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2 **ELECTRONIC PAYMENT SYSTEM AND FINANCIAL DEEPENING IN NIGERIA: A EMPIRICAL FOCUS ON**  
3 **AUTOMATED TELLER MACHINE (ATM) 2009-2017.**  
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6

7 *Abstract*

8 *This study sought to evaluate the impact of the electronic payment system on financial deepening*  
9 *indicators in Nigeria with particular focus on the popular Automated Teller Machine (ATM). The study*  
10 *adopted the ex-post factor research design and the granger causality tests, correlation analyses*  
11 *combined with other preliminary tests were used. Quarterly time series data for a 6-year-period 2009-*  
12 *2017, collected from the central bank of Nigeria statistical bulletins were used. Ratios of Broad money*  
13 *supply to Gross Domestic Product (M2GDP) and ratio of credit to the private sector to gross domestic*  
14 *product (CPSGDP) were used as the dependent variable and proxies for financial deepening, while the*  
15 *independent variables included volume of automated teller machine transactions, web payment, mobile*  
16 *payment and point of sales respectively. The research findings there exists a bi-directional relationship*  
17 *between automated teller machine transaction (LATM) and private sector credit (LCPSGDP) in Nigeria.*  
18 *Also, a unidirectional relationship between automated teller machine transaction (LATM) and broad*  
19 *money supply (LM2GDP) in Nigeria. The results recorded from the study agree with existing findings and*  
20 *theories and they all agree that there is a relationship between financial deepening and electronic*  
21 *payment channels in the Nigeria. It is therefore recommended that the government should make policies*  
22 *that will improve the use of diverse electronic channels with the aim of strengthening their impact on the*  
23 *degree of financial depth in Nigeria. Additionally, Adequate regulatory architecture should be put in*  
24 *place to ensure that the negative fallouts of the use of electronic payment channels are minimized. This*  
25 *is with the view to making them more acceptable to the people.*

26 *Keywords: e-payment; web payment; Automated Teller Machines; Financial Deepening.*  
27

28 **1. INTRODUCTION**

29 Modern technology has changed the original method of payment system into a more efficient and  
30 effective system, devoid of cash and carry syndrome. The easiness of transacting economic  
31 substances as well as a safer and quicker access to funds, among other factors, has placed e-  
32 payment system on a more elevated pace than cash-based system (Ayo, 2010). Interesting, in  
33 Nigeria, e-payment system is gaining prominence to the extent that users have now preferred to  
34 carry out monetary exchange without visiting banks.

35

36 Thus, one of the most remarkable innovations that have taken place in the Nigerian financial  
37 system recently is the use of electronic payment for banking and other financial transactions.  
38 According to (Chijioke 2016) Electronic banking is a driving force that is changing the landscape  
39 of the banking industry in Nigeria, as it has blurred the boundaries between different financial  
40 institutions, enabled new financial products and services and made existing financial services  
41 available in different packages.

42

43 The electronic payment system or electronic banking refers to the application of improved and  
44 faster information communication technology to banking especially in payment. (Anyanwaokoro  
45 1999) defined electronic banking as the application of computerized technology to banking  
46 activities especially as it concerns deposit transfer aspects of banking. He also defined e-banking  
47 as a system of banking with an electronic banking system which involves an on-line processing  
48 of the same day credit and debit transfers of funds between member institutions of a clearing  
49 system.

50

51 The use of electronic payment system is part of the outcome of the cash-less policy introduced  
52 by the monetary authorities in Nigeria called economy. Cashless economy is an economy where  
53 the physical cash circulating in the economy is minimized while payments through electronic  
54 instruments are used. Cash-less economy is a combination of the cash-based payment system and  
55 electronic payment systems (Odior & Banuso, 2013). Usually at the commencement of cash-less  
56 economy, the cash-based payment exceeds the e-payment system, with time; the former then  
57 exceeds the latter which evolves to a cashless economy.

58

59 Meanwhile, the formidable tools that are used in electronic banking system are the automated  
60 teller machine (ATM), the point of sale (POS) system, Point of Sale terminals (POS), Mobile  
61 money solutions and the automated clearing houses (ACH). Electronic payment system also  
62 employs cash substitutes such as debit cards, credit cards, electronic funds transfer, direct debits  
63 credits, internet banking and e-payments systems. This electronic payment based system has  
64 done a lot to increase the convenience of bank's customers, staffs as well as the society at large  
65 (Kelvin, 2012). Today, paying and receiving money between buyers and sellers are not

66 necessarily done through raw cash. (Chijioke 2016) further stressed that it has easily comes to  
67 mind that the introduction of e-banking by the Central Bank of Nigeria (CBN) has seen a drastic  
68 reduction in time spent by customers on transactions. These days, by merely logging into the  
69 Internet and pressing some prompts, a bank customer can conclude his transactions in record  
70 time and in a most convenient atmosphere.

71 Nigeria is cash based economy with retail and commercial payments primarily made in cash.  
72 With the introduction of electronic payment system, according to (CBN 2013) in (Okoro 2014),  
73 the volume and value of transactions of various forms of e-payment stood at 114.6 million and  
74 645.04 billion naira, respectively in 2009, showing an increase of 73.4 and 46.1 percent,  
75 respectively when compared with 66.1 million and N441.6 billion in 2008. Also, the volume and  
76 value of electronic card (e-card) transactions increased significantly from 195,525,568 and  
77 N1,072.9 billion in 2010 to 355,252,401 and N1,671.4 billion in 2013, reflecting an increase of  
78 81.5 and 55.8 per cent, respectively. The increase was attributed to enhanced public confidence  
79 in electronic card payments.

80 Inevitably, the electronic fund transfer practiced today allows money to be transferred from an  
81 individual in one location say Lagos to another individual in another location say Enugu while  
82 the sender may have paid physical cash at the money transfer agency, the cash does not move  
83 physically, what move is information (Okoro 2014).

84 This is highly embraced in the country as individuals and bank customers in Nigeria today are no  
85 longer concern about safety of their funds and increase returns on their investments only though  
86 fear of bank failure is gradually fading away due to innovations in the system. They want  
87 efficient, fast and convenient services which can only be offered to them through E-payment  
88 system. Customers also want banking services that will meet their particular needs and support  
89 their business goals for instance; businessmen want to travel without carryout cash for security  
90 reasons. They want to be able to check their balance online, find out if a cheque is cleared,  
91 transfer funds among accounts and even want to download transaction records into their own  
92 computer at work or home. All these are only achievable through electronic banking system.  
93 Hence, this study examines electronic payment system and financial intermediation in Nigeria.

94 In the operation of the electronic payment system users are issued with electronic cards which  
95 can be slotted into special electronic machines in order to effect payments. At the centre of such  
96 payment system are the Point of Sales (POS) terminals (Azeez 2011). These are to be deployed

97 across commercial points in the country. These POS terminals thus deployed will serve like the  
98 Automatic Teller Machines (ATM). In this case, upon completing a transaction and the value  
99 ascertained, the amount is entered into a POS terminal into which the electronic card has been  
100 slotted. The cash equivalent of the amount is transferred from the payer's account into the  
101 account of the payee automatically. Users are issued with a card (the electronic purse). The  
102 electronic purse is topped up using revaluation terminals. There are different types of terminals:  
103 coin & note, credit card and payroll deduction terminals. The cards are simply inserted into the  
104 revaluation terminal and certain programmed instructions are followed, and money is added onto  
105 the electronic purse. This can then be used to pay for goods/services by inserting them into the  
106 POS terminals. When the card is inserted into the POS, and the transaction amount entered, the  
107 reader reads the amount and is quickly deducted from the card) (Akhalumeh & Ohiokha, 2012).  
108 Consumers using cash or checks may be limited in the amount of funds they have for particular  
109 transactions. With cash, consumers are limited to the funds they have on hand. Sellers may be  
110 reluctant to accept checks for bigger transactions because of the risk of nonpayment. Electronic  
111 payments have addressed both of these issues: As noted by (Tijani, and Ilugbemi, 2015) e-  
112 payment or e-banking have provided consumers with access to all available funds or lines of  
113 credit for a given transaction and they have given sellers peace of mind about payment.  
114 Specifically, CBN's analytics estimated that higher card usage contributed an additional N296  
115 billion to consumption between 2011 and 2015, or a 0.1% cumulative increase in overall GDP  
116 during the sample time period. That equals about a N74 billion contributions to GDP each year.  
117 Real consumption grew at an average of 2.3% in the same period, of which 0.01 percentage  
118 points is attributable to increased card penetration. This implies that card usage accounted for  
119 about 0.4% of growth in consumption, as well as an average increase of 2.6 million jobs over  
120 2011-2015 (CBN, 2015).  
121 Furthermore, the Central Bank of Nigeria (CBN) report notes that the volume and value of  
122 electronic card transactions increased significantly from 195,525,568 and N1,072.9billion in  
123 2010 to 355,252,201 and N 1,6714.4 billion in 2015, an increase of 81.5% and 55.8%  
124 respectively. ATMs account for 97.8%, followed by web-payments (1%), POS and mobile  
125 payments (0.6%) in terms of volume. In value terms, ATM s accounted for 93.4%, web (3.5%),  
126 POS (1.9%) and mobile (1.2%). The CBN's policy of promoting electronic cards and channels is  
127 driven by the objectives of reducing banking industry costs by 30 percent. It estimated the total

128 direct cost of cash management in the Nigerian Banking Industry is N114.5billion  
129 (\$715.6million) as at 2009, with cash in transit costs (24%), cash processing cost (67%) and  
130 vault management costs (9%). The CBN projects the direct cost of cash to reach N192bn by  
131 2012. The CBN report stressed that electronic payment system have impacted the economy  
132 immensely by enhancing tax revenue, increased economic growth, increased financial inclusion,  
133 reduced robberies and cash-based fraud, reduced operating costs for banks, increased payments  
134 system efficiency and increased banking penetration. It further shows this that the system have  
135 had as high as 3.1% of GDP economic impact in 2013. This impact is largely from increased  
136 employment, savings from corruption, higher imports/domestic trade, financial sector savings  
137 from cash management, and non-financial sector substitution for cash.  
138 This obvious impact notwithstanding, the most essential area of influence of the electronic  
139 payment system has arguably been the deepening of the financial system. This has made it  
140 possible to provide services to the unserved and banking to the unbanked.

## 141 **1.2 Statement of the Problem**

142 As the Central Bank of Nigeria (CBN) and commercial banks transcend banking operations to an  
143 electronic level, there are a couple of concerns about the feasibility of the system in Nigeria.  
144 Though the system is as beautiful as it faces great challenges. A few of these inherent challenges  
145 as documented by (Olanipekun, Brimah and Akanni, 2013) are listed below: The facilities that  
146 will be used for efficient financial transactions by the available deposit money banks in Nigeria  
147 may not be able to carry the load of the electronic system; ATM's, Point of Sales system, mobile  
148 banking and other mediums have to dramatically expand to touch at least 80% of the whole  
149 country before any efficient financial intermediation can be achieved.

150 Moreover, customers also complain of network failures alongside ATM failures. Implying that  
151 network and the ATM machines must be improved dramatically to accommodate for smooth  
152 operations of financial activities (Amaka 2012) and (Okey 2013).

153 Based on these challenges, it is certainly an issue of argument whether the electronic payment  
154 system will be able to improve on economic growth in the country especially the remote or rural  
155 areas of the country.

156 There are many research works on electronic payment system especially theoretical review and  
157 performance appraisal (Okey, 2013) and (Onyinye 2012), but not much has been done  
158 empirically using secondary data to ascertain if electronic payment system so far has a

159 significant effect on the depth of the financial system in Nigeria. Findings of studies on  
160 electronic banking in Nigeria and its impact on the depth of the financial system in the Nigerian  
161 economy has relied mostly on data collected from questionnaire and field works based on bank  
162 specific studies or location specific. As a result, conclusions have been drawn on a particular  
163 location or a particular bank without the use of aggregate data to study the whole economy. Such  
164 studies are (Dahunsi and Akinyede 2014, Siyanbola, 2013 etc.). These studies have not used time  
165 series to analyze empirically the effect of electronic banking on the depth of the financial system  
166 of the Nigerian economy.

167 The central bank of Nigeria has stimulated interest in this area of study by collating and  
168 publishing e-banking and its allied statistics. With the release of such data on e-banking activities  
169 in Nigeria, it is empirically imperative to investigate the effect of electronic banking policy on  
170 the Nigerian financial system with particular focus on its deepening as whole from 2009 to 2015  
171 Therefore, this study seeks to fill the gap created by lack of research in the area of the nexus  
172 between electronic payment system and financial deepening in Nigeria.

### 173 **1.3 Objectives of the Study**

174 The broad objective of the Study is to examine the effect of electronic payment system on  
175 financial deepening in Nigeria. Specifically, the study tends to;

- 176 1. To determine whether a causal relationship exist between automated teller machine  
177 transaction and credit to private sector in Nigeria.
- 178 2. To ascertain whether there is a causal relationship between automated teller machine  
179 transaction and broad money supply in Nigeria.

### 180 **1.4 Research Questions**

181 The study is based on the following questions:

- 182 1. What is the form and direction of causality between automated teller machine transaction  
183 and credit to private sector in Nigeria?
- 184 2. To what extent can a causal relationship be established between automated teller machine  
185 transaction and broad money supply in Nigeria?

### 186 **Statement of Hypothesis**

187  $H_{01}$ : Volume of Automated teller machine transactions does not granger cause credit to the  
188 private sector in Nigeria.

189 **H<sub>02</sub>**: There is no causal relationship between automated teller machine transaction and broad  
190 money supply in Nigeria.

191

192 The study is important to the average Nigerian trader, farmer and public servant to know the  
193 benefits of the electronic banking to the Nigerian economy and the need to embrace the system  
194 completely. It will also help the unbanked in the semi-urban areas and rural areas and even in the  
195 urban areas that still did not trust the banking system in Nigeria the need to use the banking  
196 system to enable them enjoy the benefits of the cashless policy that will save the fear in carrying  
197 physical cash. The study will help to unveil how these new means of financial transactions can  
198 drive financial deepening and inclusion which will positively affect the economy at large. Also,  
199 this study is important to policy makers to enable them monitor trends in the levels and  
200 composition of electronic banking system, and to assess the impacts on the economy over time.  
201 This will enable them make the evolve rightly to the benefit of the rich or the poor in the society.  
202 This study also adds to the existing literature on the link between cashless banking system and  
203 economic growth.

204 The study is divided into five sections with introduction as section one, two is review of  
205 literature and three is methodology, four contains empirical results with five as conclusion..

## 206 **2. LITERATURE REVIEW**

### 207 **2.1 Conceptual Framework**

#### 208 **2.1.1 Payment System**

209 Payment system is seen as a financial system supporting transfer of funds from suppliers (savers)  
210 to the users (borrowers), and from payers to the payee, usually through exchange of debits and  
211 credits among financial institutions. It consists of a paper-based mechanism for handling cheques  
212 and drafts, and a paperless mechanism (such as electronic funds transfer) for handling electronic  
213 commerce transactions.

214 The payment system occupies an important place in the development of a country's economy;  
215 infact the level of development of a country's payment system is a reflection of the state or  
216 condition of the country's economy. The concept payment system has different meanings among  
217 writers. The definition ranges from a simple definition to a more complex definition. Below are  
218 different definitions of payment system from different authors: (Bruce 2012) defined payment  
219 system as an operational network - governed by laws, rules and standards - that links bank  
220 accounts and provides the functionality for monetary exchange using bank deposits. According  
221 to (Lacker 2005), payment system is referred to as the interbank settlement system, which is a  
222 contractual and operational arrangement that banks and other financial institutions use to transfer  
223 funds to each other.

#### 224 **2.1.2 Electronic payment system**

225 The electronic payment system or electronic banking refers to the application of improved and  
226 faster information communication technology to banking especially in payment. Electronic  
227 payment, popularly known as e-money, is a payment platform where users pay money in  
228 advance into their e-money account or create an e-money account that is linked to their credit  
229 card or bank account. The mechanisms that enable the operation of the system are the automated  
230 teller machine (ATM), the point of sale (POS) system, Point of Sale terminals (POS), Mobile  
231 money solutions and the automated clearing houses (ACH). However, cashless banking system  
232 also employs cash substitutes such as debit cards, credit cards, electronic funds transfer, direct  
233 debits |credits, internet banking and e-payments systems, (Kelvin, 2012).

#### 234 **2.1.3 Concept of Financial Deepening**

235 Financial deepening is a concept that has assumed prominence over the last decade. It refers to  
236 the expansion in provision of diverse forms of financial and banking services to a wider range  
237 and strata of society (Wikipedia, 2016).

238 According to the Central Bank of Nigeria (2015) financial Deepening is measured by ratio of  
239 gross domestic capital formation to GDP, ratio of gross domestic savings to GDP. Precisely, the  
240 level of financial deepening in an economy is shown by the ratio of credit to the private sector to  
241 the GDP and the ratio of broad money supply to the GDP.

#### 242 **2.1.4 Electronic Banking Instruments**

243 Electronic – based transaction seeks to drive the development and modernization of Nigeria’s  
244 cashless banking system in line with her goal of being among the top 20 economies of the world  
245 by the year 2020 (Central Bank of Nigeria, 2011). The essence of the policy is to shift the  
246 economy from a cash-based economy to a cashless one. Thus, it is geared towards engendering  
247 an efficient payment system anchored on electronic – based transactions. It is a truism that an  
248 efficient and modern payment system is a key enabler and a sine qua non for driving growth and  
249 development. The policy also aims at improving the effectiveness of monetary policy in  
250 managing inflation in the economy (CBN, 2011)

251 The electronic payment system applies to all accounts and one of the prerequisite for its  
252 development according to (Ajayi and Ojo 2006) is to encourage a payment system that is secure,  
253 convenient, and affordable. In this regard, developed countries of the world, to a large extent, are  
254 moving away from paper payment instruments toward electronic ones, especially payment cards  
255 (Humphrey, 2004).

#### 256 **2.1.5 E-Payment and the Cashless Policy**

257 Electronic based transactions are a major tool used to discourage high circulation of cash in any  
258 economy. It is also the bases for the implementation of cashless policy in Nigeria. Electronic  
259 cash is a system that allows individuals purchase goods or services in today’s society without the  
260 exchange of anything tangible. The term money still exists, but it is more in an electronic form.  
261 This is more acceptable as the world over makes a shift towards a cashless society which is being  
262 sold as a more convenient method of payment and a method of preventing crimes all the way  
263 from robbery of cash from individuals to the extent of money laundering among crime syndicates  
264 and cash stockpiling at home by corrupt government officials.

265 The CBN also defines electronic banking as the provision of retail and small value banking  
266 product and services through electronic channels. Such product and service can include deposit  
267 taking, lending, account management, provision of financial advice, electronic bill payment and  
268 the provision of other e-payment product and service such as e-money. Below are some of the e-  
269 banking product and services that is pivotal to implementation of the cashless policy from the  
270 CBN report, (Siyabola, 2013).

## 271 **2.1.6 Popular e-Banking Products**

### 272 **2.1.61 Point of Sale Terminals**

273 This mode of e-banking handles cheque verification, credit authorization, cash deposit and  
274 withdrawal and cash payment. It enhances electronic fund transfer at the point of sales. Thus  
275 customers account would be debited immediately with the cost of purchase in an outlet such as a  
276 petrol station or supermarket. The implication of this is that customers can make payment for  
277 goods and services without necessarily coming in contact with physical cash as the purchase  
278 price would be debited on the buyer's card and credited on the seller's account, (Akhalmeh,  
279 and Ohiokha, 2012).

### 280 **2.1.63 GSM/Mobile banking**

281 This mode of e-banking primarily uses mobile phones as the electronic devices. Mobile phone  
282 gives customer the opportunity to operate their account with bank as long as their phones and  
283 network services provider support the SMS (short messaging service) which would enable the  
284 customer check account balance.

### 285 **2.1.64 Automated Teller Machine**

286 Automated teller machine is a computer controlled device that dispenses and provides other  
287 services to customers who identify themselves with a personal identification number (PIN). The  
288 physical carriage of cash as well as frequent visit to the banks is being reduced. The principal  
289 advantage of ATM is that it dispenses cash at any time of the day even as it needs not to be  
290 located within the banking premises but in stores, shopping malls, fuel stations etc. unlike the  
291 traditional method where customers have to queue for a very long period of time to withdraw  
292 cash or transfer funds.

### 293 **2.1.65 Card System**

294 It is a unique electronic payment type which involves the use of smart cards. Smart cards are  
295 devices with embedded integrated circuit being used for settlement of financial obligations. It

296 can be used as credit card, debit card and even ATM cards. The power of these cards lies in its  
297 sophistication and acceptability to store and manipulate data as well as handling of multiple  
298 applications on one card securely.

## 299 **2.2 Theoretical Literature**

300 There have been no generalized theory guiding the use of electronic banking, but studies on the  
301 subject matter depends on theories that advocate for innovations and improvements in the  
302 financial and banking system. As a result, the theoretical bases for this study are based on two  
303 scholarly intellectual contributions, namely the Mckinnon-Shaw Framework and the Structuralist  
304 Approach.

### 305 **2.2.1 Mckinnon-Shaw Framework**

306 The Mckinnon-Shaw framework contained two essential issues which give room for innovations in  
307 the financial system of developing countries; (1) the financial sector is critical for economic growth  
308 and (2) extensive government controls imposed on the financial sector prevents financial deepening  
309 and hinders the contribution of the sector to development.

310 (Mckinnon 1973) came up with the proposition in his study that there is a complimentary  
311 relationship between physical capital and money which reflect in money demand. This  
312 complimentary relationship according to (Mckinnon 1973) connects the demand for money  
313 directly with the process of physical capital accumulation, due to the fact that the conditions of  
314 money supply have an influence on decision to save and invest.

315 On the other hand, (Shaw 1973), hypothesis centred on financial intermediation between the  
316 savers and users of the saved fund resulting from financial liberalisation and development. This  
317 he said increase the incentive to save and invest, stimulates investments due to an increase  
318 supply of private sector credit, and raises the average efficiency of investment. This view stresses  
319 the importance of competition within the financial markets as prerequisites for successful  
320 financial intermediation. It is the Shaw argument that give way for financial institutions in  
321 developing countries to embark on policies that leads to improvement in their financial sector.

322 However, the general notion from their debate is that the functions of financial institutions in the  
323 savings-investment process were spelt out as being an effective element for the mobilization and  
324 allocation of capital by making equal the supply of loan-able funds with the demand for  
325 investment funds and the transformation and distribution of risks and maturities.

### 326 **2.2.3 Romer's Model of Technological Change**

327 Romer's model of Endogenous Technical change of 1990 identifies a research sector specializing  
328 in the production of ideas. To Romer, ideas are more important than natural resources. He cited  
329 the example of Japan which has very few resources but was open to new western ideas and  
330 technology. It imported machines from the United States during the meija era, dismantled them  
331 to see how they worked and manufactured their better prototypes. Therefore, ideas are essential  
332 for the growth of an economy. These ideas relate to improved designs for the production of  
333 durable goods for final production. In the Romer model, new knowledge enters into the  
334 production process in three ways;

- 335 • A new design is used in the goods sector for the production of a new intermediate input.
- 336 • In the final sector, labour, human capital and available producer durables produce the  
337 final product.
- 338 • A new design increases the total stock of knowledge which increases the productivity of  
339 human capital employed in the research sector.

340 One of the policy implications of endogenous growth theory according to (Jhingan 2010) is that  
341 the measured contribution of both physical and human capital to growth may be larger than  
342 suggested by the Solow residual model. Investment on education or research and development of  
343 a firm has not only a positive effect on the firm itself but also spill over effects on other firms  
344 hence on the economy as a whole. It further implies that countries having greater stocks of  
345 human capital and investing more on research and development will enjoy a faster rate of  
346 economic growth. This may be one of the reasons for the slow growth rate of certain developing  
347 countries.

### 348 **2.3 Empirical Review**

349 A lot of previous researchers have made several findings on the effect of the electronic payment  
350 system in an economy. Some of these studies are as mentioned below.

351 (Okoro 2014) examined the impact of selected e-payment instruments on the intermediation  
352 efficiency of the Nigerian economy. Using time series data of 2006 – 2011, he employed  
353 multiple regression technique in the analysis of the data. He used intermediation efficiency  
354 indicator (the ratio of currency outside bank to broad money supply) as a dependent variable,  
355 while the automated teller machine (ATM), point of sales (PoS), Mobile and Internet service  
356 values were used as the independent variables. He made the following findings: that there is

357 significant relationship between ATM, PoS, Internet service values and the intermediation  
358 efficiency of the of Nigerian economy. However, his study also reviles that there is no significant  
359 relationship between Mobile service value and intermediation efficiency of the Nigerian  
360 economy within the period under study. This implies that the ATM, PoS and Internet services are  
361 the major instruments used by the customers of the deposit money banks in Nigeria. On the other  
362 hand, he posited that the insignificant contribution of the Mobile service value to intermediation  
363 efficiency may be as a result of the user's ignorance or the banks' insufficient effort in selling the  
364 product effectively. Therefore, his study recommends that the banks should put more effort in  
365 advertising these products in Nigeria.

366 (Iwedi and Igbanibo 2015) modelled the relationship between financial intermediation functions  
367 of banks and economic growth in Nigeria using data spanning (1970-2014). They used credit to  
368 private sector (CPS), banks deposit liabilities (DLS), and money supply (MOS) as proxy for  
369 bank financial intermediation functions while gross domestic product represents economic  
370 growth. They used the OLS regression technique and the augmented Dickey-Fuller unit root test  
371 for the analysis. The relative statistics of their estimated model shows that credit to the private  
372 sector (CPS) negatively and insignificantly correlate with GDP in the short run, bank deposit  
373 liabilities shows a positive relationship with GDP though statistical insignificant at 5% level.  
374 They also found that money supply positively and significantly correlates with GDP at short run.  
375 Their analysis revealed the existence of a long run relationship between bank financial  
376 intermediation indicators and gross domestic product in Nigeria. And the granger causality test  
377 results reveal that there exists unidirectional causality flowing from Gross domestic product to  
378 Credit to Private Sector (CPS). Bi-directional causality runs between Deposit Liabilities (DLS),  
379 Money Supply (MOS) and GDP. Their results suggest that growth in the volume of deposit  
380 liabilities could boost banks financial intermediation functions in the economy and exert a  
381 positive impact on level of productivity hence having a contagion effect on the output level of  
382 goods and services in the economy. They recommend that the managers of the Nigeria economy  
383 should fashion out appropriate policies that will enhance the bi-directional flow of influence  
384 between the banking sector where investable funds are sourced and the real sector of the  
385 economy where goods and services are produced, and there should be efficient and effective  
386 financial intermediation process in order to achieve the nominated objective of investment,  
387 productivity and economic growth.

388 (Nwaolisa and Kasie 2012) examined the user acceptability and payment problems encountered  
389 by Nigerians in utilizing electronic banking system. Their study equally ascertained the  
390 contribution of electronic retail payment to the elimination or reduction in problems inherent in  
391 the payment process in Nigeria. They sourced data from both primary and secondary sources,  
392 and data collected were analysed using tables and percentages. However, they found out that  
393 cash usage is still very high in Nigeria irrespective of the efforts of Central Bank of Nigeria  
394 towards the adoption of electronic payment system. They also reported that the reason for this is  
395 the challenges of inadequate power supply, shortage of critical technological infrastructures, lack  
396 of socio-cultural support and absence of regulatory framework that are required to operate  
397 seamless and effective electronic payment system in the country. They recommend that there is  
398 the need for the government to remove barriers to innovation, including regulatory barriers to  
399 pave way for rapid development of the electronic payment systems in Nigeria.

400 (Tijani & Ilugbemi 2015) examines the impact of electronic payments channels (EPC) on  
401 National development (ND). The study was survey targeted at current and savings accounts  
402 customers of deposit money banks in Nigeria using Ado-Ekiti as a case study. They  
403 administered one hundred and twenty (120) questionnaires in six (06) banks in Ado-Ekiti  
404 metropolis. Ninety-Eight (98) questionnaires were returned for processing, and their data was  
405 analyzed using inferential statistics specifically with the use of chi-square. Their study reveals  
406 that electronic payment channels (EPC) have impacted on the economy and therefore  
407 contributing positively to national development (ND). They recommended that the Central Bank  
408 of Nigeria (CBN) should mount other e-payment products for the promotion of trade and  
409 commerce in Nigeria. The Central Bank of Nigeria (CBN) should embark on intensive campaign  
410 for complete adoption of e-payment products especially at the grassroots level among others.

411 (Abubakar 2014) used time series data for the period 2006- 2012, to examine the effects of  
412 electronic banking on growth of deposit money banks in Nigeria. He used secondary data  
413 collected from secondary sources through annual reports and statistical bulletin of Central Bank  
414 of Nigeria. He measured electronic banking using the total value of internet and mobile banking  
415 while growth was measured using the value of total deposits and total assets of deposit money  
416 banks in Nigeria. Total deposit was regressed on internet and mobile banking, while total asset  
417 was regressed on internet and mobile banking using multiple regression technique. He revealed  
418 that positive relationships exist between mobile banking and total deposits, and between internet

419 banking and total asset while on the other hand, no significant relationships between internet  
420 banking and total deposits, and between mobile banking and total asset. He therefore  
421 recommended that banks that want to improve their deposit growth performance must offer  
422 numerous products/services through mobile phones in an effective, efficient and cost effective  
423 manner. They must also make mobile banking application all mobile phones enabled so that  
424 those customers who cannot afford Java enabled mobile phones can also use the product. He also  
425 recommends that banks that want to increase their asset holdings must offer numerous, efficient  
426 and cost effective secured transactions through the internet.

427 (Hernando and Nieto 2007) attempted to fill this gap by identifying and estimating the impact of  
428 the adaptation of a transactional web site on financial performances using a sample of 72 Deposit  
429 Money banks in Spain over the period 1994-2002. The analysis of the sample is based on several  
430 financial performance ratios. These financial ratios measure business activity as a percentage of  
431 average total assets and profitability. The results showed that the impact of transactional web  
432 adoption on banks performance take to appear. The adoption of the internet as a delivery channel  
433 involves a gradual reduction in overhead expenses. This effect is statistically significant after one  
434 and half year after adoption. The cost reduction translates into an improvement in banks  
435 profitability, which becomes significant after one and half year in terms of return on assets  
436 (ROA) and after three years in terms of return on equity (ROE).

437 (Maiyaki and Mokhtar 2010) employing a survey of 407 bank customers in 33 organizations in  
438 Kano State of Nigeria studied the effects of availability of electronic banking facilities among  
439 other factors. They study reveals that the availability of electronic banking facilities such as  
440 ATM, online banking and telephone banking do not have significant influence on customer's  
441 bank choice decision.

442 (Okoye & Ezejiofor 2013) did an appraisal of cashless economy policy in development of  
443 Nigerian economy. The objective of their study is to examine its significant benefits and  
444 essential elements, and to check the extent to which it can enhance the growth of financial  
445 stability in the country. Two research hypotheses were formulated in line with the objectives of  
446 the study. The descriptive research design was adopted for the study with a sample size of 68.  
447 The convenience sampling technique was used. The questionnaire which was structured was the  
448 main instrument used for data collection. The data collected was subjected to face validity test,  
449 and was tested with ANOVA and chi – square ( $\chi^2$ ) technique was used to test the hypotheses.

450 Their results indicate that: majority of Nigerians are already aware of the policy and majority  
451 agree that the policy will help fight against corruption/money laundering and reduce the risk of  
452 carrying cash. Major problems envisaged to hamper the implementation of the policy are cyber  
453 fraud and illiteracy. Based on the findings they made some recommendations made are: the  
454 government should adopt a different strategy to educate the non-literate Nigerians about the  
455 cashless economy; and a framework should be worked out to provide cyber security in Nigeria.  
456 Most studies reviewed works looked at e-banking from the point of the ICT and financial system  
457 holistically. In terms of datasets and instrumentation, attention was given more to qualitative  
458 studies restricted to given periods and location.  
459 Essentially, these studies were micro in nature with little or no focus on the economy in general.  
460 There is also the apparent deficiency of not using verifiable data as the publication of data on e-  
461 payment activities by the Central Bank of Nigeria started in the first quarter of 2009.  
462 None of the studies reviewed gave attention to the impact of e-payment on financial deepening  
463 even in a financial world that is giving serious attention to banking the unbanked and serving the  
464 unserved. The justification for this study therefore, is made real by the obvious gaps in literature  
465 in terms of geography and method which it is set to fill. To fill this gap, this study is isolating the  
466 most popular electronic payment instruments to investigate it in line with the need to deepen the  
467 financial system.

### 468 **3. METHODOLOGY**

#### 469 **3.1 Data and Design**

470 The *ex-post facto* research design was adopted for this study. The population of the study  
471 consists of the values of electronic payment system tools of all deposit money banks in Nigeria.  
472 Secondary source of data was used for this study, and the data were sourced from Central Bank  
473 of Nigeria's statistical bulletin. The data is a quarterly data that covers the period 2009 - 2015.  
474 The variables of interest are the ratio of broad money and credit to the private sector to gross  
475 domestic product, which will constitute the dependent variables. While the independent variables  
476 are the volumes of transactions on internet payment, Automated Teller Machine (ATM), web  
477 payment, and point of sales terminals. This study will be descriptive and inferential in nature.  
478 The data for this work is drawn from the statistical bulletin of the Central Bank of Nigeria for the  
479 range of years 2009 to 2016. Dataset covering a 8-year period is to be collected and studied.  
480 Financial deepening indicators proxied by CPSGDP and M2GDP as well will be used as drawn

481 from the said Central Bank of Nigeria publications. The volumes of transactions on internet  
482 payment, Automated Teller Machine (ATM), web payment, and point of sales terminals will also  
483 be drawn from the Central Bank Bulletin.

484 Significantly, the datasets are purely time series. Time series are observations that are ordered in  
485 time or numerical values of variables from time to time (Osuala, 2010). The second characteristic  
486 of the data set is that they are secondary. Secondary data is data created by someone other than  
487 the user. The data come from such sources as journals, publications, organizational records and  
488 data collected and kept in existing bodies of literature Hill et. al (2001).

### 489 **Model specification**

490 The model follows the Pairwise Granger Causality test which according to Gujarati and  
491 Porter, (2009) which is stated thus:

492 *The Model for the Pairwise Granger Causality Test is stated following Gujarati and Porter*  
493 *(2009) thus:*

$$494 M2GDP_t = \sum \alpha_1 LATM_{1-t} + \sum \alpha_2 LWEB_{1-t} + \sum \alpha_3 LPOS_{1-t} + u_{1t}$$

$$495 CPSGDP_t = \sum \alpha_1 LATM_{1-t} + \sum \alpha_2 LWEB_{1-t} + \sum \alpha_3 LPOS_{1-t} + u_{1t}$$

496 *For FD →E-Payment Channels*

497  $u_{1t}$  = the error terms

498 *M2GDP, LATM, LWEB, POS are as defined above.*

499 *CPSGDP and M2GDP are financial deepening indicators while LATM, LWEB, LPOS are*  
500 *electronic payment channels*

501 *→ show the direction of causality.*

502 The model is a modified form of the one developed by De Gregorio and Guidotti (1995) and  
503 Adamopoulous A (2013) in studying financial deepening on a global scale and the form used  
504 by Onwumere, Kalu and Nkwor (2015) in the study of financial deepening and economic

505 growth in Nigeria. In this context, the dependent variable is financial deepening and e-  
506 payment channels are the explanatory variables and the model will appear thus:

507  $M2GDP = F(VATM)$

508  $CPSGDP = F(VATM)$

509 where

510 F is the functional notation, thus;

511 M2GDP= ratio of broad money supply to gross domestic product (a financial deepening  
512 indicator)

513 CPSGDP= ratio of credit to the private sector to gross domestic product (a financial  
514 deepening indicator)

515 VATM = Volume of Automated Teller Machine.

516 To test the individual hypotheses as formulated, the models to be used will be as follows:

517 **Hypothesis One**

518  $CPSGDP_t = \sum \alpha_1 LATM_{1-t} + \sum \alpha_2 LWEB_{1-t} + \sum \alpha_3 LPOS_{1-t} + u_{1t}$

519 *Where*

520 *CPSGDP* = ratio of credit to private sector to gross domestic product (a financial  
521 deepening indicator)

522 *ATM* = Volume of ATM transactions

523 *WEB* = Volume of Web Payment

524 *POS* = Volume of Point of Sales Transaction

525 **Hypothesis Two**

526  $M2GDP_t = \sum \alpha_1 LATM_{1-t} + \sum \alpha_2 LWEB_{1-t} + \sum \alpha_3 LPOS_{1-t} + u_{1t}$

527 *Where*

528  $M2GDP$  = ratio of broad money supply to gross domestic product (a financial deepening  
529 indicator)

530  $ATM$  = Volume of ATM transactions

531  $WEB$  = Volume of Web Payment

532  $POS$  = Volume of Point of Sales Transaction

### 533 **3.5 Technique of Data Analyses**

534 Relevant econometric techniques were employed in analyzing the collected data and drawing  
535 conclusions, with the aim of properly examining the response of financial deepening to  
536 electronic payment systems in Nigeria from 2009 to 2014.

537 Preliminary tests are conducted for the data properties, behavior and goodness for the  
538 purposes of using them for the model estimation. It includes among other things the  
539 following: descriptive statistics like mean, median, variance, standard deviation skewness,  
540 kurtosis, (test for normality) and Correlational analyses to test for linear association.

541 Pairwise Granger Causality test is used to prove the direction of influence. The test assumes that  
542 the information relevant to the prediction of the variable are contained solely in the time series  
543 data on these variables. This test is popularized by Granger (1969) who assumed that the current  
544 values of a variable (Y) is conditioned on the past values of another (X) or the other way round.  
545 This test shows whether a bidirectional or unidirectional causality exists between the variables of  
546 interest. In this work, this test was adopted to confirm whether financial deepening indicators  
547 granger causes electronic payment systems or electronic payment systems granger causes  
548 financial deepening indicators. It may also show whether they both granger causes themselves.  
549 Specifically, it showed whether there is a causal relationship between the two and if there is, is it  
550 unidirectional or bidirectional.

551

552

553 **4. Results**

554 The table below contains the proxies for the variables under study

555

556 **Table. 1 LOG LINEARISED FORM OF FINANCIAL DEEPENING INDICATORS AND**  
557 **ELECTRONIC PAYMENT CHANNELS TRANSACTIONS – 2009 to 2017**

YEAR	LATM	LM2GDP	LCPSGDP
2009	18.50834	3.636450	3.608212
2010	17.91208	3.005978	2.923162
2011	19.66648	2.961525	2.827314
2012	19.74374	2.964042	3.015535
2013	19.50348	2.940667	2.980619
2014	19.80723	2.988507	2.954910
2015	19.780543	2.986780	2.897654
2016	19.657480	2.9876543	2.987645
2017	19.778867	2.967540	2,876543

558 **Source: Central Bank of Nigeria Statistical Bulletin 2017**

559 **4.2 Data Analysis**

560 **2.2.1 Descriptive Analysis**

561 The descriptive analysis presents the aggregative averages of the variables under study. It  
562 describes the variables under study presenting the mean, minimum and maximum values,  
563 standard deviations and measures of distribution such as skewness and kurtosis. The descriptive  
564 goodness-of-fit test is also presented to ascertain the normality of the dataset.

565 **Table 2 Description of the variables under study**

Variable	Mean	Min	Max	Std dev.	JB-Stat	Prob. (JB)	No of observations
LATM	19.19	17.91	19.81	0.79	0.95	0.62	9
LATMU	2.52	2.41	2.78	0.14	1.41	0.49	9
LCPSGDP	3.05	2.83	3.61	0.28	2.65	0.27	9
LM2GDP	3.08	2.94	3.64	0.27	3.43	0.18	9

566 **Source: Researcher's extract from E-views output**

567 From the descriptive analysis in table 3 above, the minimum and maximum values indicates  
568 closeness among the series of the dataset. The standard deviation which is a measure of  
569 dispersion from the mean confirms that there is a close dispersion among the series of the dataset  
570 while the Jarque-Bera goodness-of-fit tests and associated probabilities greater than 0.05 shows  
571 the datasets are normally distributed.

572 **2.2.2 Correlation Analysis**

573 **Table 3** Correlation Results of the Variables under study

Correlation	LCPSGDP	LM2GDP	LMOBILE	LATMU	LATM
LCPSGDP	1.000000				
LM2GDP	0.967370	1.000000			
LMOBILE	-0.295457	-0.371844	1.000000		
LATMU	-0.256958	-0.300204	0.944081	1.000000	
LATM	-0.383871	-0.471005	0.677901	0.551785	1.000000
Probability	LCPSGDP	LM2GDP	LMOBILE	LATMU	LATM
LCPSGDP	-----				
LM2GDP	0.0016	-----			
LMOBILE	0.5697	0.4679	-----		
LATMU	0.6230	0.5632	0.0046	-----	
LATM	0.4525	0.3457	0.1389	0.2563	-----

574 *Source: Researcher’s computation from E-views extract*

575 The general correlational analysis shows that there exist significant linear associations between  
 576 ATMU and mobile payment, point of sales and mobile payment, point of sales and ATMU, web  
 577 payment and mobile payment, web payment and ATMU, and between web payment and point of  
 578 sales in Nigeria.

579 **4.3.1 Hypothesis one**

580 **H<sub>1</sub>:** Transactions with automated teller machine granger cause credit to the private sector in  
 581 Nigeria.

582 **Level of significance ( $\alpha$ ) = 0.05**

583 **Results**

584  
 585 **Table 4: LATM and LCPSGDP model analysis**

LATM does not Granger Cause LCPSGDP	8	19.3951	0.0479
LCPSGDP does not Granger Cause LATM		39.4807	0.0244

587 Since the p-values of 0.0479 and 0.0244 are less than 0.05, we reject the null hypothesis and  
 588 conclude that there exists a bi-directional relationship between automated teller machine  
 589 transaction (LATM) and private sector credit (LCPSGDP) in Nigeria. This implies that the use of  
 590 automated teller machine (ATM) drives the degree of credit to private sector which is a financial  
 591 deepening indicator and financial deepening also drive the use of ATM in Nigeria.

592 **4.3.2 Hypothesis Two**

593 There is causal relationship between automated teller machine transaction and broad money  
594 supply in Nigeria.

595 **Level of significance ( $\alpha$ ) = 0.05**

596 **Results**

597

598 **Table 5: LATM and LM2GDP model analysis**

LATM does not Granger Cause LM2GDP	8	0.00065	0.9820
LM2GDP does not Granger Cause LATM		128.147	0.0077

599 **Source: Researcher's Computation**

600 Since the p-value of 0.0077 is less than 0.05, we can deduce that broad money supply drives the  
601 use of ATM in Nigeria. Hence, we reject the null hypothesis and conclude that there exists a  
602 unidirectional relationship between automated teller machine transaction (LATM) and broad  
603 money supply (LM2GDP) in Nigeria.

604 **5. CONCLUSIONS**

605 This study examined the impact of electronic payment on financial deepening in Nigeria.  
606 Following a detailed theoretical review and empirical analyses, findings were made in line with  
607 the research questions as well as set and tested hypotheses. The findings from the specific  
608 objectives of this study are as follows:

- 609 **1.** That there exists a bi-directional relationship between automated teller machine  
610 transaction (LATM) and private sector credit (LCPSGDP) in Nigeria.
- 611 **2.** That there exists a unidirectional relationship between automated teller machine  
612 transaction (LATM) and broad money supply (LM2GDP) in Nigeria.

613 We found out that the p-values of 0.0479 and 0.0244 are less than 0.05; we reject the null  
614 hypothesis and conclude that there exist a bi-directional causal relationship between automated  
615 teller machine transaction (LATM) and private sector credit (LCPSGDP) in Nigeria. This  
616 implies that the use of automated teller machine (ATM) drives the degree of credit to private  
617 sector which is a financial deepening indicator and financial deepening also drive the use of  
618 ATM in Nigeria. This implies that as the depth of the financial system increases, the use of

619 automated teller machine increases. Similarly, the use of automated teller machines leads to  
620 financial inclusion and greater deepening. This finding is consistent with Nabila and Zakir  
621 (2014) who found bidirectional causality between financial development and the use of  
622 electronic payment system.

623 From the findings made, the p-value of 0.0077 is less than 0.05; we can deduce that broad money  
624 supply drives the use of ATM in Nigeria. It is concluded that a unidirectional causal relationship  
625 exists between automated teller machine transaction (LATM) and broad money supply  
626 (LM2GDP) in Nigeria. This essentially implies that as the volume of money in circulation  
627 increases, the channel for dispensing the money should enlarge correspondingly. This agrees  
628 with the position of Ghildiyal, Pokhriyal, and Mohan, (2015) who found a bidirectional causality  
629 in the Indian economy between money supply and electronic payment channels. The results  
630 recorded from the study agree with existing findings and theories and they all agree that there is  
631 a relationship between financial deepening and electronic payment channels in the Nigeria.

632 By reason of the above findings, we recommend that the government should make policies that  
633 will improve the use of diverse electronic channels with the aim of strengthening their impact on  
634 the degree of financial depth in Nigeria. In addition, adequate regulatory architecture should be  
635 put in place to ensure that the negative fallouts of the use of electronic payment channels are  
636 minimized. This is with the view to making them more acceptable to the people. More so,  
637 government policies on financial deepening should be vigorously pursued so that its alliance  
638 with the electronic payment channels will be strengthened to the overall benefit of the Nigerian  
639 A major contribution to knowledge which this study has made is that it is based on empirical  
640 evidence from Nigeria. This makes the findings relevant for policy making in the Nigerian  
641 setting. It is our belief that this work made some contributions to knowledge based on the fact  
642 that it is a very gray and lowly unresearched area. To this effect, there are very few empirical  
643 works in this novel area. This work joins the league of the very few studies in electronic payment  
644 and financial deepening in Nigeria and can open a further study into the impact of electronic  
645 payment systems on the banking habits of Nigerians and other users of banking services in  
646 economies like Nigeria.

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