MACROECONOMIC EFFECTS OF MOBILE MONEY IN NIGERIA

Samuel Orekoya

Department of Economics, University of Ibadan, Nigeria

ABSTRACT

Mobile money is a technological innovation in the financial sector that provides numerous benefits to an economy. Despite these perceived benefits, there are concerns regarding the impact of this innovation on macroeconomic variables. This study therefore employed data from 2008M1 to 2018M12 to test the responsiveness of some macroeconomic variables to shocks from mobile money in Nigeria. Using the Toda-Yamamoto model to test for the response of these variables to shocks, the impulse response result shows that mobile money had short-run impact on macroeconomic variables but was not significant in the long run. The variance decomposition shows that output, interest rate, money supply and private sector credit accounted for more variation in price than mobile money. It is logical to conclude that mobile money modestly impacts macroeconomic variables in Nigeria. Therefore, government /policymakers should design policies to regulate mobile money transactions to guide macroeconomic variables in the desired direction to achieve macroeconomic objectives.

Keywords: Mobile money, financial innovation, Toda-Yamamoto, T-Y model, Nigeria

1. Introduction

Several studies have highlighted the role and importance of technology in nation development (see Aghion and Howitt, 1992 and Temple, 1999). The foundations and functioning of many economic sectors are based on

technology while the tremendous improvements witnessed in others have been attributed to technological innovation. The innovation of mobile money (MM) and banking technology has greatly impacted financial sector performance and the quest for financial inclusion. Mobile banking denotes a system where bank customers are offered various conventional bank services with the aid of telecommunication devices (Dona, Mouri & Hasan, 2014). Distinct from mobile banking, MM is an application that operates through software installed on a SIM card which permits owners of mobile phones to save, transfer and withdraw funds without a bank account (Masha, 2016; Suri, 2017). While this innovation has been widely embraced in several developed countries, it has recently been spreading and gaining acceptance in developing countries where it was previously inaccessible due to poor infrastructure and high cost of transaction. One of the numerous merits of adopting this innovation is the opportunity for a great paradigm shift in financial service access and delivery to unbanked and underbanked Nigerians given the burgeoning growth of cellular networks.

Between 2011 and 2014, available data from the World Bank Findex Database (2014) shows a drastic reduction (20%) in the global figure of the underbanked (Masha, 2016). In terms of global penetration in 2018, sub-Saharan Africa as a region recorded the highest level of registered MM users, having a share of 45.6 percent, while South Asia had 33.2 percent, and East Asia and the Asia Pacific had and 11 percent (GSMA, 2019). Sub-Saharan Africa also represented a total of 53 percent of global MM service worldwide while 16 percent of the region's adults settle bills, send or receive money via MM. This compares well with what obtains in all other regions that have less than 5 percent (Masha, 2016).

The number of MM service users in Nigeria is rising tremendously. In 2008 when MM was adopted, the total value of payments was ₦700 million but this grew by 85 percent to ₦1.3billion in 2009. By 2010, the volume of MM payments had grown to ₦6.7 billion, representing about 415 percent growth from that of 2009. By 2016 ending, the value of MM transactions had grown to ₦756.8 billion (CBN, 2015; 2017). This reveals the financial innovation's growing favourable reception mainly due to its convenience and wide acceptance as an alternative to cash.

Given the shift towards technology-driven banking services, MM has received wide acceptance in Nigeria as banks now offer a wide range of services that were hitherto possible only in the banking hall (Anyasi and Otubu, 2009). Aker et al. (2011) and Jack and Suri (2014) in their studies enumerated several economic benefits of MM technology, while Munyegera and Matsumoto (2014) and Mawejje and Lakuma (2017) for Uganda, Chale and Mbamba (2014) for Tanzania, and Mbiti and Weil (2011) for Kenya took a step further to empirically validate its impact on some macroeconomic variables. It has become important, in the light of the above, to empirically query MM's impact on some selected macroeconomic variables in Nigeria.

Following this brief introduction, Section 2 offers the background and stylized facts on MM in Nigeria while a review of theoretical and empirical literature on financial innovation and development is presented in Section 3. Methodology and data description are in Section 4, empirical findings and analysis are presented in Section 5 while Section 6 concludes the study.

2.   Mobile Money in Nigeria: Background and Stylized Facts

Since the inauguration of MM transfer technology in October 2007 jointly by the Global System for Mobile Communication Association (GSMA) and Western Union and its global adoption, over 120 MM projects have been undertaken by 70 emerging countries (CBN, 2007; Yakub, Bello, Adenuga & Ogundeji, 2013). It has grown phenomenally in East Africa thus promoting the region's drive for financial inclusion, especially for the rural unbanked. Taking a cue from this, the Central Bank of Nigeria (CBN) licensed 21 (6 bank-led and 15 non-bank-led) MM operators in 2011 to provide all MM related services in the country. The Nigerian Deposit Insurance Corporation (NDIC) further bolstered depositors' confidence by providing a guarantee to subscribers (with a maximum coverage of ₦500,000) for funds deposited with the operators (NDIC, 2016). This was expected to stimulate the stability and growth of the financial system and help propagate the financial inclusion drive of the Central Bank of Nigeria (CBN).
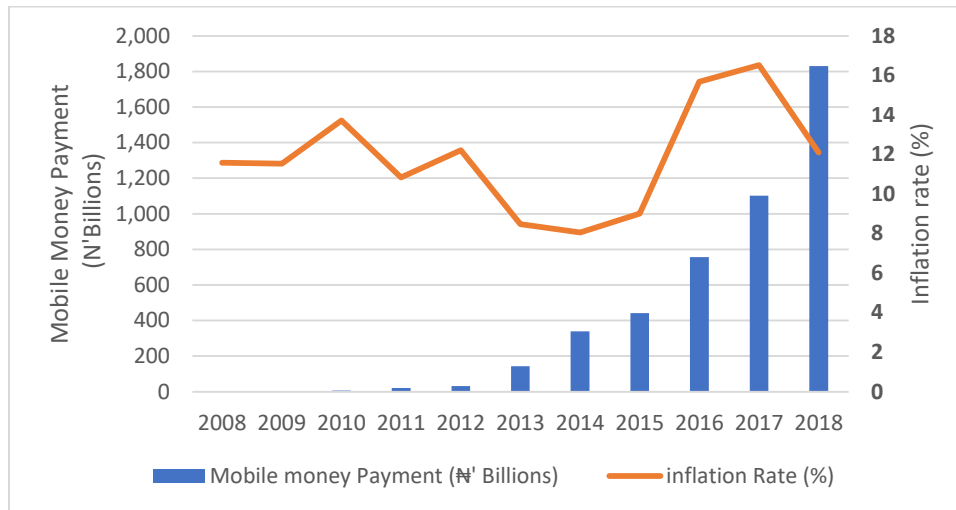
Figure 1. Mobile Money Payment and Inflation in Nigeria.
Source: Author from CBN data.

Since its adoption in 2008, MM transactions in Nigeria have grown by 857 percent from ₦0.7 billion to ₦6.7 billion in 2010. The growth rate has been phenomenal; from ₦31.5 billion in 2012 to ₦339.2 billion in 2014 and further to ₦756.9 billion in 2016. Despite the observed growing trend in MM as seen in Figure 1, inflation rate remained stable within an average of 11.5 percent during the period under review. This is attributable to the increasing growth in output during the period under review.

Between 2008 and 2009, output grew by 6.9 percent, rising from ₦48.1 billion to ₦51.4 billion and further by 7.8 percent to ₦55.5billion in 2011. Output growth remained steady but declined in 2016 by -1.5 percent when output fell from ₦69.7 to ₦68.7 billion during the country's period of recession. Also, the ratio of MM to broad money, RGDP and private sector credits have been consistently growing over time. Respectively, these ratios have grown from 0.001, 0.008 and 0.009 at inception in 2008, to 0.052, 0.198 and 0.302 in 2012 and further to 1.102, 3.620 and 6.732 in 2016. These highlight the growing importance of these indicators.

3. Literature Review

The focus of financial innovation theory is basically on providing superior quality financial products at modest cost at the prevailing factor rates. Thus, Frame and White (2004) posit that financial innovation should be a novel idea that cuts costs and offers an enriched product that gives the customer better satisfaction while Lazonick (2013) sees it as an avenue for per capita income growth. Romer (1990), Aghion and Howitt (1992), and Temple (1999) confirmed that innovation promotes economic growth and development while others (Geroski, 1989; Fare, Grisskopf, Norris & Zhongyang, 1994 and Fagerber, Srholeck & Knell, 2007), using the endogenous growth model, further confirmed that innovation could propel growth and development by engendering a competitive research sector and raising productivity. While Miller (1986, 1992) opines that financial innovation is the bedrock of growth, Lerner and Tufano (2011) believe it is a multi-purpose invention with the capacity to impact an economy's framework. Leaven and Levine (2009) assert that growth is shaped by the profit maximizing entrepreneurs' willingness to institute new technology and by financial institutions' acceptance to finance these innovations. The resulting outcome of this financial innovation process, according to Gubler (2011), is increase in productivity, institutional complexities and market fragility. However, Arcand (2013) signaled a warning to the acquisition of financial innovation by surmising that there are thresholds beyond which finance impacts negatively on economic growth. Even if MM is perceived as a recent financial innovation strategy, studies by Miller (1986) and Tufano (2003) have highlighted the effects of financial innovation on macroeconomic variables. Mbiti and Weil (2011) investigated the effect of M-PESA in Kenya and found a high propensity for people to lower informal savings mechanisms with increasing use of M-PESA, hence raising the banking rate. Further, the study found high velocity of M-PESA, implying an improvement in people's wellbeing through increased fund transfers via MM.

While investigating the importance of financial innovation in less developed countries, Arcand (2013) observed that economies with developed financial sectors had negative correlation between financial depths and economic growth while economies with small and intermediate financial sectors present a positive and robust correlation. With this, the study affirmed

that there is a threshold beyond which finance impacts growth negatively. Adopting a multiple regression method of analysis on primary data, Chale and Mbamba (2014) investigated the connection between MM service and small and medium enterprise growth in Tanzania. MM was found to have positive influence on small and medium enterprises.

In another study to examine MM services impact on household welfare, using panel data from rural Uganda from 2009 to 2012, MM service was found by Munyegera and Matsumoto (2014) to have raised the per capita consumption of households by 72 percent. Using the framework of Dynamic Stochastic General Equilibrium (DSGE) on rural and urban household producers, Adam and Walker (2015) also examined the effect of MM on monetary policy in East Africa. Findings from the study show that MM raises macroeconomic stability and reduces market incompleteness.

To examine the impact of MM transfer on small and medium-scale enterprise growth in Kenya, Simiyu and Oloko (2015) revealed that MM service has raised financial transactions, improved total sales and contributed to business growth. In another study by Waweru and Kamau (2017) to examine the effect of MM on savings and money transfer practice for low-income earners in Kenya, MM was found to have increased the number of low-income earners savings with formal banks and significantly reduced the old method of saving money at home. The study concluded that MM has propelled higher financial intermediation and investment fund mobilization.

In Nigeria, Orekoya (2017) examined the effect of MM on the conduct of monetary policy as well as the responsiveness of monetary policy to shocks from the increasing use of MM. Mobile money was found not to significantly affect monetary policy operations but marginally affected price level. Shocks from treasury bill rates were also found to impact MM more than shocks from money supply. On MM impact on prices and output in Nigeria, Orekoya (2018) found that output responds positively to positive shocks from MM. This confirms the postulations that an increase in money velocity would improve the volume of money in circulation and given the slack in the economy wherein the economy operates below potential capacity, increase in money supply will precipitate increase in output with no effect on price. The response of the consumer price index to shocks from MM was also found to be stable implying that shocks from MM transactions that result in increases

in money supply and velocity do not precipitate price increase rather they would increase macroeconomic stability.

The literature reveals the impact of MM on a variety of macroeconomic variables in some African countries but its impact on broad macroeconomic variables has not been examined empirically in Nigeria. This study sheds light on the possible relationships and provides the basis for monetary authority and other relevant economic agents to design appropriate policies to exploit the benefits of this innovation in the achievement of macroeconomic goals, especially in the light of the current reality.

4.   Methodology

4.1   Analytical framework

The demand for money explains the desire to hold money in liquid form rather than in some other forms of investment. Transitionary, precautionary and speculative motives have been adduced to influence this. The Classical school is of the opinion that money held for transitionary purposes is determined purely by income. The Keynesians argued that money is not only held for transitionary purposes but also for precautionary and speculative purposes and amounts held are determined by income and interest rate. Mobile money has an impact on the demand for money when the financially excluded accumulate their savings in non-financial assets form (Mehrotra and Yetman, 2015). This presents households with the opportunity of substituting non-financial assets with MM, thus raising the demand for money. Mobile money which facilitates financial inclusion offers households the opportunity of either converting their assets or keeping their future savings in liquid form for easy access and transactions. However, Ndirangu and Nyamongo (2015) contend that financial innovations which lead to a reduction in transaction cost and improve transaction efficiency may reduce the desire to hold money. The inference from this is that, whether MM reduces or increases money demand depends on its level of efficiency and the trust of the people in the system.

Money supply, narrowly defined, is the sum of money stock in circulation plus demand deposit. Mobile money facilitates transactions through mobile payment and banking thus making it a substitute for cash. This implies that, if

MM is proven more efficient and acceptable by the people, then most transactions will likely be consummated through this means, thus increasing the velocity of money. That is, with the same amount of money in the system, more transactions can be conducted with it and therefore, more volume of money in circulation. This review of the nexus between financial innovation and economic performance provides the basis for this study.

4.2 VAR (Toda-Yammamato) model

The Toda-Yamamoto (1995) variant of the vector autoregressive (VAR) model is adopted to capture the dynamic macroeconomic effect of MM. It is a multivariate time series model designed to capture the dynamic interrelationship among series that are stationary in mixed order (Toda and Yamamoto, 1995; Amiri and Ventelou, 2012).

Given two variables X_t and Y_t and a k-lag specification, the baseline model is defined as follows:

$$y_t = \propto_0 + \sum_{i=1}^{k} \propto_{1i} y_{t-i}$$

$$+ \sum_{j=k+1}^{k+d_{max}} \propto_{2j} y_{t-j} + \sum_{i=1}^{k} \theta_{1i} x_{t-i} + \sum_{j=k+1}^{k+d_{max}} \theta_{2i} x_{t-j} + \varepsilon_{1t} \,..(1)$$

$$x_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} y_{t-i}$$

$$+ \sum_{j=k+1}^{k+d_{max}} \beta_{2j} y_{t-j} + \sum_{i=1}^{k} \theta_{1i} x_{t-i} + \sum_{j=k+1}^{k+d_{max}} \theta_{2i} x_{t-j} + \varepsilon_{2t} \,..(2)$$

where k denotes the optimal lag length, usually determined by conducting lag order selection criteria and d_{max} is the maximum order of integration in the series.

4.3 Estimation technique and data

This work adopts the Toda-Yammamoto (T-Y) model, a variant of VAR to examine the macroeconomic effect of MM and establish causality. The T-Y model is deemed fit for this study due to the following characteristics: One, it is more efficient in estimating a multivariate model involving a mixed order of stationarity (i.e series of I(0) and I(1) order of integration) (see Toda and Yamamoto, 1995). Two, baseline VAR is designed to capture a level series model and would yield a spurious result if adopted to estimate a model of mixed order of stationarity (see Sims, 1980; Toda and Yamamoto, 1995).

Monthly data from 2008M1 to 2018M12 are used for this study to account for when MM was introduced in Nigeria till the recent available data from annual publications of the CBN and National Bureau of Statistics (NBS). The study variables include the natural logarithms of: MM payments (MMP) as proxy for MM, broad money supply (M2) for total currency in circulation, consumer price index (CPI) as a measure of the average price per basket of consumer goods, private sector credit (PSC) measures investment loans and advances to the private sector, real gross domestic product (RGDP) is the economy's output at constant price and 365 days treasury bill rate (TBR) which is the short-term interest payable on government bonds. The parameters RGDP, M2, CPI, PSC and TBR, all represent macroeconomic variables in the model. Available RGDP data were in quarterly series hence interpolated into monthly data using quadratic sum average method with Eviews.

5. Empirical Findings and Analysis

5.1 Stationarity test

Using the Augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) stationarity test techniques, Table 1 shows that all the variables are not stationary at levels except LM2. Thus, the multivariate nature of the series in the model is best captured using the Toda-Yamamoto variant of the vector autoregressive model as presented by Toda and Yamamoto (1995).

Table 1. Unit Root Test

Variables	ADF @ Levels	ADF @ 1st difference	PP @ Levels	PP @ 1st difference	Decision
LMMP	-2.296	-10.735***	-2.224	-11.180***	I(1)
LM2	-5.398**		-5.378**		I(0)
LPSC	-2.289	-12.698***	-2.343	-12.657***	I(1)
LRGDP	-2.147	-11.157***	-2.203	-11.157***	I(1)
TBR	-3.065	-8.711***	-2.547	-8.602***	I(1)
LCPI	0.266	-4.681***	-1.004	-7.056***	I(1)

** and *** represents significance at 5% and 1% respectively

Other diagnostic tests

All the series in the model are seasonally adjusted while further diagnostic tests were conducted. Appendix 1 shows that the model was correctly specified while Appendix 2 shows the normality test result.

5.2 Causality test

From Table 2, the causality test result reveals a bi-directional causality between money supply (M2) and mobile money (MMP) in the model. It indicates MM as an important factor in predicting money supply movement and vice-versa. A unidirectional causality also flows from output (RGDP) to private sector credit and from private sector credit to interest rate (TBR).

Table 2. VAR Granger Causality/Block Exogeneity Wald Tests

Dependent variable: LOG(MMP)				
Excluded	Chi-sq	df	Prob.	Decision
LOG(M2)	5.96	1	0.015	reject
LOG(CPI)	0.529	1	0.467	accept
TBR364	1.249	1	0.264	accept
LOG(PSC)	0.19	1	0.663	accept
LOG(RGDP)	0.044	1	0.834	accept
All	7.351	5	0.196	accept

Dependent variable: LOG(M2)				
Excluded	Chi-sq	df	Prob.	Decision
LOG(MMP)	3.716	1	0.054	reject
LOG(CPI)	0.318	1	0.573	accept
TBR364	0.335	1	0.563	accept
LOG(PSC)	1.08	1	0.299	accept
LOG(RGDP)	0.32	1	0.572	accept
All	5.84	5	0.322	accept
Dependent variable: LOG(CPI)				
Excluded	Chi-sq	df	Prob.	Decision
LOG(MMP)	0.473	1	0.492	accept
LOG(M2)	0.416	1	0.519	accept
TBR364	0.199	1	0.656	accept
LOG(PSC)	1.407	1	0.236	accept
LOG(RGDP)	1.307	1	0.253	accept
All	3.732	5	0.589	accept
Dependent variable: TBR				
Excluded	Chi-sq	df	Prob.	Decision
LOG(MMP)	0.381	1	0.537	Accept
LOG(M2)	0.048	1	0.826	Accept
LOG(CPI)	2.348	1	0.125	Accept
LOG(PSC)	5.208	1	0.023	Reject
LOG(RGDP)	0.159	1	0.69	Accept
All	8.475	5	0.132	Accept
Dependent variable: LOG(PSC)				
Excluded	Chi-sq	df	Prob.	Decision
LOG(MMP)	1.54	1	0.215	Accept
LOG(M2)	0.618	1	0.432	Accept
LOG(CPI)	2.006	1	0.157	Accept
TBR364	0.005	1	0.944	Accept
LOG(RGDP)	6.624	1	0.01	Reject
All	9.413	5	0.094	Reject

Dependent variable: LOG(RGDP)				
Excluded	Chi-sq	df	Prob.	Decision
LOG(MMP)	0.668	1	0.414	Reject
LOG(M2)	1.761	1	0.185	Reject
LOG(CPI)	2.313	1	0.128	Reject
TBR364	0.002	1	0.966	Reject
LOG(PSC)	0.052	1	0.819	Reject
All	5.667	5	0.34	Reject

5.3 Impulse response

The impulse response of selected macroeconomic variables to shocks from MM is shown in Table 2. Money supply (M2) responded positively to shocks in mobile money (MMP) throughout the periods. This could be because financial innovation like MM facilitates efficient transactions and increases the number of times money changes hand in the economy (velocity of money). Similarly, output (RGDP) responded positively to shocks in MM throughout the period. This follows the finding of Ndirangu and Nyamongo (2015) that financial innovations lead to reduction in money demand, transaction cost and risk associated with holding cash. This improves transaction efficiency and consequently national output.

The response of private sector credit (PSC) to shocks from MM was positive in the first seven months which is consistent with the findings of Nampewo et al. (2016) and Mawejje and Lakuma (2017) that MM positively affects credit supply by commercial banks, in the short run here. Thereafter, it responded negatively throughout the remaining periods. Price level (CPI) responded negatively to a positive standard deviation in MM throughout the period. This supports the money supply and MM relationship hence a reduction in money supply leads to a fall in price level as explained by the quantity theory of money thus facilitating small unit transactions that could have been complex to round up in cash transactions. Interest rate on the other hand (TBR) responded neutrally to shocks from MM throughout the period thus maintaining an equilibrium rate.
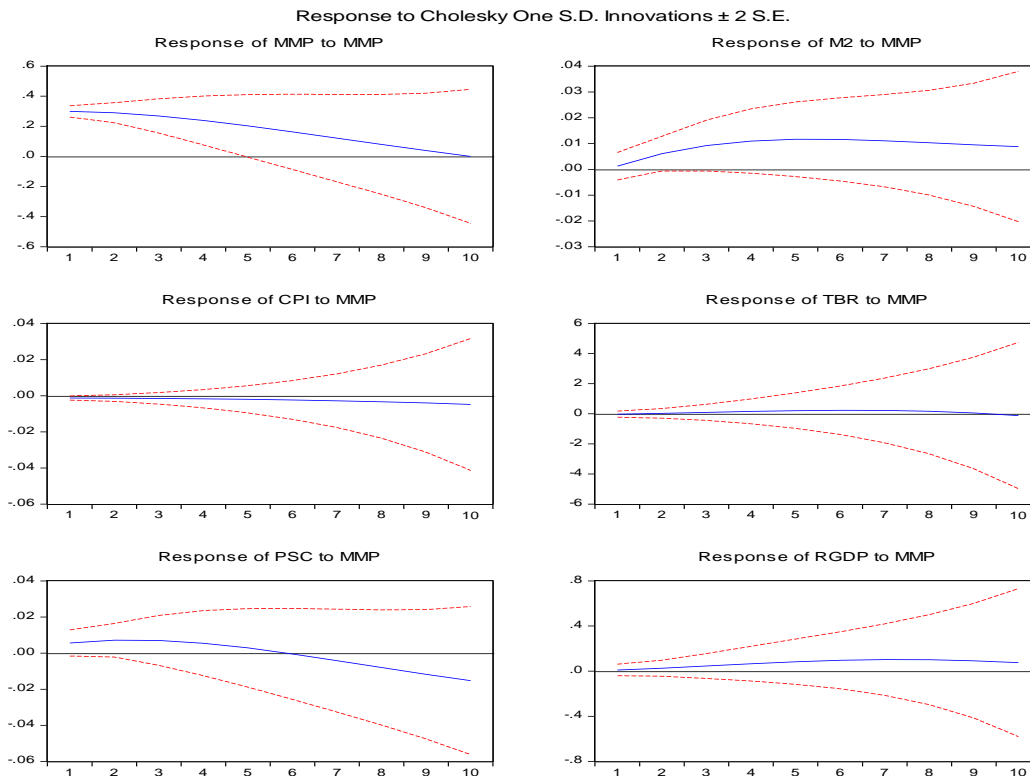
Figure 2. Impulse response

5.4 Variance decomposition

Table 3 shows the forecast error variance decomposition of selected macroeconomic variables in the model. It explains the percentage of influence a variable has on another in the model.

Variance decomposition of money supply (M2): Table 3 shows a modest contribution of MM to variation in money supply, which increased through the period accounting for 0.16 percent and 2.69 percent variation in money supply in the first and fourth months respectively but increased to 6.98 percent and 11.89 percent variation in money supply in the eighth and twelfth months respectively. Money supply own shocks diminished over time from 99.84 percent in the first month to 80.98 percent in the twelfth month. The increasing influence of MM and consequent decrease in money supply

explanation over time proves that MM endogenously influenced money supply in the model. Price level, interest rate, private sector credit and output all exhibited no influence on money supply. With the exception of output, they all showed marginal contributions to variation in money supply in the twelfth month. The CBN Monetary Policy Committee's decision to retain the policy rate at a level over some period of time, to induce investment, could account for why interest rate provided no explanation for the variation in money supply. Also, the influence of the 1998/1999 global financial crisis and the recent economic recession in Nigeria could explain the poor contribution of output.

Table 3. Forecast Error Variance Decomposition

Variables	Months	MMP	M2	CPI	TBR	PSC	RGDP
Broad Money Supply	1	0.160	99.840	0.000	0.000	0.000	0.000
	4	2.695	96.255	0.172	0.167	0.540	0.172
	8	6.976	89.692	0.873	0.778	1.330	0.351
	12	11.890	80.984	2.578	2.078	2.023	0.448
Consumer Price Index	1	3.992	5.545	90.463	0.000	0.000	0.000
	4	3.175	4.295	91.544	0.070	0.489	0.427
	8	2.548	3.395	91.034	0.254	1.204	1.564
	12	1.055	2.802	87.410	2.550	2.901	3.283
Treasury Bill Rate	1	0.078	0.437	0.188	99.297	0.000	0.000
	4	0.053	0.421	1.584	96.087	1.799	0.055
	8	0.172	0.441	4.795	90.166	4.133	0.294
	12	0.335	0.499	10.250	82.342	5.908	0.665
Private Sector Credit	1	1.895	0.639	0.086	0.060	97.319	0.000
	4	3.040	0.703	1.515	0.083	91.182	3.477
	8	3.688	1.096	4.256	0.078	81.639	9.244
	12	3.679	1.845	8.209	0.064	71.381	14.822
Real GDP (Output)	1	0.128	1.801	0.143	0.022	0.194	97.711
	4	0.490	1.007	0.577	0.028	0.125	97.773
	8	1.227	1.393	2.860	0.076	0.117	94.328
	12	2.231	2.076	7.700	0.249	0.188	87.556

Variance decomposition of consumer price index (CPI): MM and money supply explanations to variations in price level decreased respectively in the first month from 3.99 and 5.55 percent to 3.18 and 4.30 percent in the fourth month and further to 2.55 and 3.40 percent in the eighth and 1.06 and 2.80 percent in the twelfth month. This shows that over time, both MM and money supply consistently contributed less to inflation in the Nigerian economy. Rather, inflation here is induced by increasing cost of production. Own shocks impact was very significant, ranging between 91.5 and 89.4 percent variation in consumer price index throughout the period. Private sector credit and output shocks to variations in the consumer price index are rather trivial, contributing between zero and one percent variation in the first and fourth months. Only shocks from output increased to 3.28 percent in the twelfth month to further justify the cost push inflation prevailing in the economy.

Variance decomposition of interest rate (TBR): Mobile money, money supply and output, individually, account for less than one percent variation in interest rate throughout the period. This shows that MM did not in any way influence interest rate in the Nigerian economy. Own shock was highly significant throughout the period though it diminished from 99.30 percent in the first month to 82.34 percent in the twelfth month. Only shocks from price level and private sector credit accounted for variations in interest rate. From 1.58 percent in the fourth month, price level explanation rose to 4.80 percent and 10.25 percent in the eighth and twelfth months respectively. This reflects the monetary authority's decision of taming inflation by stabilizing interest rate. Shocks from private sector credit also increased from 1.80 percent in the first month to 4.13 percent and 5.91 percent in the eighth and twelfth months respectively.

Variance decomposition private sector credit (PSC): The magnitude of MM shocks that accounted for variations in private sector credit consistently grew over time, rising from 1.90 percent in the first month to 3.04 in the fourth month and steadying at 3.68 percent in the last two periods. This shows that MM modestly contributed to variation in private sector credit. Shocks from both money supply and interest rate did not significantly account for variation in private sector credit whereas, the magnitude of shocks from price level

became significant in the eighth (4.80 percent) and twelfth (10.25 percent) months. Own shock accounted for a significantly large size but declined steadily throughout the period from 97.32 percent in the first month to 71.38 percent in the fourth month. Shocks from output also explained a significant size of the variation; from 3.48 percent in the fourth month, it rose to 9.24 and 14.82 percent in the eighth and twelfth months respectively. Money supply, price level and output appear to have long-run effects on private sector credit than short-run.

Variance decomposition of output (RGDP): Aside from shocks from price level, all the other variables in the model did not seem to provide any significant explanations for variation in output. Shock from MM was not significant throughout the period accounting for between 0.13 percent in the first month and 2.23 percent in the twelfth month. This implies that MM does not influence output in the economy. Following the same trend, shock from money supply provided no significant explanation for variation in output. From 1.80 percent in the first month, it declined thereafter only to rise in the twelfth month to 2.08 percent, also implying that money supply does not influence output. Aside from long-run shocks from price level accounting for 7.70 percent in the twelfth month, both interest rate and private sector credit could not explain the one percent variation in output throughout the period. However, own shocks accounted for a very significant size of the variation in output throughout the period, with 97.71 percent in the first month but steadily declining to 87.56 percent in the twelfth month.

6.   Conclusion and Recommendation

Empirical evidence appears to generally lend credence to the potential benefits of improved and efficient financial services and innovations to the populace and the nation at large. Financial innovation in the form of mobile money remains a veritable source of unleashing these benefits to the unbanked and underbanked, especially in Nigeria, given the recently increasing coverage of cellular networks. Empirical assessment of the effects of this financial innovation reveals that mobile money modestly impacts all the macroeconomic variables used in the model for Nigeria, just like Mawejje

and Lakuma (2017) observed for Uganda. Flowing from these findings, the study recommends that the Nigerian government and policymakers should design policies to promote and regulate the use of mobile money towards stimulating the achievement of desired macroeconomic objectives. It is believed that such regulations could buffer the effect of banking restrictions on the public without fueling inflation, especially during this period of cashless policy by the monetary authority.

References

Adam, C., and Walker, S.E.J. (2015). *Mobile Money and Monetary Policy in East African Countries*. Oxford, United Kingdom: University of Oxford.

Aghion, P., and Howitt, P. (1992). A model of growth through creative destruction. *Econometrica*, 6(2), 323-351.

Aker, J.C., Boumnijel, R., McClelland, A., and Tierney, N. (2011). Zap It to Me: The Short-Term Impacts of a Mobile Cash Transfer Program. *Center for Global Development Working Paper* No. 268.

Amiri, A., and Ventelou, B. (2012). Granger causality between total expenditure on health and GDP in OECD: Evidence from the Toda-Yamamoto approach. *Economic Letters*, 116(3), 541-544.

Anyasi, F.I., and Otubu, P.A. (2009). Mobile money technology in banking system: Its economic effect. *Research Journal of Information Technology*, 1(1), 1-5.

Arcand, J.L. (2013). The role of financial innovations in developing countries: towards inclusive growth and sustainable development. A paper presented at UNCTAD Multi-year Expert Meeting on Commodities and Development.

Central Bank of Nigeria (CBN). (2007). Guidelines on Mobile Banking Services in Nigeria. https://www.cbn.gov.ng/out/2015/bpsd/guidelines%20on%20mobile%20money%20services%20i n%20nigeria.pdf

Central Bank of Nigeria (CBN). (2015). *CBN Annual Report*. https://www.cbn.gov.ng/out/2016/rsd/central%20bank%20of%20nigeria%20annual%20economic%20report%20-%20draft.pdf

Central Bank of Nigeria (CBN). (2017). *CBN Economic Report*. https://www.cbn.gov.ng/Out/2017/RSD/CBN%20Economic%20Report%20for%20the%20Month%20of%20May%202017.pdf

Chale, P.R., and Mbamba, U. (2014). The role of mobile money services on growth of small and medium enterprises in Tanzania: Evidence from Kinondoni District in Dar es Salaam Region. *Business Management Review*, 17(1), 81 – 96.

Dona, P. S., Mouri, S. I., and Hasan, M.D. (2014). Significance of exponential uses of mobile financial services (MFS) in Bangladesh. *Global Journal of Management and Business Research*, 14(4), 92 – 102.

Fagerber, J., Srholeck, M.Y., and Knell, M. (2007). The competitiveness of nations: why some countries prosper while others fall behind. *World Development*, 35(10), 1595-1620.

Fare, R., Grosskopf, S., Norris, M., and Zhongyang, Z. (1994). Productivity, growth, technical progress and efficiency change in industrialised Countries. *The American Economic Review*, 84(1), 66-83.

Frame, W.S., and White, L. J (2004). Empirical studies of financial innovation: lots of talk, little action? *Journal of Economic Literature*, 42(1), 116-144.

Geroski, P.A. (1989). Entry, innovation and productivity growth. *Review of Economics and Statistics*, 71(4), 572-578.

GSMA (2019). Global System for Mobile Communication Association. https://www.gsma.com/mobilefordevelopment/resources/the-state-of-mobile-internet-connectivity-report-2019/

Gubler, D. J. (2011). Dengue, urbanization and globalization: The unholy trinity of the 21st century. *Tropical Medicine and Health*, 39(4)(supplement), 3-11.

Jack, W., and Suri, T. (2014). Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution. *American Economic Review*, 104(1), 183-223.

Lazonick, W. (2013). The theory of innovative enterprise: A foundation of economic analysis. *The Academic Industry Research Network*, No. 13.

Leaven, L., and Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics*, 93(2), 259-275.

Lerner, J., and Tufano, P. (2011). The consequences of financial innovation: A counterfactual research agenda. *Annual Review of Financial Economics*, 3(1), 41-85.

Masha, I. (2016). Macroeconomic impact of mobile payment services; a survey research evidence. International Growth Centre/ London School of Economics and Political Science Regional Workshop, Freetown, Sierra Leone.

Mawejje, J., and Lakuma, P.C.E. (2017). Macroeconomic Effects of Mobile Money in Uganda. *Economic Policy Research Centre* Series No. 135.

Mbiti, I., and Weil, D. (2011). Mobile banking: the impact of M-pesa in Kenya. *National Bureau of Economic Research.* Working Paper No.17129.

Mehrotra, A., and Yetman, A. (2015). Financial Inclusion – Issues for Central Banks. *BIS Quarterly Review*, Bank for International Settlements: March.

Miller, M.H. (1992). Financial innovation: Achievements and prospects. *Journal of Applied Corporate Finance*, 4(4), 4-11.

Miller, M.H. (1986). Financial Innovation: The last twenty years and the next. *The Journal of Financial and Quantitative Analysis*, 21(4), 459-471.

Munyegera, G.K., and Matsumoto, T. (2014). Mobile money remittances and rural household welfare: panel evidence from Uganda. National Graduate Institute of Policy Studies. Discussion Paper No.14 – 22, pp. 1 - 40.

Nampewo, D., Tinyinondi, G.A., Kawooya, D.R., and Ssonko, G.W. (2016). Determinants of private sector credit in Uganda: the role of mobile money. *Financial Innovation*, 2(13), 1-16.

Ndirangu, L., and Nyamongo, E.M. (2015). Financial innovations and their implications for monetary policy in Kenya. *Journal of African Economies*, 24 (AERC Supplement 1), 146–171.

Nigerian Deposit Insurance Corporation (NDIC). (2016). NDIC guidelines on mobile payment system. http://ndic.gov.ng/ndic-releases-deposit-insurance-guidelines-on-mobile-payments-system/

Orekoya, S. (2017). Mobile money and monetary policy in Nigeria. *NDIC Quarterly,* 32(3&4), 21-47.

Orekoya, S. (2018). Impact of mobile money on output and prices in Nigeria. *DBN Journal of Economics and Sustainable Growth,* 1(1), 1 – 17.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy,* 98(5), 71-102.

Simiyu, C.N., and Oloko, M. (2015). Mobile money transfer and the growth of small and medium sized enterprises in Kenya. *International Journal of Economics, Commerce and Management*, 3(5), 1056-1065.

Suri, T. (2017). Mobile money. *Annual Review of Economics*, 9(1), 497-520.

Temple, J. (1999). The new growth evidence. *Journal of Economic Literature*, 37(1), 112-156.

Tufano, P. (2003). Financial innovation. In: *Handbook of the Economics of Finance*, 1(1), 307-335.

Toda, H.Y., and Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics*, 66(1-2), 225–250.

Waweru, K.M., and Kamau, J.W. (2017). The effect of mobile money on savings and money transfer practices for low-income earners in Kenya. *Journal of Business Studies Quarterly*, 8(3), 52-64.

World Bank Development Findex data base (2014).

Yakub, J.O., Bello, H.T., Adenuga, I.A., and Ogundeji, M.O. (2013). The cashless policy in Nigeria: Prospect and challenges. *International Journal of Humanities and Social Sciences*, 3(3), 200-212.