Original Research Article

Effect of Financial Innovation on Money Demand in the East African Community

Abstract

Tremendous financial changes have been witnessed in the East African Community's (EAC's) macroeconomic landscape over the past few years. These changes can shift various parameters of the money demand model. Many previous empirical studies examined the effect of scale and opportunity cost of holding money variables on money demand. However, most of them left out financial innovation which is one of the key factors influencing money demand. Additionally, they are just country specific studies and used time series data analysis technique. It is in this backdrop that a cross-country case study that investigates how financial innovation affects money demand function was carried out using the recent data and a different analysis technique which is panel data analysis. The objective of the study was to examine the effect of mobile financial innovation on money demand in the EAC. The study used secondary data for the period 2007 to 2020 and this data was obtained from the World Bank and International Monetary Fund. Both descriptive and inferential analyses were carried out. Levin-Lin-Chu test for panel unit root was done and all the study variables were found to be stationary at level. The results of balanced panel fixed effects regression analysis indicated that mobile money, ATMs, and real GDP were affecting money demand positively and their effects were also statistically significant. However, interest rate affected money demand negatively. Mobile money and ATMs were proxies for financial innovation whereas real GDP and interest rates were control variables. Therefore, it was observed that financial innovation has had a positive effect on money demand in the EAC. The findings of this study might be of great importance to monetary authorities and policy makers in the EAC. Future research studies can expand the period of study similar to this one and also increase the number of countries involved.

Keywords: Financial Innovation, Money Demand, East African Community

1 Introduction

One of the most important prerequisites or inputs for formulating and implementing monetary policy is money demand. It is, therefore, important to examine money demand and try to get an understanding of the relationship between money demand and its determinants. Money demand is the desire to hold financial assets either in the form of bank deposits or cash(Goldfeld & Sichel 1990). Economic agents specifically individuals (households) are usually motivated to hold money for various motives that include transaction, precautionary and speculative motives.These three motives hence drive the economic agents to demand money in various forms. It is also important to note that money provides liquidity to economic agents by facilitating transactions and can also earn interest. The demand for money usually stems from

the trade-off between liquidity benefit of holding money and the interest benefit of holding other equivalentsof money (Handa, 2009).Money demand is influenced by several factors.

Financial innovation (FI) is one of the recent factors that have been found to have a greater influence on money demand at the global, regional, and national level. FI is a crucial factor in the development of the financial sector and economic growthandit includes aspects such asfinancial regulations/de-regulations and technological procedures (Kipsang, 2013; Chipeta & Muthinja, 2018). According to Frame & White (2014), FI can be grouped into both products andprocesses. Examples of financial processes include financial marketsliberalization and securitization. On the other hand, some of the examples of financial products are mobile money, internet banking, debit cards, ATMs etc.

1.1 An Overview of Financial Innovation and Money Demand

The demand for money at the global levelhas increased extensively (Mlambo & Msosa, 2020). This is because a higher demand for money is likely to result in huge economic growth (Mlambo & Msosa, 2020). Generally, the trend of money demand among several countries globally has changed drastically over the past few years. One factor attributed to these changes in the trend of money demand is the continued developments in the financial sector (Dunne & Kasekende, 2018). The financial sector across several countries globally has experienced huge technological developments in the last couple of years. Some ofthese developments in the financial sector include automated teller machines (ATMs), improved payment systems and money transfer systems, automatic bill payer accounts, credit and debit cards etc. The main reason as to why new financial innovations have been embraced across the globe is their easiness and effectiveness. For example, it has resulted in reduction in transaction costs.

2 Literature Review

The classical economists developed quantity theory of money demand, which perceives income as the key determinant of money demand (Serletis 2007).The quantity theory of money demand was developed by Fisher (1911). This particular theory was explained using the equation of exchange. According to this theory, the demand for money in an economy is solely a function of the volume of transactions taking place in an economy (Fisher, 1911). Economic agents particularly households, therefore, demand money solely to meet their transaction purpose and the more money householdsrequire for transactional purpose, the more the money will be demanded. The relationship between the demand for money and the amount of transaction is expressed in the following equation:

$$MV = PT \qquad (2.1)$$

Where:

M is the quantity of money V is the transactional velocity of money

P is the price level T is the volume of transactions

Fisher (1911) argued that individuals demand money for only one purpose, which is transaction purpose. He also believed that the demandfor money is inelastic to changes in interest rate. The Cambridge school economists later modified the Fisher'sequation and came up with a different functional form of the old equation. They did so by replacing volume of transactions (T) with output (Y). The modification was necessary because there is a challenge inherent with the original Fisher's equation. The challenge is thatit is difficult to account forthe amount of transactions in an economy. Hence, output(Y) is used as a proxy for transactions (T) because the more an economy produces output, the more goods and services are transacted (bought and sold). With this particular modification by the Cambridge economists, the equation of exchange becomes:

$$MV = PY \qquad (2.2)$$

The above equation is transformed into the quantity theory of money demand by solving for the real money balance ($^{M}/_{P}$) and hence the equation is rewritten as:

$$^{M}/_{P} = \frac{1}{V}Y \qquad (2.3)$$

Equilibrium in the money market is attained when the quantity of real money supplied$^{M}/_{P}$is equal to the demand for real money balances$(^{M}/_{P})^{d}$ and $^{1}/_{V}$is equal to *k***.** It is important to note that *k* is a constant that reflects both the technological and institutional features of aneconomy which are stable during the short-run. The quantity theory of money demand is henceexpressed as:

$$(^{M}/_{P})^{d} = kY \qquad (2.4)$$

Finally, the expression of the quantity theory of money demand indicates that the demand for money is solely a function of income and many empirical studies have found out that thisrelationship is stable over time. This is the key major strength of this particular theory.

Keynes (1936) modified the quantity theory of money that was developed by the classical economists to includethe interest rate. In doing so, Keynes argued that households hold money for three main motives: the transaction motive, the precautionary motive, and the speculative motive (Keynes, 1936). The role of money as the medium of exchange is reflected in the transaction demand and precautionary demand for money. This can be interpreted to mean that income plays a major role in determining money demand. On the other hand, the role of money as a store of value is reflected in the speculative demand. Household decide between holdingmoney either in form of cash or bonds. This makes interest ratea significantvariablein the specification of money demand model(Sriram, 1999).Contrary to Fisher, Keynes argued that

the there are two key factors influencing the demand for real money balances. The two factors are income and interest rate. Also according to Keynes, the amount of transactions is a positive function of income and hence if income increases, the demand for real money balances is also expected to increase for both transactional andprecautionary motives. Moreover, Keynes opined that money demand for speculative motive is interest rate elastic since interest rate is one of the opportunity cost of holding money variables. Hence, the Keynesian money demand function is expressed as:

$$(M/P)^d = f(i, y) \qquad (2.5)$$

According to the equation above, the demand for real money balance is a function of two factors namely income and interest rate. Money demand is inversely related to interest rate (r)and positively related to income (y).Keynes further argued that the transactional velocity of money (V) is not fixed but instead it is positively related to interest rate and usually fluctuates.

The subject concerning the determinants of money demand has elicited attention among many researchers in both the developed countries and LDCs. Researchers in developed countries pioneered the empirical studies on money demand. There has also been a considerable interest in the LDCs. Several studies have been carried out to examine the impact of financial innovation on money demand in both the developed and developing countries. Researchers in the EAC have used various proxies to measure financial innovation. For instance, Sichei & Kamau (2012) used ATMs, Ndirangu & Nyamongo (2015) used time deposit ratio/currency outside banks, and Munene (2018) used volume of M-PESA and ATM transactions as proxies for financial innovation.

Mlambo and Msosa (2020) used GMM panel technique to examine the effect of financial technology on money demand in some selected African states. The findings showed that various forms of financial technology such as ATMs and mobile money have a significant negative impacton money demand. The results of this study indeed confirm that financial innovation plays a significant role in influencing money demand.

Muchlisin (2021) used VECM and secondary time series data for the period between 2010 and 2019to examine the effect of financial innovation on money demand in Indonesia. The data was obtained from Bank Indonesia and Central Bureau of Statistics. Using two proxies of financial innovation (ATM transactions and Electronic money), the study found out that the effect of ATM transactions on money demand in Indonesia is positive at 1% significance level. The study also found out that an increase in ATM transactions will increase the demand for money in Indonesia. Additionally, the study established that Electronic Money negatively affects money demand in Indonesia at one percent significance level. Therefore, as the use of Electronic Money increases, the demand for liquid money (cash) will decrease.

3 Research Methodology

3.1 Research Design

The study employed historical research design. Historical research design is the type of research design that is concerned with critical inquiry of past events (Wiersma, 1986). Historical research design was used in that it captured the trend of money demand in the EAC (Mose, 2023).

3.2 Study Area

The EAC is found within the African continent and lies in the Sub-SaharanAfrica region (EAC, 2021The EACis the regional intergovernmental organization of the Republics of Kenya, Uganda, Tanzania, Burundi, Rwanda, and South Sudan with its headquarters in Arusha, Tanzania (Babu et al., 2014; EAC, 2022). The location of EAC region is between 28045"E 41050"E and 5030"N 120"S (EAC, 2022). The EAC aims to widen and deepen cooperation or integration among its member states and other regional economic communities in, among others, political, economic and social matters for their mutual gains (EAC, 2022).

3.3 Data

This study utilized secondary panel data set of four EAC countries namely Kenya, Uganda, Tanzania, and Rwanda. Secondary data is cheaper, readily available, and easy to access (Kothari, 2004). Published data and records from international data repositories were the most preferred secondary source of data. The data wasobtained from international data repositories such as World Bank and the IMF. Data collection schedule was used when collecting the data.

3.4 Model Specification

The money demand model for this particular research study was specified generally as follows:

$$M_{it}^{d} = f(MOB_{it}, ATM_{it}, GDP_{it}, INTR_{it}) \quad (3.1)$$

$$M_{it}^{d} = \beta_0 + \beta_1 MOB_{it} + \beta_2 ATM_{it} + \beta_3 GDP_{it} + \beta_4 INTR_{it} + \mu_i + v_t + \mathcal{E}_{it} \quad (3.2)$$

$$i = 1,2,\dots\dots\dots\dots\dots,N, t = 1,2,\dots\dots\dots\dots\dots\dots\dots,T$$

Where:

M_{it}^{d} is the demand for real money balances, expressed as M2

MOB_{it} is the number of mobile money transactions (proxy for financial innovation)

$ATM_{it}$is the number of ATMs (proxy for financial innovation)

$GDP_{it}$is thegross domestic product (proxy for income; represents the scale variable in the specification of money demand model)

$INTR_{it}$is the interest rate (represents the opportunity cost of holding money variable in the specification of money demand model)

μ_i is the country fixed effects

v_t is the time fixed effects

$\mathcal{E}_{it}$is the error term and is used to capture the unexplained variations in the model

β_0, β_1, ……., β_3 are parameters to be estimated

Subscripts i and t represents country and time period respectively

The above money demand model was specified in logarithmic form. This is in alignment with the general agreement in literature that the logarithmic form is the most functional form (Sriram, 1999).

Thus,the above money demand equation (3.2) became;

$$lnM_{it}^{d} = \beta_0 + \beta_1 lnMOB_{it} + \beta_2 lnATM_{it} + \beta_3 lnGDP_{it} + \beta_4 lnINTR_{it} + \mu_i + v_t + \mathcal{E}_{it} \qquad (3.3)$$

4 Results and Discussions

4.1 Descriptive Statistics

Table 1: The Results of Descriptive Analysis

Variable	***LnMD***	***LnMOB***	***LnATM***	***LnGDP***	***LnINTR***
Observations	70	70	70	70	70
Mean	12.6575	8.117991	2.893297	10.42753	6.26149
Std. Deviation	0.5799723	1.247272	0.5042573	0.3729989	0.49814
Skewness	-0.160163	-0.970614	-1.425691	-0.539627	-0.23157
Kurtois	1.716660	2.583068	5.268332	2.188044	2.892326
Probability	0.129877	0.010060	0.000000	0.119067	0.000000
Sum	708.8199	454.6075	162.0247	583.9414	321.6128
Sum Sq. Dev.	18.50023	85.56283	13.98515	7.652050	10.64142
Minimum	11.57934	5.450541	1.20412	9.609405	5.95126

Maximum	13.50179	9.547402	3.452247	11.00288	7.21794

From the Table 1 above, the mean of money demand is 12.6575. This implies that on average, the demand for money in the EAC between 2007 and2020was 12.6575.The standard deviation is 0.5799723 which can be interpreted to mean that between 2007 and 2020, thedemand for money in the EAC was deviating from the mean by 0.5799723. The minimum of moneydemand in the EAC for the period 2007 to 2020 was 11.57934while the maximum of money demand for the same period was 13.50179. This means that the range of money demand in the EAC for the period 2007 to 2020 was 1.92245.

The mean for the number of mobile moneytransactions is 8.117991. This implies that the average number of mobile money transactions in the EAC between 2007 and 2020 was 8.117991. The standard deviation for the number of mobile money transactions is 1.247272. This means that for the period 2007 to 2020, the number of mobile money transactionsin the EAC deviated from the mean by 1.247272. The minimum number of mobile money transactions in the EAC is 5.450541while the maximum number of mobile money transactions is 9.547402. This means that for the period 2007 to 2020, the range of number of mobile money transactionsin the EAC was 4.096861.

For the case of the number of ATMs, the mean is 2.893297. This can be interpreted to mean that for the period 2007 to 2020, the average number of ATMs in the EAC was 2.893297. The standard deviation is 0.5042573. This implies that between 2007 and 2020, the number of ATMs in the EAC deviated from the mean by 0.5042573. The minimum number of ATMs in the EAC for the period 2007 to 2020 was 1.20412while the maximum number of ATMs was 3.452247. This is interpreted to mean that the range for the number of ATMs in the EAC between 2007 and 2020was 2.248127.

Looking at the case of real GDP, the mean is 10.42753. This implies that for the period 2007 to 2020, the EAC's real GDP was on average at the level of 10.42753. The standard deviation of the real GDP is 0.3729989. This means that between 2007 and 2020, the EAC's real GDP was deviating from the mean by 0.3729989. The minimum of the real GDP is 9.609405while the maximum is 11.00288. This means that for the period 2007 to 2020, the range of the real GDP in the EAC was 1.393475.

The mean for the interest rate is 6.26149. This means that for the period 2007 to 2020, the EAC's interest rate was on average at the level of 6.26149. The standard deviation of the interest rate is 0.49814. This means that between 2007 and 2020, the EAC's interest ratewas deviating from the mean by 0.49814. The minimum of the interest rate is 5.95126 while the maximum is 7.21794. This means that for the period 2007 to 2020, the range of the interest rate in the EAC was 1.26668.

All the study variables exhibited a negative skewness. This means that more observations were concentrated on the left side.Negatively skewed distributions are characterized by long left tail, which can be interpreted to mean a higher probability of extremely negative results from the variables of this particular study. As shown in Table 1 above, all the variables in this study have a kurtosis of less than three except the number of ATMs and this implies that their distribution has values that are widely spread around the mean and the probability for extreme values is less than that of a normal distribution. The number of ATMs has a kurtosis of 5.268332 (greater than three) which means that its distribution has values that are concentrated around the mean and thicker tails, therefore, a high probability of extreme values.

4.2 Correlation Results

Correlation is the measure of the degree of linear association between variables. It also shows the direction of relationship between variables. In this study, Pearson Correlation (r) was used to find the strength and direction of the linear relationship between the study variables. The correlation results are presented in Table 2 below.

Table 2 Correlation Matrix

	LnMd	LnMob	LnATM	LnGDP	LnINTR
LnMd	1.0000				
LnMob	0.5162*	1.0000			
LnATM	0.5326*	0.7637*	1.0000		
LnGDP	0.5646*	0.6631*	0.9250*	1.0000	
LnINTR	-0.5419*	0.7216*	0.8217*	0.7569*	1.0000

* Correlation is significant at five percent level (2-tailed)

From the Table 2 above, the correlation coefficient between the number of mobile money transactions and money demand is 0.5162. This implies that there is a fairly strong positive relationship between the number of mobile money transactions and money demand in the EAC. For the case of the number of ATMs and money demand, the correlation coefficient is 0.5326. This means that there is a fairly strong positive relationship between the number of ATMs and money demand in the EAC. The correlation coefficient between real GDP and money demand is 0.5646 implying that there is a fairly strong positive relationship between real GDP and money demand. For the case of interest rate and money demand, the correlation coefficient is -0.5419. This means that there is a fairly strong negative relationship between interest rate and money demand in the EAC.

4.3 Pre-Estimation Panel Diagnostic Tests

4.3.1 Panel Unit Root Test

Panel unit root test was carried out to determine the order of integration of study variables i.e. finding out whether the study variables were stationary or non-stationary. The Levin-Lin-Chu panel unit root test was employed to find out the stationarity of the study variables. LLC test is suitable for data sets with smaller number of panels as it is the case for this particular study. The following are hypotheses that this particular test is based on:

Ho: Panels contain unit roots Ha: Panels are stationary

The Table 3 below shows the panel unit root test results:

Table 3: Results of Levin-Lin-Chu Panel Unit Root Test

Variables	Levin-Lin-Chu test at Level		Order	LLC test P value at Level	LLC at First difference		Order
	Unadjusted t	Adjusted t			Unadjusted t	Adjusted t	
LnMD	-3.5996	-3.2185	I(0)	0.0006	_	_	_
LnMOB	-10.5427	-9.0935	I(0)	0.0000	_	_	_
LnATM	-8.0796	-5.4553	I(0)	0.0000	_	_	_
LnGDP	-4.2753	-3.4374	I(0)	0.0003	_	_	_
LnINTR	-6.3421	-4.2190	I(0)	0.0000	_	_	_

Table 3 above shows the results of panel unit root test. All the study variables i.e. money demand, mobile money, ATMs and GDP were found to be stationary at level and statistically significant at one percent level. The p-value for the natural log of money demand, mobile money, ATMs and GDP are zero at levels. Since the p-value is lower than the conventional critical value of 0.05, we therefore, reject the null hypothesis and conclude that the study variables do not contain unit roots and are hence stationary. This implies that all the study variables are integrated of order zero I(0).

4.3.2 Panel Cointegration Test

Cointegration refers to the long-run linear relationship between two non-stationary variables (that become stationary after differencing) and have to be integrated of the same order. One of the most commonly used panel cointegration test is the one that was proposed by Pedroni (2004). Unlike other panel cointegration tests such as Kao (1999), Maddala and Wu (1999), and westerlund (2007), a peculiar characteristic of Pedroni (2004) test is that the test is comprehensive and allows for heterogeneity in the intercepts and coefficients of the cointegrating equations and thus it is a superior technique. Additionally, the strength of the test lies in its ability to overcome the bias associated with small sample size as well as the problems of more than one cointegrating relationship.

It is important to underscore that after differencing, variables tend to lose long-run relationship and so panel cointegration test is usually carried out to establish whether variables have got long-run relationship after differencing.However, from the panel unit root test results in Table 3 above, the dependent variable (money demand) and independent variables (mobile money, ATMs, GDP and interest rate) are already stationary I(0). This, therefore, implies that there was no cointegration since the variables are integrated of the sameorder (zero).In this case, all the variables are stationary at level meaning that there was no need to conduct co-integration test in this particular study.

4.3.3 Hausman Test

Hausman (1978) came up with a specification test to determine whether to use fixed effects (FE) or random effects (RE) regression model. The results of Hausman test were obtained as follows:

Table 4: Hausman Test Results

Variable	(b)Fixed	(B)Random	(b-B)Difference	Sqrt(diag(v_bv_B))
Ln MD	1.0966	0.8533	0.2432	-
Ln MOB	-0.2622	0.3159	-0.5781	0.1697
Ln ATM	-1.0918	-0.9728	-0.1190	-
Ln GDP	5.3647	1.6134	3.7513	3.0019
Ln INTR	1.0432	0.2357	0.8075	-

Chi^2 (5) = 5.12 $Prob>chi^2$=0.02754

If the p-value is significant (i.e. p-value is less than 0.05), then we reject the null hypothesis and decide to use fixed effects model. However, on the other hand, if the p-value is insignificant (i.e. p-value is greater than 0.05), then we reject the alternative hypothesis and decide to use random effects model. From the results in Table 4 above, p-value is 0.02754 implying that the p-value is significant, hence we reject the null hypothesis make a decision touse the fixed effects (FE) model.

4.4 Post-Estimation Panel Diagnostic Tests

4.4.1 Test for Serial Correlation

Serial correlation or autocorrelation is an econometric problem caused by correlation between error terms of different time periods. Autocorrelation in linear panel models causes biased standard errors and makes the estimators inefficient. Wooldridge test (2002) was used to test for serial correlation. The hypothesesof Wooldridge test (2002) are stated as follows:

Ho: There is absence of first order serial correlation

H_A: There is presence of first order serial correlation

The results for Wooldridge test (2002) for serial correlation were as follows:

F (1, 4) =41.501 Prob > F = 0.0637

From the results above, the p-value is greater than 0.05 (i.e. p-value is equal to 0.0637) and so the alternative hypothesis of presence of first order serial correlation was rejected at ten percent significance level. This implies that autocorrelation was not a problem in the regression results. Therefore, it was concluded that the regression results were free from this particular econometric problem hence the findings were deemed reliable.

4.4.2 Test for Heteroskedasticity

Heteroskedasticity is also another common econometric problem that occurs when the error terms do not have constant variance across observations. This is problem is caused by errors of measurement and other factors such as sub-population differences. Heteroskedasticity results instandard errors beingbiased hence unreliable confidence intervals and test statistic values. The modified Wald test for heteroskedasticity was employed to carry out heteroskedasticity test. The results of modified Wald test were as follows:

Chi^2 (5) = 13.91 Prob>chi^2 = 0.0728

If the p-value is less than 0.05, we reject the null hypothesis at ten percent significance level and conclude that there is presence of heteroskedasticity i.e. variance across observations is not constant. However, on the other hand, if the p-value is greater than 0.05, we reject the alternative hypothesis at ten percent level and conclude that there is absence of heteroskedasticity i.e. variance across observations is constant.From the results of the modified Wald test above, the p-value is greater than 0.05 (i.e. p-value is equal to 0.0728) and so the alternative hypothesis of presence ofheteroscedasticity was rejected at ten percent significance level. This means that heteroscerdasticity was not a problem in the regression analysis. Therefore, we can conclude that the regression results were reliable.

4.4.3 Test for Cross-Sectional Dependence

Cross sectional dependence occurs when there is inter-dependence among cross sectional units. Cross sectional dependence results in least square estimators becoming inefficient. This problem also renders conventional t-test and f-test (that use variance-covariance estimators) invalid. Breusch-Pagan LM test of independence was used to test for cross sectional dependence. The hypotheses of Breusch-Pagan LM test of independence test were as stated below:

Ho: There exists no correlation of residuals across entities

H_A: There exists correlation of residuals across entities

The results ofBreusch-Pagan LM test of independence were as follows:

Chi^2 (5) = 15.483 Prob= 0.0618

From the results of Breusch-Pagan LM test of independence above, the p-value is greater than 0.05. Therefore, we accept the null hypothesis at ten percent significance level and conclude that there exists no correlation of residuals across entities. This implies that there was no cross sectional dependence in the regression analysis.

4.5 Inferential Analysis Results

Table 5: Balanced Fixed Effects Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.833675	1.178176	0.707598	0.4825
LnMOB	0.375593**	0.061479	6.110204	0.0000
LnATM	0.1736245 ***	0.075138	2.310400	0.0210
LnGDP	0.2638872 ***	0.074385	8.678784	0.0000
LnINTR	-0.532659***	0.206059	-2.584983	0.0125
Root MSE	0.060214	R-squared		0.989025
Mean dependent var	12.65750	Adjusted R-squared		0.987681
S.D. dependent var	0.579972	S.E. of regression		0.064371
Akaike info criterion	-2.531829	Sum squared resid		0.203040
Schwarz criterion	-2.278660	Log likelihood		77.89121
Hannan-Quinn criter.	-2.433676	F-statistic		735.9505
Durbin-Watson stat	0.638787	Prob(F-statistic)		0.000000

*** 1% significance level, ** 5% significance level, * 10% significance level

From the regression results above, the coefficient of mobile money is 0.375593.This implies that a one percent increase in the number of mobile money transactions leads to 0.375593% increase in money demand in the EAC. Since the p-value (0.0000) ofmobile money is less than 0.05, it means that 0.375593% increase in money demand is statistically significant at five percent level. This, in turn, means that there is a positive relationship between mobile money and money demand in the EAC.

This positive relationship between mobile money and the demand for money could be attributed to increased number of mobile money accounts and mobile money agents in the EAC which leads to increased number of mobile money transactions hence increase in the amount of mobile money held in form of mobile money (M-PESA). The increase in the amount of money held in form of mobile money results in increase in the demand for less liquid money which is in this case, money in mobile form (M-PESA).Money which is held in mobile form (M-PESA) is used

by economic agents in daily transactions such as making payments for goods and services purchased.

From the balanced fixed effects regression results in Table 5 above, the coefficient of ATMs is 0.1736245. This implies that a one percent increase in the number of ATMs leads to an increase in money demand by 0.1736245%. The p-value is 0.0210and being that it is less than 0.05, it means that the 0.1736245%increase in money demand is statistically significant at one percent level. These results imply that there is a positive relationship between ATMs and the demand for money. This is consistent with the expected findings since an increase in number of ATMswill lead to increased number of transactions done via ATMs. This, in turn, is expected to lead to an increase in the demand for money held in form of ATM cards.The coefficient is positive and conforms to economic theory specifically the Keynesian theory of money demand which outlined the three motives for holding money (transaction, speculative and precautionary). As the number of ATMs increase, the number of ATM transactions also increase hence increase transaction money demand.

The positive effect of ATMs on money demand in the EAC can be attributed to the fact that anincrease in the number of ATMs significantly leads to increase in the frequency of money demand. The increased number of transactions done via ATMs is attributed to the increase in number of ATMs in the EAC. It is important to note that when the number of transactions done through ATMs increase, the demand for money also increase. The number of ATM transactions affect optimal cash holding of economic agents in the sense that it leads to a reduction in time and waiting cost. Therefore, economic agents will be willing to transact any time they want by withdrawing money in ATMs.As the number of ATMs increase, they will be readily accessible by economic agents.

For the case of GDP, the coefficient is 0.2638872. This means that a one percent increase in GDP resultsin a 0.2638872% increase in money demand. The p-value is 0.0000 and since it is less than 0.05, it implies that the increase in money demand by 0.2638872% as a result of a one percent increase in GDP is statistically significant at five percent level. This, in turn, means that there is a direct relationship between real GDP and money demand.

This finding is positive and conforms to Keynesian theory of money demand. In this study, real GDP was used as a control variable and a proxy for income. Keynes argued that the there are two key factors influencing the demand for real money balances and one of them is income. Also according to Keynes, the amount of transactions is a positive function of income and hence if income increases, the demand for real money balances is also expected to increase for both transactional and precautionary motives.

For the case of interest rate the coefficient is -0.532659. This means that a one percent increase in interest rate resultsin a 0.532659% decrease in money demand. The p-value is 0.0125and

since it is less than 0.05, it implies that the decrease in money demand by 0.532659% as a result of a one percent increase in interestrate is statistically significant at five percent level. This, in turn, means that there is aninverse relationship between interest rate and money demand.

These findings conforms to Keynesian theory of money demand. In this study, interest rate GDP was used both a as a control and the opportunity cost of holding money variable. Keynes opined that the there are two key variables that influence demand for real money balances and one of them is interest rate. Also, according to Keynes, the number of transactions is a negative function of interest rate and hence if interest rate increases, the demand for real money balances is expected to decrease for both motives.

The constant is 0.833675.This can be interpreted to mean that without variables like mobile money, ATMs, GDP and interest rate, the demand for money in the EAC remains at the level of 0.833675. The p-value of the constant is 0.4825and since that the p-value is greater than 0.05, this means that the constant is not statistically significant at five percent level.

The adjusted R^2 is 0.987681. This means that 98.7681% of the changes on the dependent variable (money demand) in the EAC are explained by the explanatory variables (mobile money, ATMs, GDP and interest rate) included in the model. The model was of good fit.

5.0 Conclusions and Recommendations

The aim of this study was to determine the effect of financial innovation on money demand in the EAC. The proxies for financial innovation that were used included mobile money and ATMs. The results showed a significant positive relationship between the number of mobile money transactions and money demand. Similarly, the results indicated a significant positive relationship between number of ATM transactions and money demand. It was, therefore, concluded that there is significant positive relationship between financial innovation and money demand in the EAC.

The various forms of financial innovations that have emerged in the EAC's financial sector have resulted in introduction of new financial goods and services. These new financial products have led to increase in the efficiency of the EAC's financial sector hence complicating the monetary environment in which monetary policy is implemented. It is important to underscore that money demand is an important prerequisite in the formulation and implementation of monetary policy. Money demand is thus sensitive to changes that might occur in the monetary environment hence all the variable that affect money demand should be continuously reviewed. We can also conclude that one the variables that affect money demand that should be continuously reviewed is financial innovation. This is because various forms of financial innovation have emerged with others likely to emerge in some years to come.

Having carried out the study and found a significant positive relationship between financial innovation and money demand in the EAC,there are some policy implications that these findings might have. Firstly, the findings of this study have policy implications on the formulation and implementation of a policy aimed at promoting financial sector development and effectiveness in the EAC.The governments of EAC countries needs to ensure that their financial sectors continue developing and are effective. They can do so by endeavoring to stabilize the macroeconomic environment in which sound policies are formulated and implementedby the fiscal and monetary authorities. This will, in turn, create a stable macroeconomic environment that drives financial deepening as well as developmentof new financial products in the EAC's financial sector.

Secondly, the findings of this study have policy implications on the manner in which monetary aggregates and money demand function should be estimated or specified by the monetary authorities and researchers respectively. The findings of the study revealed the relative significance of financial innovation as a variable in thespecification of the money demand model for the EAC. It is evident that there is increased financialaccess deepening in the EAC viavarious forms of financial innovationssuch as mobilemoney and ATMs.

Thirdly, the findings of this study have policy implications on money and its equivalents. New forms of financial innovations have made it possible to easily convert liquid money (such as cash money, currency) to electronic forms (such as mobile money, M-PESA). However, this tend to blur how to distinguish monetaryassets from and non-monetary assets. It is, therefore, prudent for the monetary authorities in the EAC to come up with measures that will ensure that they have an effective control of the monetary base since new forms of financial innovations are likely to emerge.

Finally, the findings of this study have policy implications on financial innovations regulatory frameworks. The study established that mobile money is currently the most commonly used form of financial innovation in the EAC. The number of mobile money users and transactions done via mobile money have, therefore, been increasing tremendously over the years. The EAC governments, thus, needs to come up with regulatory frameworks aimed at regulating, harmonizing and protecting economic agentsusing various forms of financial innovations such as mobile money (M-PESA).

This particular study was limited to examining the effect of financial innovation on money demand in the EAC. Thus, there are some important areas of monetary economics that this study did not examine. Future research studies should be done on many countries.

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