DBN Development Bank of Nigeria
...Financing Sustainable Growth

DBN JOURNAL OF ECONOMICS & SUSTAINABLE GROWTH
VOLUME 1, ISSUE 1, 2018

IMPACT OF MOBILE MONEY ON PRICES AND OUTPUT IN NIGERIA

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Abstract
This paper examines the impact of mobile money on prices and output in Nigeria between 2008M1 to 2016M12. Using mobile money payment (MM) as a proxy for mobile money transaction, the structural vector auto-regressive (SVAR) model was adopted to test for the response of money supply (M2), consumer price index (CPI) and real gross domestic product (RGDP) to shocks from mobile money. The result shows that output responds positively to positive shocks from mobile money.

This confirms the postulations that increase in velocity of money would improve the volume of money in circulation and given the slack in the economy wherein the economy operates below full-employment or potential capacity, increase in money supply will account for increase in national productivity with no effect on price. Also, the response of consumer price index to shocks in mobile money was stable which implies that shocks from mobile money transactions that results in increase in money supply and velocity does not precipitate price increase rather it would increase the macroeconomic stability of the countries in which it is widespread.

Based on the study's findings, it is recommended that the government and policymaker should encourage the use of mobile money to achieve price and output stability. They should also develop means of controlling mobile money transactions to channel macroeconomic variables in the desired direction towards achieving the desired policy goals.

JEL Classification: *E4, E5, E52, E58*
Keywords*: mobile money, financial innovation, structural VAR, Nigeria.*

1.0 Introduction

The importance of technology and its role in the development of a nation has attracted the attention of scholars and hence discussed extensively (Romer, 1990; Aghion and Howitt, 1992, and Temple, 1999). Technology is fundamental to the development of all the sectors in any economy especially the real and service sectors.

One of the most recent innovations in technology is the advent of mobile money/banking technology in the financial sector. Mobile money is a catch-all term that encompasses all financial services provided via mobile network operators whose services mainly involve enabling users to store money on their mobile money accounts and to transfer them to other users (Adams and Walker, 2015). It is simply a regulated payment service that can be performed via any mobile device such that, even without a bank account, users can have access to their money anywhere and at any time. It accord subscribers the privilege of converting real money into electronic money (e-money) and credited into mobile devices so that financial transactions can be conducted through a mobile phone.

This reduces dependency on cash and commutes a much broader range of financial services to the unbanked population. (Phillips Consulting, 2013). Masha (2016) described it simply as payments initiated and transmitted by access to devices that are connected to mobile communication network.

While mobile money technology is already adopted in many developed countries, its spread and acceptance in the developing countries is like wildfire. Its advent has no doubt revolutionalise banking activities, doubtless monetary policies, globally. Monetary authority and commercial banks in Nigeria have had to factor mobile money payment into their policy decisions due to its impact on financial intermediation, general economic activities and policy goals especially output and prices. According to Wolf (2015), some studies at the "macro level have shown that mobile money is likely to have stabilizing effects on the paths of inflation and output" while at the micro level studies found that "mobile money helps protect the rural poor against income shocks from weather and other sources and participate in the financial system".

The increase in mobile money transactions cannot be overlooked given its likely impact on the amount of money in circulation, price level and the efficacy of monetary policy. Some central bankers have expressed concern that this innovation may undermine the efficacy of monetary policy as conventionally conducted given that an increase in mobile money transactions and balances will increase the velocity of money and money multiplier thus resulting in price increase. The attendant implication for the monetary authority is the difficulty to pursue the goal of price stability. However, the fear that mobile money may undermine the conduct of monetary policy was allayed by Adam and Walker (2015) whose finding shows that mobile money would increase the macroeconomic stability of the countries in which it is widespread with benefits going mainly to the rural lower-income households while also providing a case for targeting core inflation.

Mobile money was designed to benefit both rural and urban households. While urban household users of mobile money saves time and transaction costs, the farming households

in the rural area, contributes to welfare gains as they now have a secure place to store their savings given that they are underserved by the formal banking system. The possibility to instantly and securely receive remittances and transfer money to pay for farm and off-farm economic and non-economic activities enable funds to be channeled to where they are the most useful either for consumption or investment purposes. Mobile money account also serve as a form of savings account from where cash can be withdrawn for paying business partners in exchange for goods and services. These positively affects the level of investment and aggregate economic activities.

Mobile money technology has become widely adopted in Nigeria as banks have developed full-fledged banking service through the mobile phone technology with variety of services which were hitherto only possible in the banking hall (Anyasi and Otubu, 2009). Studies have shown the benefits of mobile money technology (Mas, 2010; Aker, et al, 2011; Jack and Suri, 2014), but its impact on prices and output is yet to be empirically validated in Nigeria. The few works on the impact of mobile money on macroeconomic variables for Africa are conducted on Uganda (Munyegera and Matsumoto, 2014; Mawejje and Lakuma, 2017), Tanzania (Chale and Mbamba, 2014) and Kenya (Mbiti and Weil, 2011). Against this background, this study seeks to empirically estimate the impact of mobile money on prices and output in Nigeria.

Following this introduction, Section 2 provides the regulations and trends of mobile money in Nigeria. Sections 3 reviews literature, provides the conceptual framework and methodology for the study while data description and sources occupies Section 4. Empirical findings and analysis occupies section 5 with Section 6 concluding the study.

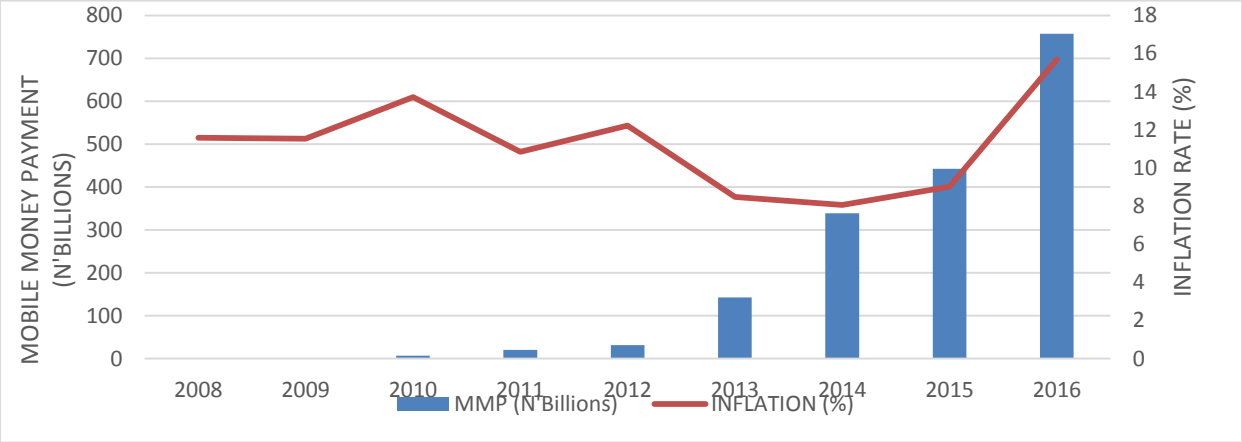
2.0 Regulations and Trend of Mobile Money in Nigeria

The Global System for Mobile Communication Association (GSMA) and Western Union jointly launched the mobile money transfer technology in October 2007. Presently, there are more than 120 mobile money projects being undertaken in about 70 emerging economies (Yakub, et al, 2013). Since then, mobile money transaction has risen globally with East Africa leading the trail. In 2011, the Central Bank of Nigeria (CBN) granted operating licenses to twenty one (21) mobile money operators (6 bank-led and 15 non-bank-led) to provide mobile money services in the country. Though the modes of operation and specific services vary among the different operators, there are some functions generally performed by all of them. These include: receipt and transfer of money, cash deposits and withdrawals, balance enquiries, purchase of airtimes and payment of bills among others.

To further bolster the confidence reposed in mobile payment system by the customers and ensure its continuity, the Nigerian Deposit Insurance Corporation (NDIC)- agency responsible for insuring depositors fund, has provided a guarantee to subscribers' for funds deposited with mobile money operators up to the maximum coverage level of ₦500,000. Through a guideline on mobile payment system released by the NDIC, it defines the pass-through deposit insurance scheme as "the protection provided by the NDIC to mobile money subscribers, where the corporation insures funds that are deposited by a mobile money operator in the deposit money banks" (NDIC, 2016). In this sense, mobile money

operators are assumed to be acting as custodian of funds on behalf of their subscribers who are the actual owners of funds deposited in the deposit money banks. Insuring subscribers' funds with mobile money operators in Nigeria is expected to not only engender financial system's stability but also promote financial inclusion.

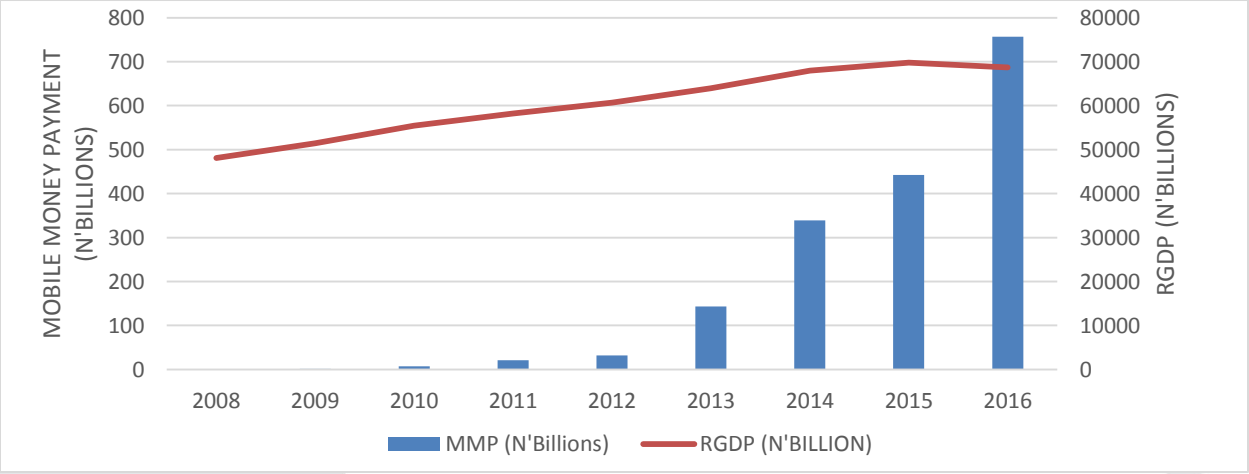
Figure1: Mobile Money Payment and Inflation in Nigeria



Source: Author from CBN data.

Mobile money transactions in Nigeria has been growing astronomically and has come to be accepted as a close substitute to cash. At the beginning of its adoption in 2008, the total mobile money transaction was 0.700 billion Naira but by 2010, the amount of money involved in mobile transaction had grown to 6.7 billion Naira which represents about 957 per cent growth from the 2010 size (see Figure 1). By the end of 2016, the value of mobile payments transactions had grown in value to 756.9 billion naira. During the same period under review, inflation rate remains at an average of 11.5per cent despite the observed phenomenal growth in mobile money transactions. The observed price stability in Fig. 2 is not unconnected with the

Figure 2: Mobile Money Payment and Real GDP in Nigeria.



Source: Author from CBN data.

increasing output growth during the period. Between 2008 and 2009, output grew by 6.9% rising from N48.1billion to N51.4billion and further by 7.8% in 20110 to N55.5billion. Output grew steadily during the period under review but the growth declined in 2016 by-1.5% when output fell from N69.7 to N68.7 billion.

3.1 Literature Review

Financial innovation theory centres on facilitating higher quality financial product at lower cost at the prevailing factor prices. Frame and White (2004) considers financial innovation as something new that; reduces cost, provides an improved product and better satisfy consumers demand. Lazonick (2012) argues that innovation creates the possibility for growth in per capita income. Scholars (Romer, 1990; Aghion and Howitt, 1992; Temple, 1999 among others) have long established that innovation fosters growth and development of the economy. Aghion and Howitt (1992) in the endogenous growth model showed that innovation led to a competitive research sector, raises productivity and consequently foster growth and development. This is similar to the findings of Geroski, 1989; Fare, et al, 1994; and Fargerber, et al, 2007. Miller (1986, 1992) describes financial innovation as an "engine of growth" while Lerner and Tufano (2002) opine that financial innovation is a "general purpose technology" which possess the potential to change the entire workings of an economy. Leaven and Levine (2009) sees growth as not only being influenced by the profit maximizing entrepreneurs' willingness to introduce new technology but also of financial institutions who finds new ways to finance these technologies. Gubler (2011) is of the view that the result of financial innovation process increases productivity, institutional complexities and market fragility. Arcand (2013) proposed that there are threshold above which finance starts having a negative effect on economic growth. That is, financial innovation is favourable to a particular economic setting beyond which it is negatively affected.

Empirically, studies have been conducted on financial innovation and its possible effect on macroeconomic variables (see Miller, 1986 and Tufano, 2003), but mobile money recently emerged as strategies of financial innovation. Few studies have been conducted on the effect of mobile money on macroeconomic variables with interesting outcomes. For instance, Mbiti and Weil (2011) while investigating the impact of M-PESA (mobile money) in Kenya, using two waves of individual data on financial access, found increase in the use of M-Pesa to lower the tendency of people to use informal savings mechanism but raised the probability of their been banked. The study found velocity of M-PESA to be high suggesting that mobile money improves individual well-being by promoting banking and increasing transfers.

Arcand (2013) examined the role of financial innovations in developing countries and found that countries with very large financial sectors experienced a negative correlation between financial depths and economic growth while countries with small and intermediate financial sector presents a positive and robust correlation between financial depth and economic growth. He concluded that there is a threshold above which finance starts having inverse

impact on growth. Chale and Mbamba (2014) adopted multiple regression method of analysis on self-administered questionnaire to investigate the linkage between mobile money service and growth of small and medium enterprise in Tanzania. The study reports a positive influence of mobile money on small and medium enterprises, which could implicitly boost output in the economy.

Munyegera and Matsumoto (2014) in a study investigating the impact of mobile money services on household welfare using household survey panel data from rural Uganda from 2009 to 2012 (including 904 household from 94 local council in Uganda) found that mobile money services increases household per capita consumption by 72 per cent. Adam and Walker (2015) using Dynamic Stochastic General Equilibrium (DSGE) framework with two sectors (the rural and the urban producer household) to investigate mobile money and monetary policy in East African countries reported that mobile money increases macroeconomic stability and help minimize the incompleteness of the market.

Simiyu and Oloko (2015) investigated the effect of mobile money transfer and the growth of small and medium-scale enterprise in Kenya and found mobile money service to have increased financial transaction thus resulting in increased sales and therefore, contributing to business growth. Nkem and Akujima (2017) conducted a study on financial innovation and efficiency on the banking sub-sector in Nigeria. They found mobile banking to be positively correlated with banking efficiency but has insignificant impact on efficiency ratio of deposit money banks in Nigeria.

Waweru and Kamau (2017) conducted a study on the effect of mobile money on saving and money transfer practices for low-income earner in Kenya, using 750 households across Kenya. Their study revealed mobile money to be associated with increase in the number of low-income earners savings with formal banks and significantly reduce the traditional method of keeping money in the house thus improving financial intermediation and investment fund mobilization.

Aron, Muellbauer and Sebudde (2015) in a study to investigate the relevance of mobile money on inflation targeting in Uganda noted that, despite the volatile nature of energy and food prices, the domestic money supply is irrelevant for food and fuel inflation. The study concludes that no serious evidence of a link between mobile money and inflation was found.

The above reviewed literature reveals the impact of mobile money on inflation and economic growth in some African countries while its effect on the Nigerian economy is yet to be empirically investigated. Understanding this relationship, which forms the thrust of this study, will help the monetary authority and relevant economic agents to map out appropriate policies that will help exploit the benefits of this innovation towards the attainment of some macroeconomic objectives.

3.2 Conceptual framework

The importance of mobile money and its impact on investment and output can be explained theoretically in traditional investment models by relaxing the assumption of perfect capital markets. For instance, the neoclassical investment model assume investment equals the rate of depreciation at equilibrium while investment is proportional to the rate of growth in output in the accelerator model. Capital stock is adjusted instantaneously, in both cases, to its desired level. The Q theory of investment assume that adjustment cost function is added to the profit maximization problem of the firm thus making investment to be defined by the optimal path to the optimal capital stock. This implies that, as long as the opportunity cost of capital is less than the marginal return on capital, investment will take place. These three models assume firms are able to adjust with zero costs and no budget restrictions and a- la- Modigliani and Miller (1958) perfect capital markets carry the implication that the firm's financial structure has no role in investment decisions.

The assumption of perfect capital market has been challenged by some studies. Stiglitz and Weiss (1981) opined that asymmetric information can lead to credit rationing which makes the availability of capital the main determinant of investment (Greenwald et al., 1984). Jensen and Meckling (1976) believes that if there is lack of internal funds managerial agency problems can lead to lower investment; and transaction costs may make external sources of finance prohibitively costly, forcing firms to rely on internal funds. The need to minimize costs becomes essential with the introduction of transactions costs and budget restrictions into a firm's profit maximization.

Mobile money has the potential to considerably reduce enforcement costs of every transaction: time and distance for services rendered can be reduced to an instantaneous transmission of information; low-cost and consistent record keeping of transactions can increase trust and nurture better terms and conditions as business transactions are repeated, thereby potentially increasing the volume of operations; and lower outstanding liquidity balances are required for the same level of business activity. Even the risks of non-payment for goods and services rendered can be reduced to almost zero provided that the mobile service provider keeps updated records on all its users and their available funds (Islam, Muzi and Rodriguez-Meza, 2016). Resources freed due to the reduction on transaction costs can thus be allocated to better uses, potentially increasing investment levels. Even though from a theoretical standpoint, transactions cost reductions or greater liquidity could affect negatively investment levels, by raising the return on savings that would favor holding financial assets over physical investment (Bencivenga, et al. 1995), one can assume that this effect is negligible in developing economies with limited markets for financial assets.

In Africa, mobile money transaction has been found to circumvent transaction costs given the poor infrastructure and under-developed banking sectors, which makes accessing banks time-consuming plus the travel costs as well as waiting in line time costs. (Aker et al., 2013; Jack and Suri, 2014). The reduction of such costs and the ease of money transfer via mobile money improves the liquidity of the firm as cash flows through the firm at a faster rate (Bangens and Soderberg, 2011). There is an established literature that has identified the positive effect of improved cash flows on investment (Kadapakkam et al., 1998) and one can hypothesize that sufficient increases in cash flows induced by mobile money may lead

to the same outcome of increased investment. Furthermore the reallocation of time away from dealing with financial transactions, including managerial time, to more productive activities can lead to increasing output and profitability (Frederick, 2014), potentially leading the firm to pursue growth opportunities through investment.

There are other channels that have been empirically uncovered through which mobile money use could indirectly lead to increased investment aside reducing transaction costs. Using a dynamic general equilibrium model with heterogeneous entrepreneurs, imperfect credit markets, and the risk of theft; Beck et al. (2015) find that mobile money use increases the use of trade credit which in turn improves firm performance. Literature has also documented the role of trade credit, via reputation effects, in increasing access to external sources of financing such as bank financing (Alphonse et al., 2006; Buckart and Ellingsen, 2004). Increases in access to finance, in turn, can facilitate investment (Rajan and Zingales, 1998; Levine et al., 2000; Demirguc-Kunt and Maksimovic, 1998; Cull and Xu, 2005). Finally, the use of transaction, saving, and financial operations data from the digital financial services platform allows to generate credit scores and evaluate and price credit risk. This can help to overcome the so-called collateral technology hurdle, which has hindered the development of credit markets in Africa (Ndung'u, Morales, and Ndirangu. 2016).

3.3 Methodology

This study adopts the Structural Vector Autoregressive (SVAR) method to examine the macroeconomic effect of mobile money in Nigeria. According to Kim and Roubini (2000), SVAR model allows for contemporaneous feedback between variables while imposing the minimal structural restriction on the model. Since there is no consensus on the number of variables required in a SVAR model to produce a plausible interpretation of an economy (Bongani, 2014), this study employs four endogenous variables.

The matrix form of the VAR equation is given as follows:

$AY_t = \sum_{i=1}^{p} B_i Y_{t-1} + \varepsilon_t$ .....(1)

where; Y = the vector containing the six endogenous variables

A = a square matrix of coefficients to be estimated,

ε = a vector of serially uncorrelated and mutually orthogonal structural disturbances,

p = the number of lags.

The structural equation represented by the above system need be identified for the purpose of policy analysis and be given economic interpretation. However, the above model is not directly observable therefore cannot be estimated to derive the true values of the coefficient vector (Bongani, 2014). Thus, the reduced form of the model, which is obtained by multiplying both sides by, A^{-1} is specified as follows;

$Y_t = A^{-1} \sum_{i=1}^{p} B_i Y_{t-1} + e_t$ .....(2)

where e_t is a vector of serially uncorrelated, but not necessarily orthogonal, reduced form disturbances. In this regard, the relationship between the reduced form VAR residuals (e_t) and structural shocks (ε_t) can be expressed as follows:

$$e_t = A_0 \varepsilon_t \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

Based on the Cholesky decomposition of the reduced form VAR, for the purpose of this study, we impose n(n-1)/2 constraints that defines matrix A_0 as a lower triangular matrix. The lower triangularity of A_0 implies a recursive scheme (because structural shocks are identified through reduced form VAR residuals) among variables (the Wald chain scheme) that have clear economic implications and has to be empirically tested as any other relationship. Identification scheme of the matrix A_0 implies that particular contemporaneous interactions between some exogenous shocks and some endogenous variables are restricted reflecting causal chain of interaction transmission.

Therefore the Wald causal chain is incorporated via convenient ordering of the variables. Thus, the variables are ordered as follows on the assumption that: mobile money (MM) are affected by own innovations; money supply (proxy with broad money, M2) is affected by mobile money, output level (real GDP) is influenced by mobile money and money supply, price level (consumer price index, CPI) is influenced by all the endogenous variables in the model. The matrix form of the SVAR model can then be expressed as seen in equation (4) below;

$$\begin{bmatrix} e^{LMM_t} \\ e^{LM2_t} \\ e^{LRGDP_t} \\ e^{LCPI_t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 \\ a_{41} & a_{42} & a_{43} & 1 \end{bmatrix} * \begin{pmatrix} \varepsilon^{LMM_t} \\ \varepsilon^{LM2_t} \\ \varepsilon^{LRGDP_t} \\ \varepsilon^{LCPI_t} \end{pmatrix} ----------(4)$$

The left hand side of equation (4) consists of the vector of residuals in the reduced form while the right hand side is the squared matrix (A_0) of coefficients associated with lagged variables and structural shocks through column vector (ε).

4.0 Data description, Scope and sources

The study adopts monthly data from 2008M1 to 2016M12. The data scope covers the period when mobile banking was introduced in Nigeria till recent available data. Data was sourced from the National Bureau of Statistics (NBS) Publications and CBN annual publications. The variables used in the study include natural logarithm of mobile money payments (LMM) which is used to proxy mobile money (data use from 2008 to 2014 were annual data, interpolated to monthly, while 2015 to 2016 data is at monthly frequency), Broad Money supply (LM2, is the total currency in circulation plus demand, savings and fixed deposit) , Consumer price index (LCPI, measures the average price per basket of consumer goods in the economy) and Real Gross domestic product (RGDP, measures the level of national output at constant price). LM2, LCPI and RGDP entered into the model as

macroeconomic variables. The RGDP were quarterly data interpolated into monthly data using E-views.

5.0 Empirical Findings and Analysis

5.1 Stationarity Test

Table 1: Stationarity Test

Variables	Ng-Perron @ Levels	Ng-Perron @ 1st difference	Phillips-Perron @ Levels	Phillips-Perron @ 1st difference	I(d)
LCPI	-2.79582	-31.1009***	-2.249	-7.869***	I(1)
LM2	-16.7579*		-4.196***		I(0)
LMM	-15.5441		-2.9178	-13.917***	I(1)
LRGDP	-4.02102	-52.849***	-1.6601	-9.793***	I(1)

***,**,* represent 1%, 5% and 10% significance level.

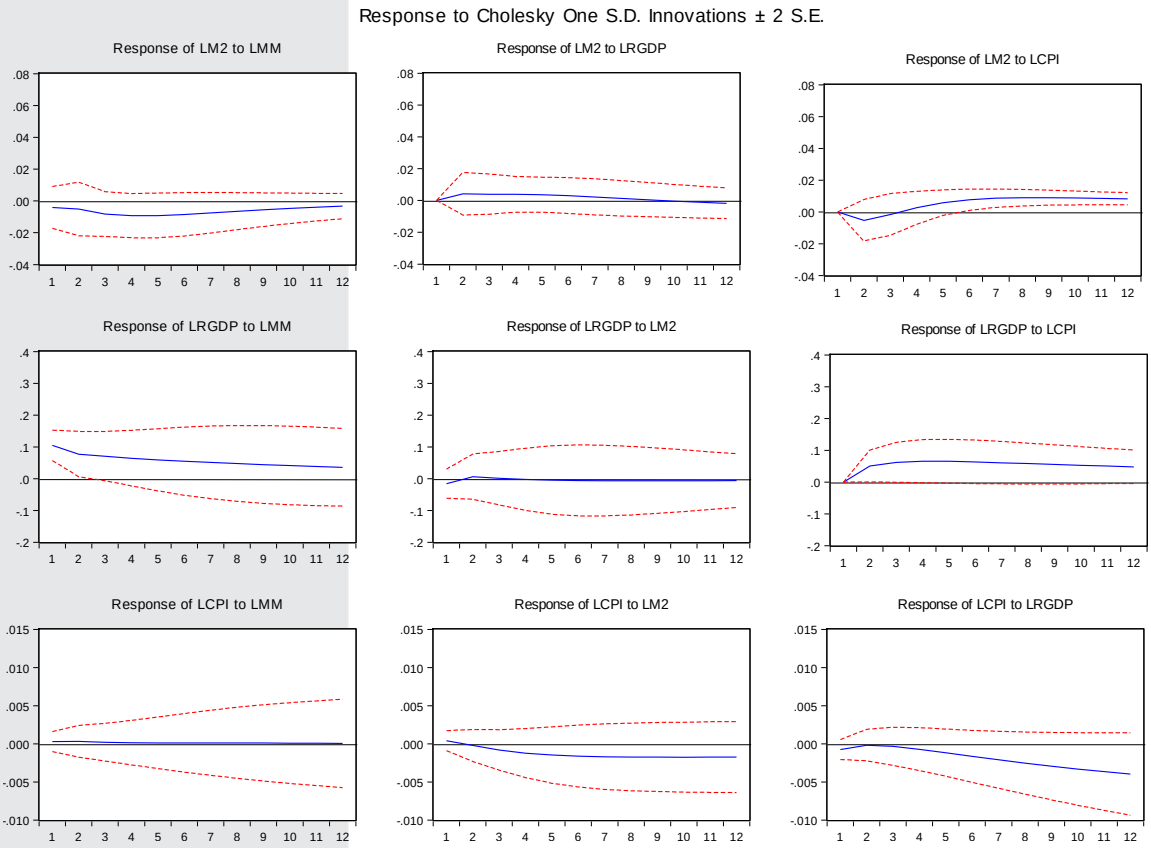
Table 1 indicates that only LM2 is stationary at levels while LCPI, LMM and RGDP are stationary at first difference using both Ng-Perron and Phillips-Perron (PP) test.

5.2 Impulse Response

The impulse response from SVAR model as presented in Figure 1 reveals the short run effects of mobile money on money supply, output and prices. It shows the responses of these variables to one standard deviation shocks in mobile money.

From the results, the effect of mobile money on money supply as shown in the impulse response indicates that a one standard deviation positive shock in mobile money reduces money supply up to the first fifth months, reaching its all-time maximum at this period and thereafter rises but still negative up to the 12th month. This indicates that shocks to mobile money only have minimal effect on money supply. The negative response of money supply to shocks in mobile money jives with Ndirangu and Nyamongo (2015) assertion that mobile money may reduce the demand for money if it reduces transaction cost and risk involved in dealing with cash.

Figure 1: Impulse Response



Output responds positively to positive shocks from mobile money throughout the first 12 months and later tend towards equilibrium. The positive response confirms the postulations that increase in velocity of money would improve the volume of money in circulation and given the slack in the economy wherein the economy operates below full-employment or potential capacity, increase in money supply will account for increase in national productivity with no effect on price.

The response of consumer price index to shocks in mobile money was stable as observed with the blue line lying on the threshold throughout the twelve months. This implies that shocks from mobile money transactions that results in increase in money supply and velocity does not precipitate price increase. This lends credence to the findings of Aron, Muellbauer and Sebudde (2015) that no serious evidence of a link between mobile money and inflation exist.

5.3 Forecast Error Variance Decomposition (FEVD)

This explains the percentage of variance in the equation that is captured by the explanatory variables and its determinants. It shows the impact of shocks in the endogenous variables on the exogenous variable.

Mobile money's own shock wholly accounts for variation in the first month as shown in Table 2. Throughout the first four quarters, shocks to all variables in the model accounted for an insignificant variation in mobile money. Only money supply and consumer price index accounted for a moderate variation in the latter period. Price had no influence on mobile payment in the first month and later had 1.47 percent, 5.46 percent and 10.68 percent influence on mobile money in the fourth, seventh and tenth month respectively. Money supply and output have approximately 2.00 percent influence on mobile money throughout the period. Own shock impact attenuated throughout the period from 100.00 percent in the first month to 96.5 percent, 92.44 percent and 86.89 percent in the fourth, seventh and tenth months respectively.

Table 2: Forecast Error Variance Decomposition

Variables	Month	LMM	LM2	LRGDP	LCPI
Mobile Money	1	100.0000	0.0000	0.0000	0.0000
	4	96.5071	1.9008	0.1193	1.4729
	7	92.4437	1.5561	0.5443	5.4559
	10	86.8992	1.5447	0.8796	10.6765
Money Supply	1	0.3717	99.6283	0.0000	0.0000
	4	2.2805	96.7324	0.5515	0.4357
	7	4.4693	92.5121	0.8091	2.2095
	10	5.2995	89.3059	0.8037	4.5909
Real Output	1	16.5750	0.3827	83.0423	0.0000
	4	9.8143	0.1123	86.0638	4.0097
	7	8.6117	0.0980	85.7549	5.5355
	10	8.2040	0.1072	85.3384	6.3504
Price Level	1	0.1760	0.3606	1.2733	98.1902
	4	0.0851	0.8842	0.4530	98.5777
	7	0.0509	1.9105	1.8521	96.1866
	10	0.0374	2.4292	4.5228	93.0106

Table 2 shows that mobile money's contribution to variation in money supply is modest and increasing through the period accounting for 0.37 percent, 2.28 percent, 4.47 percent and 5.29 percent variation in money supply in the first, fourth, seventh and tenth month

respectively. This indicates that the influence of mobile money on money supply grows over time. Real output contributed less than 1 percent variation for all the quarters. This could be attributed to the recent economic downturn experienced in Nigeria.

The consumer price index tends to have more log run effect than short run effect on money supply. It has no influence in the first month, 0.44 percent, 2.21 percent and 4.59 percent variation in money supply in the fourth, seventh and tenth month respectively. This bear out the Keynesian postulate that during economic slack, increase in money supply may not precipitate increase in price level. Own shocks diminish marginally overtime from 99.63 percent in the first month to 89.31 percent in the tenth month. This is an indication that all explanatory variables are endogenous to model.

Aside own shock, mobile money accounted for more variation in output, in the short-run, than any other variables as shown in Table 2. Mobile money's significant explanation of the innovation decreased through the period from 16.58 percent in the first month to 9.81 percent in the fourth and later to 8.61 percent and 8.20 percent in the seventh and tenth month respectively. Conversely, price level, which had no influence in the first month, contributed 4.0 percent, 5.54 percent and 6.35 percent to output variations in the fourth, seventh and tenth month respectively. Own shock rose in the fourth month and declined during the seventh and tenth months while money supply accounted for an insignificant variation in output.

Mobile money shock to variations in price level is insignificant throughout the periods. Aside own shocks money supply and output are the other variables accounting for variation in price level. Output explains 1.27 percent, 0.45 percent, 1.85 percent and 4.52 percent variation in consumer price index for the same periods. Own shocks impact was very significant but diminished through the periods.

6.0 Conclusion and recommendation

Findings from this study shows that shocks from mobile money transactions that results in increase in money supply and velocity does not precipitate price increase thus confirming the findings of Aron, Muellbauer and Sebudde (2015) that no serious evidence of a link between mobile money and inflation exist. It also shows that mobile money would increase the macroeconomic stability of the countries in which it is widespread as observed by Adam and Walker (2015). We recommend thus that government and policymaker should encourage the use of mobile money to achieve price and output stability. They should also develop means of controlling mobile money transactions to channel macroeconomic variables in the desired direction towards achieving the desired policy goals.

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