

Contribution of Financial Innovations to Money Demand: A Case of Kenyan Financial Market

**Lewis Otieno Omollo^{1*}, Juliet Wanjira Karanu²,
and Moses Wafula Wekesa³**

¹Master's Student, The School of Business and Economics, Masinde Muliro University of Science & Technology, Kenya.

²Lecturer, The School of Business and Economics, Masinde Muliro University of Science & Technology, Kenya.

³Assistant Professor, The School of Business and Economics, Masinde Muliro University of Science & Technology, Kenya

*Corresponding Author's Email:
leotieno234@gmail.com

Article's History

Submitted: 19th August 2022

Accepted: 3rd September 2022

Published: 6th September 2022

Abstract

Aim: This study sought to assess how financial innovation has affected demand for money in Kenya.

Methods: The research looked at the value of transactions made using modern innovations including ATMs, point-of-sale (POS), online banking, and phone banking. Under the cointegration, granger causality, and error correction modeling, the study used the ordinary least squares (OLS) regression methodology as the estimate method.

Results: Financial innovation, according to the study, has an important role in growing money demand in a country by enhancing financial visibility, facilitating financial processes during trades, and enhancing financial competence. Financial system innovation in emerging nations such as Kenya indicates a potential for financial sector expansion. Financial innovation has shown to be a fundamental predictor of financial advancement, high-tech expansion, efficient financial market access, and hence better economic growth via the diversity of financial facilities.

Conclusion: Financial innovation has resulted in the development of employment opportunities in non-bank financial institutions. It has also led to integration of commercial bank, non-bank private lenders, insurance firms, and housing finance firms.

Recommendations: This study recommend the central bank of Kenya (CBK) to fine-tune its policies to ensure it is well suited to deal with the challenges posed by sophisticated financial innovations. CBK can increase its capability to predict the consequences of financial innovations and act quickly to counter any negative effect of financial innovation on the effectiveness of monetary policy. The study also recommend company and organizations managers to adopt financial innovations in order to boost service quality through efficient and quick service provision via innovations like mobile and online payment systems.

Keywords: *ATM, financial innovations, mobile money, POS.*

INTRODUCTION

Over time, payments tools in trades have changed from valuable metals to papers and coins denominations. Similarly, financial innovations have shifted financial firms from centrally controlled to client-oriented service delivery organizations. Financial innovations have been spurred by technological progress throughout the world, despite the fact that certain nations have been more advanced in adopting these technologies. Modern economies, according to Ndirangu and Nyamongo (2015), cannot flourish without competent financial infrastructures. The financial structure is one of the basic forms of contemporary civilization. It is described as an interconnected aspect of the socioeconomic systems and therefore a vital component of the social networks (Ndirangu et al., 2015). The system regulates the expenditure and amount of assets in the market as an absorbed element of the international monetary system. It creates the mechanism for the flow of resources across various stakeholder categories such as government agencies, commercial entities, consumers, and banking firms. In other terms, advancements in financial innovation will eventually have an impact on the financial ecosystem.

Financial innovation, in its broadest sense, refers to the introduction of new financial items, tools, financial processes, and organizational architecture in the financial system. Financial innovation plays critical roles such as assisting the financial system to function effectively, which subsequently enhances the functioning of monetary policy, lowering transaction expenses through increased capital efficiency, resulting in accelerated economic expansion and advancement, and boosting financial intermediaries in the financial system (Nkoro & Uko, 2013). The global expansion in information and communication technology (ICT) has aided in the effective introduction and operation of financial innovations. With globalization and internet access in Kenya, the financial sector has exploded with a flood of financial goods and services such as the use of automated teller machines (ATMs), point-of-sale (POS) terminals, mobile banking, and online banking (Nazaritehrani & Mashali, 2020).

Financial innovations are multifaceted and may be categorized as the innovation spiral (Caverzasi & Tori, 2018). This means that new financial innovations produce new financial configurations that function in new financial markets. This suggests that financial innovations may cause shifts in arrangements, changes in the legal framework, the creation of new financial tools, and the establishment of institutions concentrating on these new developments. The introduction of new ideas, processes, and solutions for existing problems is a critical component of financial innovations. Most importantly, it improves corporate competitiveness and adds value to the enterprise. It may be defined as all financial, high-tech, methodical, and profit-making actions required to build new markets with value-added financial resources. Financial innovation raises the value of financial products and services, improves capital accretion and allocation methods, advances financial development strategies, and boosts the performance of financial organizations (Shaughnessy, 2015). Therefore, the proficiency of financial organizations has an influence on financial development over the enhanced way of transactions that accelerate international and national trade (Sabandi & Noviani, 2015).

Financial innovation, on the contrary, can have a negative impact on monetary policy effectiveness and can jeopardize the atmosphere in which monetary policy functions (Adrian & Liang, 2016). For instance, the emergence of newer financial products can erode contractionary monetary policy aimed at decreasing surplus liquidity because

economic actors can comfortably move money from less liquid investments to more liquid packages offered by financial intermediaries, undermining monetary policy performance (Gbadebo, 2010). Financial innovation, in particular, the advancement of financial technology, goods, and services, may have an impact on the efficient operation of the demand for money function. The demand for money function may become unstable as a result of financial innovation, making the velocity of the money demand function unpredictable. The volatility of the demand for money function caused by financial innovation may have far-reaching implications for monetary policy decisions. For example, increased usage of this alternative form of money can substitute for traditional forms of money, reducing demand for money to the point where it can replace the use of other liquid financial instruments, weakening the efficacy of monetary policy formation. The link between the demand for money and the factors that influence its behavior is the foundation of macroeconomic theories and a key component in the development and execution of monetary policy in every economy. Against this context, the purpose of this research was to determine how financial innovation has influenced money demand in Kenya.

2.0 LITERATURE REVIEW

2.1 Empirical Studies

Matthew, Fasina, Olowe, and Adegboye (2010) examined the impact of financial innovation on monetary policy transfer mechanism, focusing particularly on the impact of financial innovation on the interest rate channel of the monetary transmission mechanism in Nigeria using monthly data covering from 1996 to 2006. Employing the Two Stage Least Squares (2TLS) technique, the study found that financial innovation has a weakening effect on the interest rate channel of money transmission mechanism. This result implies that financial innovation has posed a serious challenge to the conduct of monetary policy in Nigeria. Also, Matthew et al., (2010) examined the effect of financial innovations on demand for money in Nigeria for the period spanning from 1970 to 2008, using the Engle and Granger Two-Step Cointegration technique. The co-integration result showed that there was a long run association among the variables. Result of the error correction model showed that financial innovation has negative and significant influence on money demand in Nigeria.

Hye (2009) undertook investigation on the link between financial innovation and money demand in Pakistan during the period of 1995-1 to 2007-12 using the robust techniques of co-integration and error correction mechanism (ECM). The result of the co-integration test showed that that there exists a long run relationship among the variables. The result of the short run dynamics revealed that financial innovation has statistically significant effect on money demand in Pakistan both in the long and in the short run. The study revealed that the short run elasticity was larger than the long run elasticity during the period.

Safdar and Khan (2014) carried out a study on the effect of financial innovation on money demand and the effect of money market disequilibrium on output gap in Pakistan, utilizing the ordinary Least Squares (OLS) estimation technique. The study used number of Automated Teller Machines (ATMs) as a measure of financial innovation. The result of the estimation revealed that financial innovation by way of number of ATMs has negative impact on money demand in Pakistan. Similarly, Sichei and Kamau (2012) carried out study on the effect of

financial innovation on demand for money in Kenya, using quarterly data for the period spanning from 1997:4 to 2011:2. The authors used the number of ATMs as a proxy for financial innovation. The cointegration analysis was performed for the study. The result showed that there was no significant effect of financial innovations on the demand for money.

Apere (2017) carried out a study on the impact of financial innovation on demand for money in Nigeria, utilizing data for the period covering from 1981 to 2016, employing the Vector Auto Regression (VAR) methodology as estimation method. Outcome of the estimation showed that financial innovation has a negative influence on the demand for money in Nigeria. This according to the author is that as financial innovation increases, people tend to move away from a more liquid asset to not too liquid assets. Mujuri, Kibet, and Kiprop (2018) investigated the impact of financial innovation on demand for money function in Kenya, utilizing data from 2008 to 2016. The study employed the Autoregressive Distributed Lag (ARDL) technique, based on the Bounds testing approach. The result of the study showed that financial innovation impacted positively on demand for money function in Kenya. Specifically, volume of ATM exerted positive and significant effect on demand for money in Kenya. From the review, it is noticed that few studies exist in Nigeria examining the impact of financial innovation on demand for money. These studies do not seem to use modern payment channels such as the Automated Teller Machines (ATMs) transactions, Mobile banking transactions, Point of Sale (POS) transactions, and Internet banking transactions in their analysis. This is the main focus of this study and departure from the previous studies in Nigeria and the gap the study filled.

2.2 Theoretical Framework

2.2.1 Financial innovation hypothesis

Financial innovation hypothesis was developed following empirical studies carried out by various authors like Merton (1992), Allen and Gale (1994), and Grinblatt and Longstaff (2000). The financial innovation hypothesis exists in two versions: financial innovation - growth hypothesis and financial innovation-fragility version. The main proposition of the financial innovation hypotheses is derived from various theoretical literature and empirical investigations carried out by authors to investigate the impact of financial innovation on economic growth. According to the financial innovation - growth hypothesis, financial innovations play a very important function in the financial system by helping in the reduction of agency costs, facilitating sharing of risks in the financial system, helping in improving the quality and variety of banking services, and ultimately enhances allocative efficiency in the financial system (Allen & Gale, 1994; Berger, 2003; Grinblatt & Longstaff, 2000; Houston, Chen, Lin, & Yue, 2010; Merton, 1992). Deducing from this proposition, it means that financial innovation has ability of raising the efficiency of the financial system by increasing the variety of financial products and services, which leads to improvement in matching individual savers requirements with firms searching for funds (Chou, 2007).

Also, within the theoretical postulate of the financial innovation-growth hypothesis, it is posited that financial innovation do results in the emergence of new financial technologies such as modern payment channels such as the Automated Teller Machines (ATMs), the Mobile Banking, Point of Sale (POS) banking transactions, and Internet banking transactions, which reduces transaction costs and promotes the productivity of capital. On the other side of the

argument, the financial innovation-fragility version considers financial innovation from the sceptical view point or dark side. According to this version, financial innovation is the responsible factor causing financial crises because the process of financial innovation does culminate in unprecedented increase in the creation of credit, which makes for the initial boom and thereafter the burst (Brunnermeier, 2009). It is argued that financial innovation provides financial institutions opportunity to design and create structured products capable of exploiting investors' misunderstandings of the financial markets (Henderson & Pearson, 2011). Furthermore, it is argued that financial innovation driven by arbitrage regulation does not allow for efficient allocation of resources but rather reinforces financial fragility which adversely affects effective implementation of monetary policy (Houston et al., 2010).

2.2.2 Diffusion of innovation theory

The diffusion of innovation theory was first propounded by Rogers in 1962. This theory is an attempt to explain the process through which new ideas and technology spread across the social system. According to the diffusion of innovation theory, the process of technology adoption does not take place concurrently in a social system but that it is a process whereby some people are disposed to the adoption of an innovation in advance of others. From the innovation point of view, the diffusion of innovation theory has been applied to explain the adoption of technology. Rogers (1995) argued that the process of technology diffusion comprises four aspects, namely an innovation or new technology itself, the social system, the communication channels of the social system, and time horizon. This process as advanced in the theory is dependent on the level of human capital development. Thus, the higher the level of human capital, the faster the process of innovation transfer and adoption. Since the formulation of the diffusion of innovation theory, it has been applied in numerous areas, including the financial system. For instance, the revolution in information and communication technology has resulted to financial innovation which led to the proliferation of new financial instruments, products and services, and new forms of organization structure in the financial system. Financial innovation by way of new financial instruments such as Automated Teller Machines (ATMs), internet banking, mobile banking, Point of Sales (POS) evolved as a result of diffusion of innovation in the form of information and communication technology (ICT) into the financial system.

2.2.3 The classical theory of money demand

The classical theory of money demand is embedded in the quantity theory propounded by Irving Fisher in 1911. Although, the classical economists did not explicitly propound the theory of money demand, but their views are inherent in the quantity theory. In the classical theory, the demand for money is meant for transactions purposes as money is demanded for payment for goods and services. In other words, people demand money solely for transaction purpose and the more money people need for transactional purpose, the more money they will demand (Jhingan, 2004). This relationship between money demand and the level of transaction is expressed in the equation of exchange expressed as: $MV = PY$ (1)

Where: M = the total quantity of money; V = velocity of money circulation; P = the general price level and T = total amount of goods and services exchanged for money.

Equation 1 states that the quantity of money multiplied by the number of times money changes hands in a given year must be equal to nominal income (the total nominal amount spent on goods and services in that year). Fisher assumed velocity of money circulation to be reasonably constant in the short-run. His view of short-run constant velocity transforms the equation of exchange into the quantity theory of money demand. To show that the quantity theory of money is indeed a theory of money demand can be seen by dividing both sides of the equation (1) by V to yield:

$$M = (1/V)PY \dots\dots\dots (2)$$

Since at equilibrium, the quantity of money (M) that people hold equal to the quantity of money demand (M_d). Hence, M in Equation 2 can be replaced by M_d using k to represent the quantity, $(1/V)$, so that Equation 2 can be rewritten as:

$$M^d = KPY \dots\dots\dots (3)$$

Since k is a constant, the level of transactions generated by a fixed level of nominal income PY determines the quantity of money M_d that people demand. In this regard, Fisher's quantity theory of money suggests a money demand function is determined by income only, with interest rates having no effect.

2.2.4 Keynes's liquidity preference theory

The liquidity preference theory of money demand was propounded by Keynes (1936). In his famous book "The General Theory of Employment, Interest and Money", Keynes identified three motives people demand for money to include: the transactional motive, the precautionary motive and the speculative motive. Keynes believed that the demand for real money balances depends on both interest rate and income. According to Keynes, transactional and precautionary motives are positively related with income. Moreover, Keynes argued that money demand for speculative motive is negatively related to interest rate. From the three motives of Keynes, a preliminary money demand equation can be expressed as:

$$M_d = M_t + M_p + M_{sp} \dots\dots\dots (4)$$

Where: M_d is money demand, M_t is transaction demand for money, M_p is the precautionary demand for money and M_{sp} is the speculative demand for money. Keynes holds that transactions demand for money and precautionary demand for money is the function of income, while money demanded for speculative purposes is a function of interest rate. Hence, the Keynesian money demand function in an explicit form is expressed as:

$$M_d/P = \alpha_0 + \alpha_1 Y - \alpha_2 i + \varepsilon \dots\dots\dots (5)$$

Equation 5 states that money demand has positive relationship with income, but negative relationship with interest rate.

2.2.5 Friedman modern theory of money

Milton Friedman in 1956 developed a theory of the demand for money in a famous article, "The quantity Theory of Money: A Restatement". Friedman's theory is considered to the modern quantity theory of money. The theory states that a change in money supply will change the price level as long as the demand for money is stable. Such a change according to the theory affects the real value of national and economic activity only in the short-run. The modern theory

indicates that the demand for money should be a function of the resources available to individuals (their wealth) and the expected returns on other assets relative to the expected return on money. Friedman in his empirical study on “Monetary Trends in the United States and the United Kingdom (1982)” formulated the following demand for money function for an individual wealth holder with slightly different notations from his original study of 1956 as: $M/P = f(Y, W, R_m, R_b, R_e, gp, u)$(6)
Where: M = the total stock of money demanded; P = the price level; Y = the real income; W = the fraction of wealth in non-human form, R_m = the expected nominal rate of returns on money, R_b = expected rate of returns on bonds, including expected changes in their prices, R_e = expected rate of returns on equities, including expected changes in their prices, $gp = (I/P) (dP/dt)$ = expected rate of change of prices of goods and hence expected nominal rate of return on physical assets, and u = variables other than income that may affect the utility attached to the services of money. In Friedman’s restatement the quantity theory of money, the supply of money is independent of the demand for money. The supply of money is unstable due to the actions of monetary authorities. On the other hand, the demand for money is stable.

3.0 METHODOLOGY

The model for this study is anchored on the eclectic approach based on the Keynesian theory of money demand and the financial - innovation hypothesis. According to the Keynesian theory, demand for money is a positive function of income and a negative function of interest rate. According to the financial innovation hypothesis, financial innovation usually results in the emergence of new financial products and services by way of emergence of sophisticated payment channels such as ATMs, POS, internet banking, and mobile banking transactions. However, since the main focus of this study is to specifically examine the impact of financial innovation on demand for money function, the traditional determinants of money demand such as income and interest rate are dropped from the model to give way for the examination of the impact of financial innovation on demand for money function. The dependent variable is the demand for money, while the independent variables include modern financial transaction channels such as the ATMs, mobile banking transactions, POS and internet banking transactions. Thus, the empirical model for this study can be formulated and expressed as:

$$MD = f(ATMV, POSV, NETV, MOBV).....(7)$$

Where: MD = money demand, represented by broad money supply in Nigeria (in million naira) ATMV = volume of Automated Teller Machines transactions (in millions) POSV = volume of point of sales transactions (in millions) NETV = volume of internet banking transactions (in millions) MOBV = volume of mobile banking transactions (in millions) The econometric log linear form of Equation 7 can be expressed as follows: ω

$$LMD = \omega_0 + \omega_1 LATMV + \omega_2 LPOSV + \omega_3 LNETV + \omega_4 LMOBV + U.....(8)$$

Where: ω_0 to ω_4 are the parameters to be estimated and U_3 is the random error term. The theoretical expectations concerning the signs of the parameters are as follows: $\omega_1 < 0$, $\omega_2 < 0$, $\omega_3 < 0$, $\omega_4 < 0$.

3.1 Estimation Technique/Procedures

The study made use of ordinary least square (OLS) regression technique. The reason for employing the classical Ordinary Least Squares (OLS) is that of all classes of estimators, the Ordinary Least Squares (OLS) is the Best Linear Unbiased Estimator (BLUE) because it has minimum error. However, before the model was estimated, several pre-estimation tests were carried out to ascertain the adequacy of the model. The unit root test was carried out to determine the order of integration of the variables. The unit root test is conducted using the Augmented Dickey-Fuller (ADF) test.

We accept the null hypothesis of the presence of unit root if $\gamma = 0$ and reject it if $\gamma < 0$. The cointegration test is carried out to determine if there exist long run relationship or not among the variables. The Johansen and Juselius (1990) multivariate approach was employed, making use of the trace test and the maximum eigenvalue test. The cointegration equation based on the vector autoregression specification can be expressed as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta y_{t-i} + C + \varepsilon_t \quad \dots\dots\dots(9)$$

Where: $\Delta Y_t = n \times 1$ vector of the variables in period t ; $\Gamma_i = i = 1 \dots k-1$ is the $n \times n$ matrix of coefficient of the short run specification; $C = n \times 1$ vector of the constant term; $\Pi =$ the $n \times n$ matrix of the long run impact; and $\varepsilon_t = n \times 1$ vector of error term. The null hypothesis is that $H_0: \beta_i = 0$ (there is no long run relationship among the variables) and $H_A: \beta_i \neq 0$ (there a long run relationship among the variables). To reach an acceptable conclusion for the presence of cointegration, at least one cointegrating equation must be established otherwise there is no cointegration among them. That is, if at least one computed test value is greater than the test critical value at the 5% level of significance, then we can conclude that there is long run association among the variables. Lastly, the error correction model is specified aimed at estimating the short run dynamics of the model.

3.2 Data Sources and Description

Secondary source of data is used as the main method of data collection. The relevant data for this study were obtained from the Central Bank of Kenya (CBK) annual report and Statement of Account, Central Bank of Kenya (CBK) statistical bulletin. The study was based on time series data collected on quarterly basis from the period 2009 to 2019. Money demand is measured in millions of Kenyan shillings and was obtained from the Central Bank of Kenya (CBK) statistical bulletin (various years). Volume of automated teller machines transactions, volume of mobile banking transactions, volume of internet banking transactions and volume of point of sales transactions are all measured in absolute million, being that they are number of transactions in each of the payment channels.

4.0 ANALYSIS OF RESULTS

4.1 Descriptive Statistics

Table 1 presents descriptive statistics on the captured variables in this study. Data as presented in the table showed that the mean values of money demand, volume of automated teller

machines transactions, volume of mobile banking transactions, volume of internet banking transactions and volume of point of sales transactions were Ksh 5,045,384 million, Ksh 32,699,232 million, Ksh 3,944,216 million, Ksh 1,418,143 million and Ksh 6,473,402 million, respectively. The maximum values of the variables were Ksh 8,176,067 million, Ksh 67,257,659 million, Ksh 44,734,358 million, Ksh 382,009 million, and Ksh 1,366,745 million for money demand, volume of automated teller machines transactions, volume of mobile banking transactions, volume of internet banking transactions and volume of point of sales transactions, respectively. The minimum values of the variables were Ksh 2,524,787million, Ksh 2,178,261million, Ksh 30,978 million, Ksh 81,185 million, Ksh 33,285 million, respectively for money demand, volume of Automated Teller Machines transactions, volume of mobile banking transactions, volume of internet banking transactions and volume of point of sales transactions.

Table 1: Descriptive statistics

Statistics	MD	ATMV	MOBV	NETV	POSV
Mean	5,045,384	32,699,232	3,944,216	1,418,143	6,473,402
Median	5,041,411	28,789,024	1,848,438	382,009	1,366,745
Maximum	8,176,067	67,257,659	4,4734,358	8,088,924	36,358,469
Minimum	2,524,787	2,178,261	30,978	81,185	33,285
Skewness	0.203271	0.236930	3.772866	1.980668	1.673927
Kurtosis	1.873787	1.948256	17.25064	5.851182	4.584059
Jarque-Bera	2.628326	2.439632	476.7011	43.67261	25.14851
Probability	0.268699	0.295285	0.000000	0.000000	0.000003

Notes: MD = Money demand, ATMV = Volume of ATM transactions, MOBV = Volume of mobile banking transactions, NETV = Volume of internet banking transactions, POSV = Volume of point of sales transactions.

Examination of the data in the table showed that the distributions for all the variables were positively skewed, given the positive values of skewness exhibited by the variables. However, examination of kurtosis showed that the distributions for volume of mobile banking transactions, volume of internet banking transactions and volume of point of sales transactions were leptokurtic, while the distributions for money demand and volume of automated teller machines transactions were platykurtic.

4.2 Unit Root Test

Given the times series nature of the data used, the study carried out the unit root test to ascertain the stationarity properties of the variables. This was carried out to avoid estimating a spurious regression. The test was conducted using the Augmented Dickey-Fuller (ADF) test. The test result is presented in table 2, which shows that all the variables are non-stationary at level, except the CMR, CD, CP and G-Sec 10, but all become stationary after the first difference. This implies that all the variables are I (1), except for the CMR, CD, CP and G-Sec 10 which are I (0), which fulfils the criteria necessary to apply ARDL.

Table 2: Unit root test results (ADF and PP)

Variable	ADF Statistic			
	Level	5% Critical Value	1st Diff.	5% Critical Value
LMD	-1.091688	-2.936942	-6.738966	-2.931404
LATMV	-1.472401	-2.931404	-6.441519	-2.933158
LPOSV	-0.027050	-2.933158	-8.680675	-2.933158
LNETV	-0.196231	-2.933158	-7.549894	-2.933158
LMOBV	-0.867801	-2.931404	-8.316712	-2.933158

The result as depicted in the table using the Augmented Dickey-Fuller (ADF) test showed that no variable was stationary at level since the computed ADF statistic values in absolute terms were less than the critical values at the 5% level of significance. Based on this result, the null hypothesis of absence of unit root cannot be rejected. However, at the first difference of the variables, they were all found to be stationary. That means all other variables plus inflation rate were stationary after their first difference, and hence were integrated of the first order.

4.3 Granger Causality Test

The result of the pairwise granger causality test for the causal relationship among the variables is depicted in table 3.

Table 3: Granger causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
SATMV does not Granger Cause MD	42	0.68845	0.5087
MD does not Granger Cause ATMV		4.14863	0.0237
MOBV does not Granger Cause MD	42	1.63489	0.2087
MD does not Granger Cause MOBV		0.76901	0.4707
NETV does not Granger Cause MD	42	0.28030	0.7571
MD does not Granger Cause NETV		2.47879	0.0977
POSV does not Granger Cause MD	42	0.56646	0.5724
MD does not Granger Cause POSV		2.71315	0.0795

Result of the granger causality analysis showed that there is unidirectional relationship running from money demand to volume of ATMs transactions. This means that money demand granger caused volume of ATMs. There was also unidirectional relationship running from money demand to volume of internet banking transactions. Furthermore, there was unidirectional relationship running from money demand to volume of point of sales (POS) transactions. This implies that money demand granger caused both internet banking transactions and point of sales transactions. Lastly, there was causality relationship between money demand and mobile banking transactions.

Table 4: Parsimonious result

Dependent Variable: D(LMD)				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.360817	1.666585	1.416560	0.1663
D(LMD(-1))	0.296237	0.174801	1.694712	0.0998
D(LATMV)	2.026825	1.550751	1.306996	0.2005
D(LMOBV(-2))	1.122177	0.570748	1.966151	0.0580
D(LNETV)	9.723837	5.060283	1.921599	0.0636
D(LNETV(-1))	1.820830	0.787468	2.312260	0.0274
D(LPOSV)	1.505931	0.568976	2.646739	0.0125
D(LPOSV(-1))	-1.902496	0.720258	-2.641409	0.0127
ECM(-1)	-0.315648	0.116412	-2.711463	0.0107
R-squared	0.564393	Mean dependent var		479.9832
Adjusted R-squared	0.530492	S.D. dependent var		765.8990
S.E. of regression	626.6853	Akaike info criterion		15.90995
Sum squared residue	12567502	Schwarz criterion		16.28610
Log likelihood	-317.1541	Hannan-Quinn criter.		16.04693
F-statistic	3.468168	Durbin-Watson stat		1.935260
Prob(F-statistic)		0.005481		

As indicated in the table 4, the error correction variable has the expected negative coefficient and was statistically significant in line with theoretical expectation. The ECM's coefficient of 0.315 showed that about 32% of the disequilibrium in the system is eliminated within one quarter. This is a slow speed of adjustment from short run disequilibrium to long run equilibrium. The adjusted R-squared of 0.530 showed that the estimated equation has a good fit and moderately high explanatory power. Specifically, about 53% of the total variation in the dependent variable was accounted for by the independent variables. The F-statistic of 3.468 with its low probability value of 0.005481 showed that the overall model is statistically significant at the conventional 1%, 5% and 10% levels of significance. This means that the independent variables have joint impact on the dependent variable. Meanwhile, the Durbin-Watson statistic of 1.935 showed that there is no problem of autocorrelation in the model.

Analysis of the short run coefficients showed that one period lagged of money demand has a positive relationship with the current value of money demand in Kenya in line with a priori expectation. This indicated that a 1% increase in the previous one period of money demand resulted in an increase in the current value of money demand by approximately 0.30%, ceteris paribus. Statistically, the variable was statistically significant in its effect on the current period's money demand at the 10% level of significance, given its low probability value of 0.0998.

The volume of ATM transactions has a positive effect on money demand in Kenya. This shows that a 1% increase in the volume of ATM transactions resulted in an increase in money demand by approximately 2.03%, ceteris paribus. The variable was however not statistically significant in influencing money demand at any of the conventional 1%, 5% and 10% levels of significance, given its high probability value of 0.2005. The result showed that the volume of mobile banking transactions has a positive relationship with money demand in Kenya. This result in real term shows that a 1% increase in two periods lagged volume of mobile banking

transactions led to an increase in money demand by approximately 1.12%, other factors held constant. The variable was also statistically significant in influencing money demand at the 10% level of significance, given its low probability value of 0.0580.

Furthermore, volume of internet transactions has a positive relationship with money demand in Kenya. In real term, the result showed that a 1% increase in the current and one period lagged volume of internet transaction led to an increase in money demand by about 9.72% and 1.82%, respectively. The variables were also statistically significant in influencing money demand in Kenya. While current period's volume of internet transactions was significant at the 10% level of significance, given its low probability value of 0.0636, one period lagged volume of internet transactions was statistically significant at the 5% level of significance, given its low probability value of 0.0274.

Lastly, volume of point of sales (POS) transactions in the current period has a positive relationship with money demand in Kenya. This result in real term showed that a 1% increase in the current period's volume of point of sales (POS) transactions resulted in an increase in money demand by approximately 1.51%. On the other hand, one period lagged of volume of POS transactions has negative impact on money demand in Kenya. This, in real term means that a 1% increase in one period lagged of volume of POS transactions resulted in a decrease in money demand by about 1.90%. The variables were also statistically significant in influencing money demand at the 5% level of significance, given their low probability values of 0.0125 and 0.0127, respectively.

5.0 CONCLUSION AND RECOMMENDATION

This study was carried out to investigate the impact of financial innovation on demand for money in Kenya using quarterly data for the period 2009 – 2019. Theoretical literature has established that financial innovation by way of new financial products and services exert significant influence on the workings of the monetary policy and hence money demand function. Based on this assertion, this study was carried out to investigate this claim for Kenya employing modern payment channels such as Automated Teller Machines (ATMs) transactions, Point of Sales (POS) transactions, Internet banking transactions, and Mobile banking transactions.

The result obtained showed that financial innovation has mixed impact on money demand in Kenya during the period of analysis. For instance, financial innovation has positive impact on money demand through volume of ATM transactions in the current period, two periods lagged of volume of mobile banking transactions, current period and one period lagged of volume of internet banking transactions, and current period's volume of Point of Sales (POS) transactions in Kenya. On the other hand, financial innovation has negative impact on money demand through one period lagged of volume of point of sales in Kenya.

Based on the result, the study recommended the central bank of Kenya (CBK) to fine-tune its policies to ensure it is well suited to deal with the challenges posed by sophisticated financial innovations. CBK can increase its capability to predict the consequences of financial innovations and act quickly to counter any negative effect of financial innovation on the effectiveness of monetary policy. The study also recommend CBK to roll out policies that will attract more participants such as non-government and private sector funds to the Kenyan money

market. This will deepen the market and make the market more dynamic and amenable to monetary policy and counter any adverse effect of financial innovation. Finally, the study recommend company and organizations managers to adopt financial innovations in order to boost service quality through efficient and quick service provision via innovations like mobile and online payment systems.

Funding Sources

The authors received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest

The authors declare no conflict of interest.

REFERENCES

- Adrian, T., & Liang, N. (2016). Monetary policy, financial conditions, and financial stability. *Financial Conditions, and Financial Stability (July 2016)*.
- Aliha, P. M., Sarmidi, T., Shaari, A. H., & Said, F. F. (2017). Investigating the effect of financial innovations on demand for money on a world scale: A systems GMM panel data approach. *Journal of Global Business and Social Entrepreneurship*, 3(5), 181-188.
- Allen, F., & Gale, D. (1994). *Financial innovation and risk sharing*. MIT Press: Cambridge, MA.
- Apere, T. O. (2017). *The implications of financial innovations on money demand in Nigeria*. Paper presented at the In Proceedings of ISER 94th International Conference, Zurich, Switzerland, 16th-17th December 2017.
- Berger, A. (2003). The relationship between capital and earnings in banking. *Journal of Money, Credit and Banking*, 27(2), 432-456.
- Brunnermeier, M. K. (2009). Deciphering the liquidity and credit crunch 2007-2008. *Journal of Economic Perspectives*, 23(1), 77-100.
- Caverzasi, E., & Tori, D. (2018). The Financial Innovation Hypothesis: Schumpeter, Minsky and the sub-prime mortgage crisis.
- Chou, Y. K. (2007). Modelling financial innovation and economic growth. Why the Financial Sector Matters to the Real Economy? *The Journal of Economic Education*, 38(1), 78-91.
- Gbadebo, O. O. (2010). Does financial innovation affect the demand for money in Nigeria? *Asian Journal of Business Management Studies*, 1(1), 08-18.
- Gbadebo, O. O., & Okunrinboye, O. A. (2009). Modelling the Impact of financial innovation on the demand for money in Nigeria. *African Journal of Bussiness Management*, 3(2), 39-51.

- Goldfeld, S. M. (1994). *Demand for money: Empirical studies*, in P. Newman, M. Milgate and J. Eatwell (Eds) *the new palgrave dictionary of money and finance*. London: Macmillan Press.
- Grinblatt, M., & Longstaff, F. A. (2000). Financial innovation and the role of derivative Securities: An empirical analysis of the treasury STRIPS program. *Journal of Finance*, 55(3), 1415-1436.
- Henderson, B. J., & Pearson, N. D. (2011). The dark side of financial innovation: A case study of the pricing of a retail financial product. *Journal of Financial Economics*, 100(2), 227-247.
- Houston, J., Chen, L., Lin, P., & Yue, M. (2010). Creditor rights, information sharing, and bank risk taking. *Journal of Financial Economics*, 96(3S), 485-512.
- Hye, Q. M. A. (2009). Financial innovation and demand for money in Pakistan. *Asian Economic Review*, 51(2), 219- 228.
- Jhingan, M. L. (2004). *Macroeconomic theory* (3rd ed.). Delhi: Konark Publishers.
- Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with application to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210.
- Keynes, J. M. (1936). *The general theory of employment, interest and money*. New York: Macmillan Cambridge University Press.
- Matthew, A. O., Fasina, F. F., Olowe, O., & Adegboye, F. B. (2010). Empirical modeling of the impact of financial innovation on the demand for money in Nigeria. *International Research Journal of Finance and Economics*, 58, 73-90.
- Merton, R. C. (1992). Financial innovation and economic performance. *Journal of Applied Corporate Finance*, 4(4), 12-22.
- Misati, R. N., Lucas, N., Anne, K., & Shem, O. (2010). Financial innovation and monetary policy transmission in Kenya. *International Research Journal of Finance and Economics*, 50(1), 123-136.
- Mujuri, B., Kibet, L., & Kiprop, S. (2018). Effect of financial innovation on money demand in Kenya. *Journal of Economics and Sustainable Development*, 9(16), 163-182.
- Nazaritehrani, A., & Mashali, B. (2020). Development of E-banking channels and market share in developing countries. *Financial Innovation*, 6(1), 1-19.
- Ndirangu, L., & Nyamongo, E. M. (2015). Financial innovations and their implications for monetary policy in Kenya. *Journal of African Economies*, 24(suppl_1), i46-i71.
- Nkoro, E., & Uko, A. (2013). Financial sector development-economic growth nexus: Empirical evidence from Nigeria. *American International Journal of Contemporary Research*, 3(2), 87-94.

- Noyer, C. (2008). *Challenges of financial innovation for the conduct of monetary policy*. Paper presented at the In Speech delivered at the International Monetary Fund-Bank of France-Bank of England Conference, Paris.
- Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: The Free Press.
- Safdar, S., & Khan, A. (2014). Demand for money, financial innovation and money market disequilibrium. *IOSR Journal of Humanities and Social Science*, 19(2), 36-41.
- Sichei, M. M., & Kamau, A. W. (2012). Demand for money: Implications for the conduct of monetary policy in Kenya. *International Journal of Economics and Finance*, 4(8), 72-82.
- Solans, E. D. (2003). *Financial innovation and monetary policy*. Paper presented at the In Excerpts of Speech Delivered at the 38th SEACEN Governors Conference and 22nd Meeting of the SEACEN Board of Governors on "Structural Change and Growth Prospects in Asia -Challenges to Central Banking", Manila (13 February).