cashless economy (Moses-Ashike, 2011). Marco and Banliera (2004), ascertained that increased usage of cashless policy banking instrument strengthens monetary policy effectively and that the current level of e-money usage does not pose a threat to the stability of financial system. According to Akhalumeh and Ohiokha (2012) [3], as a policy instrument, CBN has hinged economic growth and development on the cashless system, CBN sees cashless policy as a tool for tracking corruption and money laundering.

2.1 Theoretical framework

2.1.1 Endogenous growth theory

Some of the short comings of the neo-classical model gave birth to a new growth theory where the essentials determinants of growth are made to be endogenous in the model. The new model makes the rate of technological change to be endogenous and can be influenced by government actions and policies. The proponents of the endogenous growth are derived by the views that government policy and economic behavior must be able to affect the growth rate in the long run (Froyen, 2009). Romer (1986), initiated the endogenous growth theory which was improved by the contribution of Lucas, (1988) in his work "on the Mechanics of Economic Development" and Robelo (1991), in his study titled "Long-Run Policy Analysis and Long-Run Growth"

The simplest endogenous model is the AK model which eliminates diminishing returns to capital which was characteristic of Neo-classical theory (Hussein & Thirwall, 2000). The AK model is stated as follows Y=AK, where Y= output, A= a positive constant that reflects the level of the technology and K= capital (broad sense to include human capital).

Some of the assumptions of this model are

- Population is stationary.
- Constant exogenous saving rate.
- Fixed level of technology.
- Constant marginal product of capital.

The model asserted that the growth in output depends on total productivity, improved financial intermediation and the rate of savings. Therefore, it is not disputable that growth rate of an economy is an increasing function of the saving rate. Hence, the government policies has a great influence, thus policies to raise saving rate will invariably improve the growth rate.

Hence, the growth model of this study is anchored on AK endogenous model to postulate that growth in developing economies is derived from financial development policies targeting the enhancement of the economic sectors in particular and growth of national economy in general. This led to this equation: AOG = F(PLR, DR, ATM, POS, MPT)

2.2 Empirical Framework

Suberu, Afonja, Akande and Adeyihka (2015) [35], studied the Effect of Cashless Policy, Saving and Bank Credit on Nigerian Deregulated Economy. The study examines the implications of cashless banking; with a view to exposing the possible and prospects it contributes to the economy whilst employing aggregated approach. Data were gathered through secondary sources and ordinary least square econometric technique was used to analyze the data. The study revealed that the marginal productivity coefficient of bank credit to domestic economy is positive and insignificant.

Akhalumeh and Ohiokha (2012) [3] examined the Cashless Economy: The imperatives. The study adopted structured questionnaires as a means of data collection and the collected data were analyzed using simple percentage procedure. The results of the analysis indicate that; majority of Nigerians are already aware of the cashless policy and majority agree that the policy will to help fight against corruption/money laundering and reduce the risk of carrying cash. They also agreed that the major problem of the policy will be cyber fraud and illiteracy.

Omotunde, Sunday and John-Dewole (2013) investigated the Impact of Cashless Economy in Nigeria. Survey research was adopted using primary data collected through questionnaire. Some of the responses from the respondents shows that cashless policy will increase employment and reduces cash related robbery thereby reducing risk of moving around with cash, cashless policy will also reduce cash related corruption to minimal level and attract more foreign investors to the country and reduce the cost of banking services, high security and safety risks and also affect positively the economic growth.

The effect of Cashless Policy of Government on Corruption in Nigeria was investigated by Tajudeen (2013) [36]. This study assessed the perceptions of the stakeholders on the types of corruption that can be reduced by the cashless policy. Primary and secondary data were sourced and used for the study. Unstructured questionnaire were administered to 100 purposively selected respondents with 25 respondents each from the banking sector, government officials, government contractors and academics. Secondary data were sourced through library research. Data collected were analyzed using descriptive statistics. The results found out that no single strategy can address all issues of corruption and that the policy can only reduce minor corruption which is the lowest level of corruption in the country.

Osazerberu (2014) investigated the Cashless Policy and Banks' Profitability in Nigeria, using Electronic Banking as a platform. In his study, he used secondary data which was analyzed using content analysis comparing profits under cash based policy with a cashless regime. Some of the variables used to proxy Cashless Policy are, Mobile Banking, Internet Banking, ATM and POS. the results reveal that cashless economic policy positively affect the profitability of bank through reduction in cost of operation and banking the unbanked populace.

Adedokum (2017) examined the effect of Cashless Banking on the Financial Performance of Small and Medium Scale Enterprises. The study is cross sectional in no nature and hence collected data using self-administered questionnaire to the 120 respondents. Multiple Regression Analysis was used to test the hypothesis formulated for the study using Statistical Package for Social Science (SPSS) version 20. The result of the analysis reveals that Mobile Banking and Point of Sales (POS) machines have significantly impacted on the financial performance of SMEs.

Okoye and Ezejiofor (2013) [28], investigated on an appraisal of Cashless Economy Policy in Development of Nigeria Economy. The objective of the study is to investigate its significant benefits and essential elements and to determine the extent to which it can improve the growth of economy. The researchers used descriptive research design and used a conveniences sampling technique to select sample size of 68. The questionnaire was the main tool used in gathering of data and valid test was conducted using ANOVA and Chi-Square (X^2) Technique in testing hypothesis. The result reveals that majority of Nigerians are already aware of the policy and majority agree that the policy will help to fight against corruption and money laundering.

Ezeamama, Nnamani, Marire and Mgbodile (2014) [9], studied the impact of Central Bank of Nigeria Cashless Policy in Nigeria Economy. The Survey Research Design was employed with questionnaire as data collection instrument. A total of 500 traders, students and civil servants were sampled for the study. The questionnaire was structured on demographics and benefits of cashless economy in Nigeria. The major statistical technique used was descriptive, use of frequency table and charts. The result therefore indicates that the introduction of cashless policy in Nigeria can be seen as a step in the right direction and will have positive impact in modernization of Nigeria payment system, reducing cost of banking services and also curb banking corruption.

3. Methodology

3.1 Research Design

The study employs ex-post facto research design. According to Kerlinger (1973) [20], ex-post facto design is a systematic empirical inquiry in which the investigator does not have

direct control over the value of the variables included in the study.

3.2 Nature, Sources and Scope of Data

Annual time series secondary data collected from CBN Statistical Bulletin are used for the analysis. The data used in the analysis cover the period 2009 to 2017. The period covered is informed by the availability of data of the independent variables.

3.3 Description of Variables

Prime Lending Rate (PLR)

This is an interest rate at which bank lends to their favoured customers, that is those with good credit rating.

Deposit Rate (DR)

The term deposit rate refers to the amount of money paid out as an interest by bank or financial institution on deposits. Bank pay deposit rate on saving and other investment accounts.

Automated teller machine transaction (ATM)

Automated teller machine is an electronic banking outlet for completing basic transactions without the aid of a branch presentation or teller. It is refers to all the banks transactions done with the use of automated teller machine. Such transaction includes, cash withdrawal, money transfer, business transaction, payment for services and credit payments.

Point of sale transaction (POS)

Point of sales transaction comprising of all the payments of goods and services made with the POS machine. POS is an electronic machine located at the various business transaction centers for easy buying and paying for goods and services. This is to reduce the carrying around of bulk cash and in recent time, POS comprises of a computer, monitor, cash drawer, receipt printer, costumer display and a barcode scanner and also a debit/credit card reader.

Mobil Payment Transaction (MPT)

Mobile payment transaction represents all the payment transaction made through the use of mobile gargets and internet facilities.

3.4 Model Specification

The model of this study is anchored on the work of Osazerbern (2014) who used mobile banking, internet banking, ATM and POS as proxies for cashless policy. This study therefore sought to examine the causality between the Cashless Policy and Growth using Cashless Policy index; Prime Lending Rate, Deposit Rate, Automated Teller Machine Transaction, Point of Sales Transaction, Mobile-Payment Transaction. Hence the functional model of the study is

$$AOG = F(PLR, DR, ATM, POS, MPT)\ldots\ldots\ldots\ldots \quad (1)$$

Where, PLR = Prime Lending Rate, DR, = Deposit Rate, ATM = Automated Teller Machine Transaction, POS = Point of Sales Transaction and MPT = Mobile-Payment Transaction.

Functional model can be re-structured in a mathematical equation as below

$$AOG = \beta_0 + \beta_1 PLR + = \beta_2 DR + = \beta_3 ATM + \beta_4 POS + \beta_5 MPT + \mu\ldots \quad (2)$$

Where β_0 = constant, β_{1-5} = coefficient of the regression and μ = error term,

3.5 Estimation Techniques

This study used series of econometric techniques in testing the causal relationship between financial development and agricultural sector output. It employed time series data and this necessitated stationerity tests in order to avoid spurious regression. Sequentially, the Unit Root Test (Stationery) is followed by the Co-integration procedure to examine whether there is existence of long run relationship between variables of technologies of cashless policy in Nigeria. The Error Correction Model (ECM) was used to provide information on the long run relationship and short run relationship as well as the speed of adjustment between the two variables in incorporating the equations the Error Correction Term (ECT). Causality Test was also employed to found out if there is evidence of causal relationship between the specific technology of cashless policy variables and agricultural sector output in Nigeria, thus, it is used to estimate the stated hypotheses.

3.5.1 Testing for Stationery/Unit Root

Prior to identifying any possible long run relationship, it will be important to test time series data for stationerity as the key concept underlying time series processes. According to Hlanganam (2012), (Brooks 2002) [6], most economic variables are non-stationery in nature and yet the stationary properties can influence the behavior and properties of a series. Employing regression analysis on non- stationary series may lead to spurious (meaningless) results and useless conclusion (Gugerati, 2013). The regression of two non-stationery series may shows "good" results when assessed by using usual test statistics (such as T-ratios, F-statistics and R^2 values) when in fact the results shouldn't have indicated presence of relationship (Hlangenam, 2012). Stationerity Test can also be useful in determining if trending data should be first differenced or regressed on deterministic functions of time to render the data stationery. This implies that non stationery time series data might need to be differenced more than once before it becomes stationery. If the time series are stationery in their levels, they are said to be integrated of order zero i.e., 1(0), If the time series are stationery in their first difference, then they are said to be integrated of order one, i.e. (1); and at last, if they are stationery in their second differences, they are said to be integrated of order two i.e. 1 (2). The order of integration of the variables is tested using Argument Dickey – Fuller (ADF) (Dickey & Fuller; 1981) Unit Root Test for the presence of unit root.

3.5.2 Co Integration Test

Co – integration Test is a follow up to Unit Root Test in order to establish whether or not there exists any long – run relationship between the variables.

Though, there are so many ways to test co-integration but

the concept of Co-integration was first introduced by Granger (1981). Two time series are said to be Co-integrated if a linear combination of the two variables in stationery. The need for Co-integration test arises, when all the series of interest should be integrated of the same order, at least I (1) from stationery test. Harris (1995) however, shows that it is not necessary for all the variables in the model to have the same order of integration, especially if theory a priori concluded that such variables should be included; thus a combination of I (0), I (1), I (2) can be investigated for co-integration. This study therefore resorts to use Engle-Granger approach to Co – integration.

3.5.3 Engle – Granger Co-integration Approach

The sequence of this approach starts by conducting a test between two non – stationery time series to determine if they are co – integrated of the order I (1). The test requires conducting Ordinary Least Squire (OLS) Regression. Saving the residuals and then running the ADF or PP tests on those residuals in order to determine whether or not it is stationery. If it is stationary at level, it indicates that there is existence of long run relationship and a follow up test will be conducted.

3.5.4 Error Correction Model (ECM)

According to Gujarati (2003) [13], Error Correction Mechanism (ECM) was first used by Sargan and later popularized by Engle and Granger corrects for disequilibrium. If variables X and Y are co-integrated; that is, there is a long-term or equilibrium relationship between the two variables of course in the short run there may be disequilibrium. Therefore, one can treat the error term as the "equilibrium error". The existence of long run co-integration equilibrium provides for short run fluctuation, in order to straighten out or absolve these fluctuations was made to apply the Error Correction Model (ECM) (Ibenta, 2008).

Granger (1981), showed that if variables X and Y are Co-integrated, then, the two variables have an error correction representation. The Error Correction Model (ECM) provides information on the long run relationship and short run relationship as well as the speed of adjustment between the two variables in incorporating to the equations of the Error Correction Term (ECT). Therefore the bellow error correction model was estimated.

Objective model: AOG = β_0 +β_1PLR+=β_2DR+=β_3ATM+ β_4POS+β_5MPT + μ

3.5.5 Granger Causality

The next test employed in this study is the Granger Causality Test. Once the variables are found to be Co-integrated, this indicates that a long – run equilibrium relationship exists between growth and technologies of cashless policy in Nigeria. Therefore it is imperative to test the existence and direction of relationship between these variables. Granger Causality Test is needful in testing whether changes in one variable are a cause of change in another. The theory of Granger Causality states that variable X Granger causes Y, if y can be better predicted using the histories of both X and Y than it can using the history of y alone. Testing causality in the granger sense involves using f-tests to test whether lagged information on a variable y provides any statistically significant information about a variable X in the presence of lagged X, if not, then y does not granger cause x (Granger, 1981). The Granger Causality Test will be used to estimate the bellow hypothesis:

To examine the Relationship between technologies of Cashless Policy Variables and Agricultural Sector Output in Nigeria.

4. Data Presentation and analyses

Table 1: Nigeria Macroeconomic Variables on the Relationship be tween technologies of Cashless Policy and Agricultural Sector Output in Nigeria

	LnAOG	PLR	DR	LnATM	LnPOS	LnMPT
2009	7.452185	17.41	2.79	4.93	1.255616037	-2.8134107
Q2	7.661038	18.68	2.77	4.98	1.011600912	-2.2072749
Q3	7.934059	18.38	2.79	4.84	0.90825856	-0.6539265
Q4	7.84306	18.98	3.38	4.94	0.828551818	-0.5447272
2010	7.588473	18.86	3.23	4.14	1.01884732	-0.1392621
Q2	7.76347	18.49	2.6	4.39	0.982078472	0.31481074
Q3	8.05699	16.98	1.5	4.74	1.029619417	0.60976557
Q4	7.946805	16	1.49	4.95	1.499623046	0.9439059
2011	7.691411	15.76	1.47	5.81	1.83736998	1.19996478
Q2	7.920584	15.78	1.41	5.90	1.864080131	1.31372367
Q3	8.18041	15.84	1.45	5.96	2.156402583	1.61143592
Q4	8.032774	16.69	1.41	6.17	2.266957915	1.93585981
2012	7.790602	16.7	1.45	6.12	0.623456943	0.07839119
Q2	8.019345	16.74	1.32	6.18	2.167693934	1.59466714
Q3	8.284095	16.77	1.72	6.21	2.69119424	1.98242514
Q4	8.293176	16.63	1.74	6.30	3.120405084	2.90365927
2013	7.900252	16.58	1.72	6.42	3.26899676	3.1302008
Q2	8.126052	16.62	2.04	6.51	3.432097708	3.36438292
Q3	8.336579	16.59	2.43	6.59	3.764586602	3.52413189
Q4	8.401991	17.09	2.48	6.70	4.105021143	4.04442947
2014	8.154777	16.85	3.30	6.66	4.211650455	4.19509328
Q2	8.22825	16.57	3.42	6.75	4.252088584	4.30618525
Q3	8.603509	16.49	3.36	6.94	4.356727195	4.45987786
Q4	8.583472	16.28	3.44	6.92	4.567992762	4.78309342
2015	8.226536	16.84	3.57	6.97	4.581184823	4.79669922
Q2	8.315968	16.42	3.60	7.10	4.579647229	4.82310017
Q3	8.692736	17.20	3.66	7.33	4.589244035	4.82743335
Q4	8.674197	16.93	3.50	7.45	4.594008121	5.10120699

Source: CBN Statistical Bulletin of various years

Legend; PLR = Prime Lending Rate, DR = Deposit Rate, LnATM = Natural log. of Automated Teller Machine transactions, LnPOS = Natural log. of Point of Sales Transactions, LnMPT = Natural log. of Mobile Payment Transactions, LnAOG = Natural log. of the Agricultural Sector Output in Nigeria. The raw data from where this table is derived are at the appendix.

Table 2: Unit Root Test Results of the Unit Root Test of Technologies of Cashless Policy Variables and Agricultural Sector Output in Nigeria

S/N	Variables	At level	At 1st difference	At 2nd difference	Order of ( )	Results		
						At level	At 1st different	At 2nd difference
1	LnAOG	-	-	-14.13225	1(2)	Not significant	Not significant	Significant
2	PLR	-	-	-9.185403	1(2)	Not Significant	Not significant	Significant
3	DR	-	-	-3.709455	1(2)	Not significant	Not significant	Significant
4	ATM	-	-4.175434	-	1(1)	Not significant	Significant	Significant
5	MPT	-	-	-11.36365	1(2)	Not significant	Not significant	Significant
6	POS	-	-	-3.238532	1(2)	Not significant	Not significant	Significant
	At 5% L.s	-	-2.967767	-2.971853				

***Source*:** Authors computation using E-view 10 computer package

The result of the above unit root analysis reveals that ATM is stationary at first difference while LnAOG, PLR, DR, MPT and POS are stationary at their second differencing. Hence, it is needful to test for Co-integration of technologies of Cashless Policy variables and Agricultural Sector Output.

Table 3: Co-integration Test of technologies of Cashless Policy Variables and Agricultural Sector Output in Nigeria

Null Hypothesis: RESID01 has a unit root			
Exogenous: Constant, Linear Trend			
Lag Length: 1 (Automatic - based on SIC, maxlag=6)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.28095	0.0000
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	
*MacKinnon (1996) one-sided p-values.			

***Source*:** Authors computation using E-view 10 computer package

The result of co-integration analysis reveals that the p-value is less than 0.05 critical value and the value of Augmented Dickey- Fuller (ADF) is -11.28095 which is greater than critical value at 5% with the value of -3.595026 absolutely. This is an indication that technologies of cashless policy variables and agricultural sector output are having long run relationship; hence, the null hypothesis which states that the variables will not converge at long run is rejected.

Table 4: Error Correction Model of technologies of Cashless Policy and Agricultural Sector Output in Nigeria

Dependent Variable: D(D(LNAOGQ))				
Method: Least Squares				
Date: 05/12/18 Time: 04:48				
Sample (adjusted): 0001 0031				
Included observations: 29 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.033269	0.028183	1.180447	0.2524
D(D(PLR))	0.101251	0.042893	2.360523	0.0291
D(D(DR))	-0.235228	0.051554	-4.562770	0.0002
D(ATM)	-0.000328	0.000327	-1.004736	0.3276
D(D(MPT))	-0.003405	0.002846	-1.196324	0.2463
D(D(POS))	0.010574	0.004999	2.115371	0.0478
ECM(-1)	-1.988860	0.158824	-12.52240	0.0000
R-squared	0.930989	Mean dependent var		-0.008746
Adjusted R-squared	0.909196	S.D. dependent var		0.335165
S.E. of regression	0.100998	Akaike info criterion		-1.522636
Sum squared resid	0.193810	Schwarz criterion		-1.183918
Log likelihood	26.79427	Hannan-Quinn criter.		-1.425098
F-statistic	42.71970	Durbin-Watson stat		1.800655
Prob(F-statistic)	0.000000			

***Source*:** Authors computation using E-view 10 computer package

The regression equation of technologies of Cashless Policy and Agricultural Sector Output in Nigeria is restructured to accommodate the error correction model coefficient of the independent variables as follows: LnAOG = 0.033269 +0.101251PLR -0.235228DR -0.000328ATM -0.003405MPT +0.010574POS. The above equation indicates that the technology of cashless policy variables DR, ATM and MPT have adverse relationship with the agricultural sector output while PLR and POS have positive effect on the dependent variables. The P-value of ECM shows the existence of short run relationship while the P-value of PLR, DR and POS reveal that the variables have statistical significant relationship with the agricultural sector output in Nigeria and the P-value of ATM and MPT show that they don't have any significant relationship with the agricultural sector output in Nigeria. The adjusted R-squared value 0.909196 of the estimated model shows the co-efficient of multiple determinants. It indicates that 91% of the changes that occur in the dependent variables (AOG) are influenced by the changes in the independent variables; hence it is a very good financial policy for boosting of agricultural sector output in Nigeria. The probability (F-statistics) value is less than 0.05 critical values which indicates that all the variables of technologies of cashless policy put together have statistical significant effect on the agricultural sector output in Nigeria and finally the Durbin-Watson value 1.800655 indicates the absence of auto correlation which shows the absent of positive first order serial correlation.

4.1 Model Estimation

The result of Pairwise Granger Causality Test was used to address the objective of the study. The model results were used to answer the questions and hypotheses.

Table 5: Pairwise Granger Causality Test for the hypotheses

Pairwise Granger Causality Tests			
Date: 05/12/18 Time: 11:23			
Sample: 0001 0031			
Lags: 2			
Null Hypothesis	**Obs**	**F-Statistic**	**Prob.**
PLR does not Granger Cause LNAOGQ	26	0.45241	0.6421
LNAOGQ does not Granger Cause PLR		0.07907	0.0243
DR does not Granger Cause LNAOGQ	26	0.78750	0.4680
LNAOGQ does not Granger Cause DR		2.07978	0.1499
ATM does not Granger Cause LNAOGQ	26	29.0243	9.E-07
LNAOGQ does not Granger Cause ATM		0.41460	0.6659
MPT does not Granger Cause LNAOGQ	26	7.78067	0.0030
LNAOGQ does not Granger Cause MPT		7.11963	0.0044
POS does not Granger Cause LNAOGQ	26	10.0948	0.0008
LNAOGQ does not Granger Cause POS		1.25625	0.3053

***Source*:** Authors computation using E-view 10 computer package

Demand following hypothesis

HO: P= 0, i.e, AOG does not granger cause PLR, DR, ATM, POS, MPT

H1: P=1, i.e, AOG does granger cause PLR, DR, ATM, POS, MPT

Supply leading hypothesis

HO: P=0, i.e, PLR, DR, ATM, POS, MPT does not granger cause AOG

H1: P=1, i.e, PLR, DR, ATM, POS, MPT does granger cause AOG.

The decision rule of the Granger Causality Test states that if the P- value of the estimate is lesser than 5% we reject the null hypothesis and vice versa.

4.2 Discussion of Findings

The F-statistics and P-value of the equation one shows that there is evidence of uni-directional causality running from agricultural Sector Output to Prime Lending Rate, thereby indicates demand following hypothesis.

The F-statistics and P-value of the equation two of the Causality Test reveals that there is no evidence of causality running between DR and AOG. Therefore, there is evidence of independent causality. It indicates that Deposit Rate (DR) and Agricultural Sector Output (AOG) are not predicting each other.

The value of F-statistics and P-values of the equation three and five shows unidirectional causality from ATM to AOG and POS to AOG respectively. Hence, there is existence of supply leading hypothesis this implies that Automated Teller Machine Transaction (ATM) and Point of Sales Transaction (POS) predicts Agricultural Sector Output in Nigeria (AOG).

The result of the Pairwise Granger Causality Test in equation four reveals the existence of Bi-directional relationship between MPT and AOG. Therefore, there is evidence of feedback causality between Mobile Payment Transaction (MPT) and Agricultural Sector Output in Nigeria.

The results of ECM of Ordinary Least Square revealed that PLR, DR, and POS with P-values of 0.0291, 0.0002 and 0.0478 respectively have significant effect on agricultural output in Nigeria while ATM and MPT with P-values of 0.3276 and 0.2463 do not have any significant effect on the agricultural output in Nigeria. Thus, the Prob. (F-statistic) value of less than 0.05 critical values shows that all the variables of technologies of cashless policy put together have significant relationship with the dependent variable and this gives a strong support to the model estimation of the Granger Causality Test of the hypotheses.

The result of Unit Root Analysis revealed that ATM is stationary at first difference while AOG, PLR, DR, MPT and POS are stationary at their second differencing. Hence, Co-integration Test was conducted and the result indicated existence of long-run equilibrium between technologies of Cashless Policy and Agricultural Sector Output in Nigeria.

Error Correction Model (ECM) Analysis results showed that technologies of Cashless Policy Variables DR, ATM and MPT have adverse contributions to agricultural sector output while PLR, and POS have positive contributions to agricultural sector output in Nigeria. The P-value of PLR, DR, and POS revealed that the variables have statistical significant effect in explaining the changes that occurred in the agricultural sector output in Nigeria and the P-values of ATM and MPT showed that they don't have any significant effect on the Agricultural Sector Output in Nigeria. The adjusted R-squared value 0.909196 of estimated model showed the co-efficient of multiple determinants. It indicates that 91% of the changes that occur in the dependent variables (AOG) are influenced by the changes in the independent variables; hence it is a very good financial policy for boosting of Agricultural Sector Output in Nigeria. The Prob. (F-statistics) value is less than 0.05 critical value which indicates that all the variables of technologies of Cashless Policy put together have statistical significant effect on the Agricultural Sector Output in Nigeria.

The result of Pairwise Granger Causality test showed unidirectional causality running from AOG to Prime Lending Rate (PLR), no evidence of causality running between Deposit Rate (DR) and Agricultural Sector Output (AOG) and the result also proved Bi-directional relationship between MPT and AOG. Therefore, there is evidence of Feedback Causality.

Hence, the causality between technologies of Cashless Policy Variables and Agricultural Sector Output in Nigeria provided more support for the supply leading hypothesis. Thus, there is evidence of unidirectional causality from ATM to AOG and from POS to AOG respectively, therefore, ATM and POS predict agricultural sector output in Nigeria (AOG). Though, this is in accordance with the a priori expectations and also in agreement with the results of the ECM which revealed the adjusted R-squared value as 0.909196, which indicates that 91% of the changes that occur in the dependent variables (AOG) are influenced by the changes in independent variables. The Prob. (F-statistics) value is less than 5% critical value which shows that all the variables of technologies of Cashless Policy put together have statistical significant effect on the Agricultural Sector Output in Nigeria, hence, this is a very good financial policy to boost Agricultural Sector Output in Nigeria. These results also solidify the conclusions of Gupta (1984) [14], King and Levine (1993) [21], Adelekun (2010), Ibrahim and Shuaibu (2013) [18], Sanni (2012), Nzotta (2004) [27], Ndebbio (2004), Carlinand Mayer (2013) [8], Calderon and Liu (2003) [7], Goldsmith (1967) [12], Shaw (1973) [34], McKinnon (1973) [24], Fase and Abma (2003) [10] who posits that economic development was as a result of financial development and therefore the direction of causality ran from financial development to real growth. Thus, the agricultural sectors output will depend on the effectiveness and efficiency of technologies of cashless policy variables in Nigeria.

5. Summary of Findings

- The Co-integration Test result indicated that technologies of Cashless Policy and Agricultural Sector Output have long-run equilibrium relationship with one another.
- The adjusted R-squared co-efficient of determination indicated that technologies of Cashless Policy explains 91% of changes in Agricultural Sector Output in Nigeria and hence is a very good policy for boosting of AOG.
- Prob. (F-statistics) co-efficient is less than 5% indicated that the indicators of the explanatory variables put together have significant effect on the dependent variable. Hence, the Null Hypothesis (H_O) is rejected.

- The Granger Causality Test indicated unidirectional relationship running from AOG to DR, bi-directional causal relationship between MPT and AOG, and also no evidence of causal relationship between DR and AOG, thus, there is evidence of demand following, Feedback and Neutral Hypothesis respectively.
- The result of Granger Causality Test showed more support for the existence of supply leading hypothesis, thus, there is evidence of unidirectional causal relationship running from ATM and POS to AOG revealing the existence of supply leading hypothesis (Financial Development leads AOG).

6. Conclusion

The study posits that technologies of Cashless Policy have had both positive and adverse contributions on the dependent variable, though; PLR, ATM and MPT are not having significant effect while DR and POS are having significant effect on the Agricultural Sector Output in Nigeria. The Pairwise Granger Causality Test showed more support for supply leading hypothesis; hence the study concludes that technologies of cashless policy predict the agricultural sector output in Nigeria. However, the variations in the cashless policy variables will result to changes in the agricultural sector output in Nigeria.

7. Recommendation

The services of ATM, MPT and POS should be upgraded by ensuring the availability of power supply, skilled labour, adequate security and availability of cash at any particular point in time. For its financial services to impact more positively on the agricultural sector, there is need for these financial services like, ATM, MPT and POS to be extended to the rural areas where most of the agricultural activities in developing countries are taking place. The technicalities involved in the use of ATM, POS and MPT should be reduced considering the users exposure and also there is need for organizing of workshops and seminars to increase the educational capabilities of the average Nigerian citizens that are expected to be using those technologies of cashless policy.

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