

An Assessment of the Impact of E-payment Adoption on Cost Efficiency of Selected Deposits Money Banks

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Abstract— Empirical studies have confirmed high cost of operations in the Nigerian Deposits Money Banks (DMBs) in term of maintaining and keeping physical cash, .thus creating room for further investigation in the financial sub- sector (Central bank of Nigeria Report 2009). The current study becomes important due to inadequate empirical research in the area of E-Payment adoption influence on banks' cost efficiency in the Nigerian context. The study therefore examined the impact of E-Payments adoption on cost efficiency of the Nigerian Deposits Money Banks (DMBs). Secondary data were obtained from annual report and accounts of ten quoted (DMBs) between 2005 and 2012. Based on the likelihood ratio (LR) statistics from Stochastic Frontier Analysis (SFA) the result indicated positive and significant (at 0.05) improvement in the cost efficiency of the sampled banks. The overall mean cost efficiency obtained (1.214) exceeds 1 indicating that e-payment adopting banks could reduce their cost by to remain at highest possible efficient level in the sector. This means that e-payment adoption caused the cost efficiency of the sampled banks to increase. The findings from the study are expected to assist banks in the formulation and implementation of E-payments policy for improved performance in the economic sub-sector.

Index Terms— E-Payments; E-Payments Adoption; Cost Efficiency; Deposits Money Banks

I. INTRODUCTION

The explosive growth of the Internet is bound to have a profound impact on the accounting profession as submitted by Kogan, Sudit and Vasrhelyi (2009) such that growing body of financial information has to be collected, classified, presented, analyzed, and assured by accountants on line. The implication of this new development in e-commerce is that accountants must follow the new rule in presenting information using the technology. The results of the study of AL-Refae (2012) showed that using e-commerce affects the design of Accounting Information Systems and that using e-commerce provides appropriate accounting information about available substances at the right time, at a credible and stable degree for decision makers.

E-commerce, according to Bansal and Sharma (2006), is rapidly transforming the way accounting functions are

performed, posing new challenges to the accounting profession. This view is further corroborated by Olivier (2000) that one of the most important current influences on the accounting profession is the development of new information technology. Traditional business models are increasingly coming up against their limits while innovative payment solutions are urgently required to boost internationally oriented e-commerce. Payment system providers, service providers, network operators and financial institutions pin great hopes on new payment systems (Heng, 2008). Further is the observation of AL-Refae (2012) that e-commerce has become a realistic fact that includes an international open market that is not constrained by any geographical borders with the increasing growth in using the internet as an intermediate to execute the operations of the e-commerce.

Prior to the advent of personal computers, businesses were limited to manual methods for keeping track of financial data. According to Tavakolian (1995), the manual accounting system consists of paper ledgers, typewriters and calculators. Typewriters were used to type invoices and cheques, and all calculations were performed using calculators. However, with this system it was possible for errors to be introduced into the data since they could go undetected for quite some time. Like many other industries, the accounting industry changed with the arrival of personal computers. A computerized accounting system is able to handle financial data efficiently, but the true value of an accounting system was that it was able to generate immediate reports regarding the company (Amidu and Abor 2011; Memis, 2011). According to Memis (2011), E-accounting is "electronic enablement" of accounting and accounting processes which are more traditionally manual and paper-based like electronic payments, electronic commerce, the technology of bar codes, electronic signature, electronic invoice, etc. E-accounting comprises not the representation of the accounting information in electronic format but also concerns all accounting cycles, processes and functions in an enterprise that uses financial /accounting information.

According to Spremic, & Jakovic, (2012) the cost of an e-banking transaction is up to 50 times cheaper for the bank compared to counter transaction. It is quite obvious that transaction information system and accounting information system as their vital part plays very important role in implementing e-business concept. Their study concluded that indeed Accounting Information System usage affects the e-business efficiency. Furthermore, Kogan, Sudit & Vasrhelyi (2009) observed that accountants will now operate in an increasingly networked world with most organizations being on the net and thus accountants have access to the internet any where they find themselves either at work or home. This suggests that the era of waiting to get to office to

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generate information on business performance is over. Studies on accounting information system confirm strong and positive influence of AIS and e-business efficiency and as such becomes subject of concerns to the accountants and players in commerce (Abu-Musa 2008;; Kogan et al , 2009; Al-Refae (2012; Spremic and Jacovic 2012).

The efficient and effective use of resources is a key objective of every banker. Whilst this issue has always been relevant, global trends such as increasing competition for financial services, deregulation, technological innovations and banking consolidation have brought more attention on controlling costs and providing products and services more efficiently (Spong, Sullivan & De Young, 1995). All these put together form the thrust of the current study on e-payments adoption impact on banks cost efficiency using ten quoted deposits money banks in Nigeria.

1.2 Statement of the Problem

The recent cashless policy of the Nigerian government has been a subject of concern to players in commerce. The CBN strategic plan on payment system is to ensure that a larger proportion of currency in circulation is captured within the banking system, thereby enhancing the efficacy of monetary policy operations and economic stabilization measures. Empirical studies have confirmed high cost of operations in the Nigerian Deposits Money Banks (DMBs) in term of maintaining and keeping physical cash .thus creating room for further investigation in the financial sub sector (CBN Report 2009). Nigerians are known for tendency to hold cash for transactional purposes and have passion for carrying about physical cash. This calls for more informed approach to achieving cost efficiency in the banking sector. The need for compliance with the central bank of Nigeria (CBN) cashless policy has created challenges for the surviving commercial banks in Nigeria on performance. For instance, all banks in Lagos zone are expected to comply with the cashless policy by having ATM, EPOS, WEB and Mobile banking. While some banks are seen to have all forms of e-banking services so that transactions along e-payment becomes effortless, others are not fully complying, which generate further enquiry. The current study becomes important due to inadequate empirical research in the area of E-Payment adoption influence on banks' cost efficiency in the Nigerian context.

1.3 Objectives of the Study

Analyze the pattern of e-payment transactions system by Deposits Money Banks (DMBs) in Nigeria;

Assess the effect of e-payment adoption on cost efficiency of Nigerian commercial banks; and

1.4 Research Hypothesis

HO: E-payments adoption does not significantly influence banks cost efficiency.

II. LITERATURE REVIEW AND CONCEPTUAL UNDERPINNINGS

2.1 Concept of Cost efficiency and E-Payments System in the Deposits Money Banks

Costs in banking are primarily incurred by providing payment processing, deposit safekeeping, cash access, and loan initiation and monitoring services through a geographically diversified set of general and specialized branch offices as well as ATMs. While deposit safekeeping and loan services are specific to branch offices, ATMs substitute with branches

for cash withdrawal, balance inquiry, and account transfer services. Some initial payment processing may occur at branch offices but most is incurred in separate dedicated facilities associated with the bank or outsourced to non-bank processors. All of these services involve labor, physical capital, and materials operating expenses and our purpose are to determine statistically the association of operating costs to the processing of check, and card payment transactions as well as the use of ATMs and branch offices. Interest rates on deposits and loans do not really affect the production of payment services and ATMs but can influence the tradeoff between the use of branch offices to collect (lower cost) deposit funds and sell/service mutual funds relative to (more expensive) interbank purchased monies over the interest rate cycle. However, the presence of inefficiencies is considered an inherent feature of banking. According to Turati (2003), "banks are regarded as firms that emerge as a result of some sort of market imperfections; hence they bring about a certain degree of inefficiency with respect to perfect competitive outcomes". A study conducted by the European commission in 2001 supported the above thinking when it revealed that European banks were particularly inefficient (Turati, 2003). Efficiency in banking can be distinguished between allocative and technical efficiency. Allocative efficiency is the extent to which resources are being allocated to the use with the highest expected value. Outputs could be loans or total balance of deposits, while inputs include labour, capital and other operating costs. A firm is also said to be cost efficient if it is both allocatively and technically efficient (Mester, 1997; Watkins, Hristovska, Mazzanti, Wilson, and Schmidt 2014). Studies on X-inefficiency, as a measure of the loss of allocative and technical efficiency, have been carried out particularly internationally. The results of the study of Berger & Mester, (1997) showed that X-inefficiency is between 20-30 percent of total banking costs in the US. However according to Bos and Kool (2006) in general, banks experienced higher profit efficiency than cost efficiency. Concetta (2011) studied impact of ICT on TE in Italian FIRMS using both the translog and the Cobb-Douglas production functions are used in order to estimate the impact of information and communication technology on technical efficiency (TE) in Italian manufacturing firms over the period 1995-2003. Results show that ICT investments positively and significantly affected firms' technical efficiency. Moreover, group, size. Also

2.2 Measurement of Cost Efficiency in Commercial Banks

The term "efficiency" refers to the maximizing of output in such a way the input resources are less utilized, banking efficiency is defined as difference between observed quality of input and output variables with respect to optional quality of input variables. The efficient banks can achieve a, maximum value of ONE in comparison to inefficient banks can reduce to ZERO (Haseeb, Ramiz ur, Ghulam, Awais 2010) There are some difference approaches to measuring efficiency; namely, the non-parametric (linear programming), the parametric (stochastic – frontier, production - function) approach etc. data whether the recapitalization, merger and acquisition programmes were successful evenly on the other hand, the result will also find out the inefficient banks, if shrinking them together with the efficient banks in order to benefit from scale advantages will be more beneficial.

There have been several studies analyzing banks efficiency in Nigeria and other countries of the world. For example

RamMohan (2002, 2003) used financial measures for comparing operational performance of different categories of banks over a period of time. However, most of the studies which look at the efficiency of Indian commercial banks concentrate on efficiency of only the public sector banks, other look at the relationship between ownership and efficiency. RamMohan and Ray (2004) compared the revenue maximizing efficiency of public, private and foreign and foreign banks in India, using physical qualities of inputs and outputs in the 1990's. Using deposit and operating cost as inputs and loans, investments and other income as outputs, they found that public sector banks were significantly better than private sector banks on revenue maximization efficiency, but between public sector banks and foreign the difference in efficiency was not significant. There are a number of studies that describe the methodology of DEA as applied to banking (Drake, 2004; Fethi and Pasiouras, 2010). Studies in Chinese for example suggest exceptionally high levels of cost inefficiency in Chinese banks. These are Chen et al (2005) that found average inefficiency levels of 44% -66% in 1993-2000, and Matthews et al (2007) found inefficiency levels 50%-60% in 1997-2004. However Arif and Can (2008) report average cost inefficiency of 30% for 1995-2004.

Some researchers in Pakistan also employed the data employed the Data Envelopment Analysis (DEA) model, Notable among is Daniel (2003) who studied the commercial bank efficiency in the Vise grad region before joining European union and also to consider differences in efficiency across the countries. He used non parametric programming technique; Data Envelopment Analysis (DEA) and model to estimate efficiency of different banks for period of (1999-2002) the sample test for every year were 59 banks in 1999, 72 in 2000, and 62 in 2002 respectively. The result indicated that average efficiency of banking intermediation in 2002, the banking industries could be distinguished as more and less efficient. Czech and Hungarian banking sector were on average evaluated as the most efficient followed by with non – marginal distance, by the public banking sector. The Slovak banking sector stands apart with a substantial gap in efficiency scores

AbdulQuoyum (2007) investigated the yearly efficiency scores of 20 banks for period of (1991-2005). He used non-parametric programming technique, Data Envelopment Analysis (DEA) model to estimate efficiency of 20 banks for period (1991-2005). The result indicated that efficiency score of banking improves from 65% in 1991 to 87.6% in 2005. As a result of which banks are able to expand their core business activities, they strengthened their capital base, improved assets quality and profitable during the year 2005. This development clearly reflected the increase competition among banks and improvement in efficiency of banks sector. In Nigeria as well some researchers have employed DEA to measure the bank performance. For instance Ayadi, Adebayo and Omolehinwa (1998) measured the bank performance in Nigeria by applying data envelopment analysis to the financial data of ten banks from 1991 to 1994. They used interest paid on deposit, total expenses, and total deposit as inputs while total loans or interest and non-interest income were considered as outputs. They found that banks in existence for long period of time were relatively efficient than other banks in the sample and banks having poor management showed bad performance and that was the key determinant of the bad performance of banks in Nigeria. Furthermore Davies

(2011) studied scales economics in banks over period before, during and after banks consolidation in development world using Nigeria as a case study. It adopted the data envelopment analysis (DEA) for computing scale economics scores of the stability banks in the country in 2001-2008. The results revealed that on average, more banks enjoyed economies of scale in period of consolidated than in the period of 3 years after consolidation. Furthermore, banks records economies of scale in the pre-consolidation era than in post-consolidation period, the level of economies of scale over the period in the sector is promising.

Tanvir and Waseem (2008) estimated technical efficiency under suggested specification, data envelopment analysis (computer) program developed by Coelli (1996) is used. After analysis commercial banks operating in Pakistan got 27 different technical efficiency scores under this specification of DEA and among these banks 7 got the highest technical efficiency score. Lowest technical efficiency score obtained by a bank under the specification is 0,003, so the highest input reduction under the specification that should be carried out by that bank to achieve obtains level of profit efficiency is about 99.70% of the current level of inputs. Ali et al (2002) used DEA and found that the most striking conclusion from this ranking is that the smallest bank in Kuwait, the industrial bank of Kuwait, is consistently the most efficient of all banks in the country in each year of the four years of the sample.

Usman, Adewoye and Akinlo (2009) investigated the problem of inefficiency in the Nigerian insurance market from the perspective of their cost structures. The study used the secondary data of financial reports of thirty randomly selected insurance firms which spanned over a period of ten years and applied transcendental logarithm model to evaluate their performance from the cost structures strategy. The results indicated that only large scale firms sampled belong to this category. This result suggested that premium income would contribute to insurance firm's performance, only when a sound investment decisions are made. Further to this is the study of Usman (2009) that made use of Cobb – Douglas cost and profit functional model to investigate performance of randomly selected insurance firms. It could be seen from the result that there was inverse relationship between the cost of labor and the firms' profit, which means that as the cost of labor used in the day to day activities of the firms increased, there would be an increase in the total cost of production and there by the level of profitable of the firm reduced. The outcome suggested that a few insurance firms in Nigeria mostly do not pay claims; therefore, establishing reason why there is apathy for insurance service among insuring public. Labor price was significant in this study, but showed an inverse relationship with business.

Alese, Ogunbanjo, Falaki and Adewale (2006) focused on measuring technical efficiency of internet service providers in western Nigeria by the using stochastic trans log frontier model as a relationship among certain network characteristics taken in as inputs in the day to day provision of service. Consequently, an internet service model estimation questionnaire was designed and ministered to a total of 203 randomly sample internet service providers in order to collect data about these network characteristics. A comparative analysis of estimation from two models was carried out the hypotheses that the Cobb-douglas model adequately represent the data were accepted in both methods. However it was found that although the means technical efficiency is high

(about 91.2%) wide variation of about 64.9% exists between the lowest and the highest technical efficient service providers. Furthermore, network characteristics such as transmission link and transmission band width hence the greater effect on the technical efficiency of a service provider in western Nigeria.

In measuring the efficiency of banks, non-performing loans have an exogenous impact on efficiency. Because it may potentially make significant changes in scale and technical efficiency, empirical studies such as Drake and Hall (2003) have suggested that it is very important to control this kind of exogenous impact. The age of bank affects its operation stability and management attitude. Second generation banks have a short establishment period. It has pressure to cover its start-up cost, leaving little resources for investment in e-payment. In the case of first generation banks, they have been in operation for a long period of time, and their financial situations are also steady, to some extent. Thus, first generation banks have enough money to invest and update their status.

To measure bank efficiency, non-performing loans are also an important variable, due to their impact on banks' scale and technical efficiency. Prior studies have indicated the importance of controlling its exogenous impact; hence its inclusion in the model.

III. METHODOLOGY

Out of the twenty commercial banks existing as at 2013 fifteen of them were quoted on the Nigeria Stock Exchange out of which ten selected for the purpose of the study. These ten banks are expected to have fulfilled listing requirements and thus disclosure of relevant information for the study is expected to have been made by all the quoted banks. Ten of these were purposively selected for this study. The reason for purpose choice of the sampled commercial banks is based on their quotation on the Stock Exchange and consistent records of performance during the period of study. The annual reports of sampled banks covering 2005 to 2012 were analyzed to achieve the objectives of the study.

The main objective is to estimate the impact of e-payment adoption on cost efficiency of Deposits Money Banks. Cost X-efficiency measures the extent to which a bank's costs approximate those of the "best practice" or least cost bank, producing an identical output bundle under the same conditions. The measure is derived from a cost function where the dependent variable is each bank's total costs, and the independent variables include the prices of inputs, the quantities of variable outputs, and a composite error term. A general version of this cost function for a bank may be written as

$$(1)$$

Where

C = total costs

w = input prices

y = output quantities

e = u+v

u = an X-inefficiency factor that may raise costs above the best-practice level

v = the random error incorporating the measurement error or a random shock to bank costs, deemed occasional.

The empirical model for the purpose of this study is specified as:

$$y = f (BAZ, SLV, NPLR, BCD) \dots\dots\dots (3.5)$$

Explicitly, y is represented as CE1it and CE2it t
 $CE1it = \alpha_0 + \beta_1 BAZit + \beta_2 SLVit + \beta_3 NPLRit + \beta_4 BCDit + e_{it} \dots\dots\dots (3.6)$

$CE2it = \alpha_0 + \beta_1 BAZit + \beta_2 SLVit + \beta_3 NPLRit + \beta_4 BCDit + e_{it} \dots\dots\dots (3.7)$

i represents the number of banks (15)

t represents time period (2005-2012); and

CE1, 2, the dependent variables represents two cost efficiency measures;

These explanatory variables are defined as follows:

BAZ = log (TA)

SLV = PE/NE

NPLR = NPL/TL

BCD = 1 if a bank is a new bank (established since 1991), and 0 otherwise.

Where

BAZ = bank size

SLV = salary level

NPLR = non-performing loans

BCD = bank categorization dummy

TA = total assets

PE = personnel expense

NE = number of employees

NPL = non-performing loans

TL = total loans

Measurement of Cost Efficiency Variables

The definition and measurement of dependent and independent variables that will be used in the study are provided below.

Dependent variable

Operating cost rate (CE1): measures cost efficiency of banks' operating activities. The higher the measure, the lower the cost efficiency of operating activities

Asset management cost rate (CE2): measures asset management efficiency of the banks. The higher the CR2 measure, the lower the asset management efficiency.

Operating cost rate (CE1) and asset management cost rate (CE2) variables are defined as:

$CE1 = OE/TR$

$CE2 = OE/TA$

Where

CR1= operating cost rate

CR2 = assets management cost rate

OE = operating expense

TR = total revenue

TA = total assets

IV. RESULTS AND DISCUSSION

4.1 Pattern of e-payment System by Commercial Banks in Nigeria

The adoption of e-payment system has improved Nigeria's payment landscape. This is evident in terms of volume and value of the level of adoption in the country. The level of this adoption has continued to increase significantly. For example, ATM hit close to 90 to 100 million transactions monthly in November 2011 having and accounted for N168, 171,231 worth of transactions as at 2010. Throughout the sample period, the volume and value of ATM remain the highest. Table 4.1 and 4.2 show the volume and value of e-payment transactions for the sample period.

Table 4.1: Pattern of Adoption of e-Payment System by Volume (billion)

Payment instruments	Volume					
	2006	2007	2008	2009	2010	2011
ATM	3,608,022	4,765,467	18,954,942	49,671,367	168,171,231	167,962,665
Web (internet)	1.71	5.1	2.4	-	4.3	
Mobile	-	161,679	1,576,207	7,471,388	7,471,388	
POS	0.019769	0.091211	0.535376	0.627314	535,767	

Source: CBN Annual Reports: 2006, 2007, 2008, 2009 and 2011 (half year report)

Table 4.2: Pattern of Adoption of e-Payment System by Value (billion)

Payment instruments	Value (billions naira)					
	2006	2007	2008	2009	2010	2011
ATM	18.91	41.28	143.30	285.87	405.87	764.14
Web (internet)	3.51	7.1	5.7	-	47.6	
Mobile	-	0.0447	0.165	0.013	10.30	
POS	0.09	0.946.22	0.0068	0.0078	5.4	

Source: CBN Annual Reports: 2006, 2007, 2008, 2009 and 2011 (half year report).

4.3 Effect of e-payment adoption on cost efficiency of Sampled Banks

The cost efficiency estimated from stochastic frontier is presented in Table 4.3 to 4.4. The overall mean cost efficiency was 1.214. This means that the e-payment adopting banks could reduce its costs by 21.4 percent to match its performance to the level of the most efficient bank in the sector. This finding confirms the earlier findings of previous studies of Bos and Kool (2006) that, in general, banks experienced higher profit efficiency than cost efficiency. The

maximum likelihood method (Table 4.4) is applied to estimate the parameters of the model and the prediction of the efficiencies of the banks. The estimation results of the cost efficiency show that bank size and SLV are significantly related to cost efficiency of banks. However, the influence of SLV is negatively related to cost efficiency while bank size is positively related to cost efficiency of banks. Similar implication was obtained for Cost function using OLS parameter estimates.

Table 4.3 Function OLS Parameter Estimates

Variables	Parameters	Coefficient	T-Ratio
Constant	β_0	-0.014159484	-0.124
Bank size	β_1	0.09453	10.37**
SLV	β_2	-0.0049011	-1.89***
NPLR	β_3	0.36465	0.99366
BCD	β_4	-0.02447	-0.348485
Variance parameters			
Sigma-squared	σ^2	0.038599561	
Gamma	Γ	0	
Log likelihood	Llf	11.00	
Mean Cost efficiency		1.214	

Source: Data analysis, 2013

Table 4.4: Cost Function Maximum Likelihood Parameter Estimates

Variables	Parameters	Coefficient	T-Ratio
Constant	β_0	-0.16496	-1.615
Bank size	β_1	0.0917	10.837***
SLV	β_2	-0.005068	-2.14715***
NPLR	β_3	0.27007	0.27007
BCD	β_4	-0.00693479	-0.10556
Variance parameters			
Sigma-squared	σ^2	0.06770	2.6849
Gamma	Γ	0.7933	4.453
Log likelihood	Llf	11.837	11.837

Source: Data analysis, 2013

Table 4.5 shows that on the average, cost efficiency of bank H is highest (3.393), followed by Bank J (1.288) and Bank E (1.25), Eco bank is followed by Bank A (1.2185) while Bank B, Bank D and Bank F are among the lowest. This implies that Bank H and Bank J would need to reduce their operating cost by a larger percentage relative to others. This finding also tallies with Usman (2009) who found that there was inverse relationship between the cost of labor and the firms' profit. It is in tandem with the study of Ayadi et al (1998) that period of existence and size of banks determine their efficiency and Davies (2011) that more banks enjoyed economies of scale in the period of consolidation than the periods earlier

Table 4.5: Average cost efficiency scores, 2005–2011

Banks	Average Cost efficiency
Bank A	1.2185
Bank B	1.185
Bank C	1.227
Bank D	1.18
Bank E	1.25
Bank F	1.065
Bank G	1.115
Bank H	1.395
Bank I	1.168
Bank J	1.288

Source: Data analysis, 2013

Test of Hypothesis

H₀: E-payments adoption does not significantly influence banks cost efficiency.

Based on the likelihood ratio (LR) statistics from stochastic frontier analysis, the stated null hypothesis is rejected. The overall mean cost efficiency obtained exceeds 1 indicating a need for e-payment adopting banks to reduce their cost to remain at highest possible efficient level.

CONCLUSION AND RECOMMENDATION

The overall result from the analyses showed that e-payment adoption caused the cost efficiency of the sampled banks to increase. The findings from the study are expected to assist banks in the formulation and implementation of E-payments policy for improved performance in the economic sub-sector. In the light of the above it is suggested that: Banks should design long-term strategic planning for better implementation and elimination of obstacles for development

of e-banking, including educational packages for customers of banks in branches and organize training courses for improving skills of employees.

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