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Effect of Mobile Money on Money Demand in Kenya: Time Series Regression Analysis

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Abstract
The unprecedented growth of mobile phones to make transactions has become a dependable form of payment for low-income earners living in rural and urban Kenya, increasing demand for goods and services and stimulating demand for money. However, its effect on money demand and subsequent effect on monetary policy is inconclusive as observed from past empirical studies. Furthermore, the rapid adoption of mobile money has generated new data needs and growing interest in understanding its contribution to the money demand function. It is against this background that time series data and *ordinary least squares* technique are applied to review the effect of mobile money on the demand for money in Kenya for the period from 2007 to 2020. The results of the regression model indicate that an increase in mobile money leads to an increase in demand for money in the economy. The study has established that mobile money has a substantial influence on money demand growth in Kenya attributed to the low transaction cost and payment habits of Kenyans, they are more convenient than carrying cash and business people feel safe managing cash flow. The empirical estimates of this study imply that the central bank and the financial stakeholders need to put in place policies such as providing affordable smartphones, cheap mobile internet services, licensing new mobile operators and reducing tax on transaction costs to increase money transfer through money mobile systems.
Keywords: mobile money, money demand, digital financial services, time series
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1. Introduction

Digital financial services are one of the recent economic dynamics that have been found to have revolutionized the financial sector landscape regarding money transfers, savings and general money demand function (Bilyk, 2006; Shirono et al., 2021). Digital financial services are important for the development of the financial sector through accelerating financial inclusion, stimulating financial innovation, encouraging a cashless economy and growing the number of money transactions (Chipeta & Muthinja, 2018; Mohamed & Nor, 2023). Financial innovation includes aspects such as increased financial technological development adoption, digital financial services uptake, and new financial procedures accompanied by new financial regulations (Kipsang, 2013; Chipeta & Muthinja, 2018). Financial development and innovation can be grouped into financial products and processes (Frame & White, 2014). The financial products include internet banking, mobile money transfer and ATM (*automated teller machine*) use. On the other hand, financial processes are financial market liberalization and securitization practices (Kipsang, 2013).

The definition of money demand in any economy depends on the ability to spend or turn less liquid assets into liquidity. The money demand is usually classified as narrow money (M1) and broad money (M2 and M3) (Kasekende, 2016; Dunne & Kasekende, 2018). The demand for money depends on the desire of households and businesses to hold different forms of financial assets. Several financial innovations such as mobile money transfers, the use of ATM cards and Internet banking have been identified as the most recent innovations in finance that have increased the adoption of money demand. These innovations are likely to stimulate money demand growth as a result of their efficiency, are seen to be safe, easy to use and have minimum transaction cost (Wahyunda, 2021). For instance, mobile money enables the mobile phone subscriber to deposit, withdraw and transfer money thus growing transactions in the money economy and general growth of the ease of doing business (GSMA, 2022). This will cause the demand for liquid assets (cash) to decline as demand for less liquid assets like mobile money grows and thus increase aggregate money demand in the economy as a result of efficiency established by new modes of payment and the desire by households to hold electronic money rather than physical assets for safety (Dunne & Kasekende, 2018; Chukwunulu, 2019).

In most developing countries, Kenya included, the use of mobile money has led to the collection of money and growth in savings and reduction of savings in the form of less liquid assets. Mobile money has also encouraged cashless payment and as such reduced risks for small-scale businesses in Kenya by offering safety to business owners and growing their businesses. With the launch of Mpesa the unbanked population have been brought to the main banking system. Mobile banking has allowed most of the population to access banking services such as transactions, paying bills, savings and most businesses are now able to borrow loans and even some earn interest from their savings (GSMA, 2022; IMF, 2022).

In recent times sub-Saharan African countries, Kenya included, have recorded revamped financial sector development, reforms and innovations geared towards strengthening its financial and monetary sectors and boosting its economy. The major financial development was the invention of mobile money (MPESA) transfer developed in 2007 in Kenya by Safaricom Company. This improved technology in the communication industry and accelerated further growth in mobile money services (GSMA, 2022; IMF, 2022). Several sub-Saharan states have also adopted mobile money transfers from different communication providers such as Airtel Money, MoMo, Orange Money, MPESA, Vodafone and many more geared at growing financial services. In addition, improved mobile money transfers have also improved the velocity of money by reducing the amount of money held in cash (Dunne & Kasekende, 2018; Kasekende & Nikolaidou, 2018). Generally, most countries in the Sub-Saharan African region have experienced a boom in the amount transacted via mobile money coupled with low transaction costs and increased efficiency (Shirono et al., 2021).

In Kenya, the Financial Access Survey (FAS) reports that since the introduction of mobile transfers in 2007, the aggregate value transacted through mobile has grown gradually from Ksh 16.3 billion (0.8 % of GDP) in 2007 to 3,747.3 billion in 2018 (36.9% of GDP) (Tiriongo & Wamalwa, 2020). From most recent statistics on total transactions, for instance, in 2020, in the aggregate Kenya mobile money transfers amounted to 2.2 billion transactions fueled by COVID-19 restrictions and measures that encouraged the use of internet and mobile money transfer services (Tiriongo & Wamalwa, 2020; IMF, 2022). The total transaction value for mobile money grew by 22 per cent between 2021 and 2022, from $1 trillion to around $1.26 trillion. Kenya is expected to continue recording positive increases in mobile money transactions. However, despite this significant uptake and usage of mobile money transfers, few empirical studies have tried to explore the effect of mobile money on money demand in the Kenyan economy especially after the COVID pandemic. The objective of the study, therefore, is to investigate the impact of mobile money on money demand in the Kenyan economy.

2. Literature Review

Theoretical literature has been reviewed to investigate the impact of mobile money on the money demand model and in broad money function (Shirono et al., 2021). According to classical economists, mobile money is seen as a medium of exchange as captured by the quantity theory of money. The quantity theory identified transaction motive and medium of exchange as the key reason for households and businesses holding money (Baumol, 1952; Friedman, 1956; Serletis, 2007). Friedman considers five different forms in which wealth or money can be held, namely, money, bonds, equities, physical goods and non-physical goods for easy exchange. Money demanded will depend on household income, interest rate, and price level, the quantity of money in circulation, the volume of price and, choices and the volume of transactions (Tobin, 1956; Fisher, 2007; Serletis, 2007; Makunika et al., 2021).

Keynes (1936) improved on quantity theory by including interest rate as a key determinant of money demand in any economy. Keynes's theory postulates that people demand money for three motivations: speculative, precautionary and transaction motives (Keynes, 1936). While transaction and precautionary motives depend on income, speculative motives depend on the rate of interest or existing physical and market assets (Tanchev & Mose, 2023).

Friedman (1956) and Tobin (1956) developed the Portfolio theory of money demand. The theory emphasizes the function of money as a store value and as an alternative asset to physical ones (Serletis, 2007). According to Portfolio theory, money demand by economic agents depends on physical asset returns, risk involved, rise in inflation, cost of transaction and fall in interest rate, available size of wealth and attractiveness of these assets as compared to holding money (Serletis, 2007). The theory also identifies the importance of financial innovation in influencing money demand in an economy through the use of different financial assets cutting the cost of transactions while maximizing the rate of returns for a given amount of risk. It explains the contribution of different forms of financial assets such as mobile money, ATMs and internet money to the money demand

function.

Several empirical studies have been carried out to examine the effect of mobile money on money demand as shown in Table 1 below.

Table 1. Review of Empirical Studies

Author (s)	Period/ Sample	Method	Findings
Kipsang (2013)	1970-2012 for Kenya	ARDL	Mobile money is not significant
Mwangi (2014)	2000-2012 for Kenya	OLS	Increase in mobile money increases money demand
Nakamya (2014)	2003-2011 for Uganda	OLS	Increase in mobile money increases money demand
Dunne & Kasekende (2018)	1980-2013 for Sub-Saharan states	POLS	Increase in mobile money increases money demand
Kasekende & Nikolaidou (2018)	2000-2014 for Kenya	ARDL	Increase in mobile money increases money demand
Mlambo & Msosa (2020)	1995-2014 for African states	GMM	Increase in mobile money decreases money demand
Wahyunda (2021)	2010-2019 for Indonesia	VECM	Increase in mobile money increases money demand
Asongu & Salahodjaev (2022)	2010-2014 for developing states	Tobit	Increase in mobile money increases money demand
Mohamed & Nor (2023)	2010-2020 for Somalia	ARDL	Increase in mobile money increases money demand
Kipchirchir & Mose (2024)	2007-2020 for East African states	POLS	Increase in mobile money increases money demand

Note: ARDL= Autoregressive Distributed Lag; VECM=Vector Error Correction Model; OLS= Ordinary Least Squares; GMM= *Generalized Method of Moments; POLS*= Pooled Ordinary Least Squares

Source: Authors computation (2024).

Table 1 empirical review summary shows that the authors have used different estimation techniques and data sets to investigate the effect of mobile money on money demand in selected countries. Most reviewed studies have identified positive relationships that exist between mobile money and money demand attributed to efficiency, acceptability and low transaction cost (Nakamya, 2014; Wahyunda, 2021). However other studies have also identified insignificant or negative relationships attributed to low usage and lack of confidence in electronic and mobile money (Kipsang, 2013; Mlambo & Msosa, 2020). Generally, the empirical findings have been mixed or inconclusive. The study intends to fill this gap using recent data and advanced estimation methodology.

3. Research Methodology

3.1 Sample and Data

The study adopted a longitudinal research design to investigate the role of mobile money transfers on money demand in Kenya. Longitudinal research is preferred because it's able to capture the trend, any change that may occur over a period of time and effect of mobile money on demand for money in Kenya using time series data (Kipchirchir & Mose, 2024). The research employed secondary time series data for Kenya. The sample country was selected due to the availability of data and the adoption and surge of mobile money transactions since 2007 (Kevrekidis et al., 2020; GSMA, 2022). Kenya is bisected by the equator and has a latitude of 0.0236° S, and a longitude of 37.9062° E (Kevrekidis et al., 2020). Figure 1 shows the map of Kenya showing the location of the study area (Gündüz & Agayi, 2021).

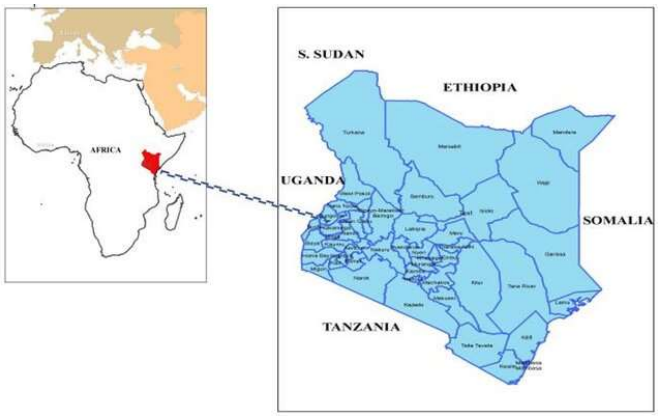

Figure 1: Sketch Map of Kenya showing the location of the Study Area

Source*:* Kevrekidis et al. (2020) and Gündüz and Agayi (2021).

Annual time series data on money demand, real GDP, interest rate and number of ATMs was collected from World Development Indicators, World Bank database. In addition, the secondary data on mobile money transactions was obtained from the Financial Access Survey (FAS), International Monetary Fund. The study period chosen ranges from 2007 to 2020. 2007 was chosen as it is during this period that mobile money (MPESA) transfer was adopted and the period saw several financial innovations across the financial sector (GSMA, 2022). The description of data sources and variable measures is given in Table 2.

Table 2: Measurement of Variable

Variable	Abbreviations	Measurement	Priori Expectation	Data Source
Money demand	MOD	real money balances/M2	Dependent variable	World Bank
Mobile money	MMT	Number of mobile money transactions per 1000 adults	Positive	Financial Access Survey
Automated teller machines	ATM	Number of ATMs per 100,000 adults	Positive	World Bank
Income levels	INC	Real Gross Domestic Product	Positive	World Bank
Interest rates	INR	Real interest rate	Negative	World Bank

Source: Asongu and Salahodjaev (2022).

3.2 Model Specification

The study adopted Keynes's (1936) theory to derive the study estimation model. The Keynes theory specified the money demand function as follows:

$$M^d = k(Y) + L(r) \quad (1)$$

where M^d = the demand for money

K (Y*)* = the transaction and precautionary motive depending on the level of income (*Y)*

L (*r*) = the speculative motive which depends on the interest rate (*r*).

Following the theoretical works of Keynes (1936) in equation 1 and further modification, the functional relationship of the variable is given under:

$$MOD_t = f(MMT_t, ATM_t, INC_t, INR_t) \quad (2)$$

$$MOD_t = \alpha_0 + \alpha_1 MMT_t + \alpha_2 ATM_t + \alpha_3 INC_t + \alpha_4 INR_t + \mu_t \quad (3)$$

$$t = 1,2, \ldots\ldots\ldots\ldots\ldots\ldots, T$$

where:

MOD = the demand for money (proxy by real money balances, M2). The study adopts M2 monetary aggregate to measure money demand. M2 is preferred since it is less affected by financial shocks and has a good relationship when modelled with income (Dunne & Kasekende, 2018).

MMT = the mobile money transactions (proxy by number of mobile money transfers per 1000 people). The measure has been adopted in several empirical studies as observed in the empirical works of Kipsang (2013) in Kenya and Wahyunda (2021) in Indonesia.

ATM = the Automated Teller Machines transactions (proxy by number of ATMs per 100000 people). The measure has also been used in Kenya by Kipsang (2013) and Mose and Kipchirchi (2024) in empirical studies.

INC= level of income. Income growth was measured by real gross domestic product as used by Dunne and Kasekende (2018) and Asongu and Salahodjaev (2022) empirical studies.

INR = the interest rate measured by real interest rate (%) as explained by Mankiw and Summers (1986) on the key role of interest rate in influencing speculative money demand.

μ_t = the error term and assumed to be normally distributed,

α_0= is the constant term,

α_1, …., α_4 = parameters to be estimated,

Subscripts t = number of time series observations.

Linearizing the variables (Gisore, 2014) the new model is transformed as below

$$lnMOD_t = \alpha_0 + \alpha_1 lnMMT_t + \alpha_2\, lnATM_t + \alpha_3 lnINC_t + \alpha_4 lnINR_t + \mu_t \quad (4)$$

3.3 Methods of Time Series Regression Analysis

A time series analysis technique was used to estimate the effect of mobile money on money demand in Kenya. Time series analysis is preferred as it helps understand better the data set (Enders, 1995). Time series analysis procedures such as smoothing and seasonality adjustments help remove noise and outliers, making the data set more reliable and interpretable. In the preceding data analysis procedure, the unit root test was first conducted followed by the Co integration test and lastly, estimation using Ordinary Least Squares (OLS) regression analysis. Unit root test is applied to test whether a time series variable is non-stationary and possesses a unit root. The unit root test is important to minimize the generation of misleading findings and conclusions (Gujarati, 2004). The most common unit root test in time series is the Augmented Dickey-Fuller (ADF) test, the Phillips-Perron (PP) test, and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The study used the Phillips- Perron unit root test to check whether the data set had a unit of integration problem. A cointegration test is applied to confirm the long-run relationship or cointegration between independent and dependent variables. The common cointegration tests are the Johansen and Engel-Granger tests. They are used to test long-run or cointegrating relationships between several non-stationary time series variables. Compared to the Engle-Granger test, the Johansen test allows for more than one long-run relationship. Autoregressive Distributed Lag (ARDL), Ordinary Least Squares (OLS) and Vector *autoregressive (VAR)* estimation techniques are used in econometrics to analyze regression models. The

most common method used for time series regression analysis is ordinary least squares (OLS) regression. To provide a more solid and reliable analysis *ordinary least squares* (OLS) estimation method was adopted during the time series data analysis as applied in Tanchev and Mose (2023) empirical study in Europe. OLS estimated coefficients will show the magnitude and direction of the relationship between dependent and independent variables. After estimating the model, it's essential to check for model adequacy and any violations of the regression model's assumptions. This includes testing for autocorrelation, heteroscedasticity and normality residual test. These tests help ensure that the regression model is appropriate and reliable. For estimation results to be robust several pre and post-diagnostic tests were carried out namely normality test (Jarque-Bera test), heteroskedasticity (Breusch-Pagan-Godfrey) and autocorrelation (Breusch - Godfrey LM test) and were corrected accordingly.

4. Regression Analysis and Interpretations

This section presents the findings and interpretation of time series regression analysis results obtained. The unit root test is first conducted followed by the cointegration analysis and lastly ***ordinary least squares*** estimation results are presented. Unit root problem test was applied to test whether a time series variable is non-stationary and possesses a unit root. Table 3 shows the estimation results of the Phillips- Perron unit root problem test aimed at identifying the stationarity of the variables of interest. The results are presented below.

Table 3: Stationary Test

Variable	Level		First difference		Order of integration
	adjusted t-Statistics	Probability	adjusted t-Statistics	Probability	
MOD	-4.014	0.0108	_	_	I(0) **
MMT	-8.841	0.0000	_	_	I(0) ***
ATM	-7.073	0.0001	_	_	I(0) ***
INC	-4.963	0.0022	_	_	I(0) ***
INR	-6.184	0.0003	_	_	I(0) ***

Source: Authors computation (2024).

Table 3 shows that money demand, mobile money transactions, ATM access, income level and interest rate were stationary. This meant that all study variables were integrated of order zero. Since all study variables were integrated at order zero, a cointegration test was not necessary. Cointegration analysis is used to test long-run or cointegrating relationships between several non-stationary time series variables. Hence, cointegration test to check if the variables have long run relationship was not performed. The study proceeded to estimate a single equation using the OLS estimation approach. In Table 4 the result of regression analysis is presented.

Table 4: Regression Results using OLS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MMT	0.109	0.033	3.238***	0.0089
ATM	-0.059	0.210	-0.282	0.7836
INC	1.090	0.042	25.665***	0.0000
INR	-0.229	0.065	-3.523***	0.0055
$Cons$	-3.441	1.372	-2.507*	0.0335
The goodness of fit test	R-squared	0.9837	Adjusted R-squared	0.9788
Normality test	Jarque-Bera test		0.368	0.3815
			F-Statistic	**Prob.**
Serial correlation test	Breusch-Godfrey test	Prob > F	0.456	0.5163
Heteroscedasticity test	Breusch-Pagan test	Prob > F	1.058	0.4302

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ are significance levels, in which the null hypothesis is rejected.
Source: Authors computation (2024).

Table 4 results show that mobile money transaction is positive and significant at five per cent. This implies as

mobile money transactions increase by 1 per cent money demand in the Kenyan economy will grow by about 0.1 per cent. Every mobile money transaction creates demand for money according to Keynes and Fishers hypothesis. This is attributed to the ability of mobile money to improve efficiency in transactions, stability in the money market, minimize transaction costs and thus grow money demand in the economy (Dunne & Kasekende, 2018; Wahyunda, 2021; Mohamed & Nor, 2023). Moreover, mobile money reduces transaction cost for households and helps them to save and grow capital through creating financial history. As noted nominal cash demand rises with nominal transactions growth. Generally, Kenya has experienced positive growth in digital finance, especially mobile money transfer and has seen growth in money demand and demand for goods and services. The Kenyan economy has recorded a surge in the registration of new mobile money accounts, the purchase of new phones and the opening of new mobile money agents across the economy thus further accelerating the growth of money demand (Shirono et al., 2021). In most developing countries Kenya included, the use of mobile money has led to the collection of money in savings and reducing savings in the form of hard money. As captured by Keynes's theory, an increase in mobile money as a means of transaction and medium of exchange is likely to influence positively money demand (Keynes, 1936). Mobile money has been identified to be safe and easy to use in making transactions across the Kenyan economy (GSMA, 2022). Economic agents also have been attracted by low transaction costs being implemented by Central banks and the government as a precautionary measure for the COVID-19 pandemic. Generally, the cost of mobile money transactions has been decreasing since its inception. The impact has seen a rise in money held in less liquid form and generally increasing overall money demand in the economy impacting macroeconomic variables (Mawejje & Lakuma, 2019; Asongu & Salahodjaev, 2022; GSMA, 2022). The study findings agree with previous studies namely Mwangi (2014) in Kenya, Nakamya (2014) in Uganda, Kasekende and Nikolaidou (2018) in Kenya and Wahyunda (2021) in Indonesia. All these studies attributed the positive result to an increase in the velocity of money and efficiency. In contrast, Kipsang (2013) in Kenya and Mlambo and Msosa (2020) in selected African countries recorded insignificant and negative results respectively. This was attributed to high transaction costs, exchange rate volatility and high inflation in some countries and poor mobile network coverage in most African countries (Kaboro & Mose, 2019). Such findings by Kipsang (2013) approve of Friedman's observation that money demand is stable most of the time (Friedman, 1956).

From regression estimates of control variables, an increase in the level of income has a positive and significant effect on money demand in Kenya. The findings support Keynesian hypothesis. As income increases transaction motives are likely to increase and as such this increases the demand for money in the economy (Asongu & Salahodjaev, 2022). Kipsang's (2013) and Mwangi's (2014) studies in Kenya also identified the importance of income level and its influence on precautionary and speculative motives. As supported by theory, the interest rate was significantly negative on money demand. According to Keynes (1936), an increase in interest rates will discourage real money balances for precautionary and transaction motives and generally reduce money demand in the economy (Mbazima-Lando & Manuel, 2020). The finding on real interest rates supports similar studies in Kenya by Kipsang (2013), Mwangi (2014), and Mbazima-Lando and Manuel (2020) in selected African countries. ATM access in Kenya was not significant. This implies during the study period ATM use was not able to influence money demand. This is possible with an increase in the use of mobile money the use of ATMs has reduced in Kenya. In contrast, other empirical studies report a positive relationship between ATM access and money demand (Serletis, 2007; Kipchirchir & Mose, 2024). Households may *visit ATMs more often and withdraw small amounts of cash*, which would increase the demand for small bank notes.

The model was of good fit as supported by the coefficient of determination (adjusted R^2) ^{of} 97 per cent. Adjusted R-squared shows how well the data fit the regression model. These imply that the explanatory variables were able to explain the dependent variable by about 97 per cent. Moreover, the results are robust to the diagnostics such as heteroscedasticity test, normality residual test and autocorrelation test.

5. Conclusion

Since the advent of mobile money services in Kenya in the year 2007, the economy has recorded expansion in household and business transactions coupled with an increase in money demand and economic growth. However, failure to manage the expansion and growth of mobile money can slow money demand growth, economic growth and financial sector development. The study set out to investigate the role of mobile money transactions on money demand in Kenya for the period between 2007 and 2020. The study adopted time series regression analysis namely unit root problem test, co-integration test and OLS estimation technique to meet study objectives using secondary time series data. From the OLS estimation findings, the study has identified the significant role mobile money transfer plays in expanding money demand in Kenya. This has been attributed to low mobile money transaction cost, efficiency, safety and ability to grow household savings and capital to firms. However, the

development in money demand will also impact monetary and macroeconomic variables. Thus, several policies are needed to check this growth and maintain stability in the financial and monetary sectors.

The study has established that an increase in mobile money transactions will imply growth in money demand. Thus, the government and Central Bank need to enact a regulatory framework aimed at guiding the use of mobile money transfers in the economy and also protecting the economic agents involved. In addition to encouraging mobile money transfers, the Central Bank of Kenya needs to enact policies and rules that regulate transaction costs to influence money demand positively in the economy. The government need to reduce tax on transaction costs and mobile money taxation to encourage demand for financial services. Reduced transaction cost will help household better manage cash flow and save at the same time firms will be able to invest. As noted nominal cash demand rises with nominal transactions growth. The government of Kenya could provide affordable smartphones and mobile internet service to increase money transfers through money mobile systems. The Central Banks can also license new mobile money providers to increase competition in the communication industry that provides mobile financial services at affordable rates and thus increase access to money transfer and grow money demand. The Central Banks need to register all mobile money agents to control money laundering and electronic money fraud. All these policies will be aimed at protecting consumers, service providers, agents and the government. The study was limited to Kenya. Considering many countries have diverse macroeconomic conditions there is a need for further research in other developing countries for policy prescription. Future studies can also consider investigating the determinants of mobile money adoption in Kenya to complement the above study findings.

References

Asongu, S., & Salahodjaev, R. (2022). Demand-Side Mobile Money Drivers of Financial Inclusion: Minimum Economic Growth Thresholds for Mobile Money Innovations. Journal of the Knowledge Economy, 1-23.

Baum, C. (2006). An introduction to modern econometrics using Stata. Stata press.

Baumol, W. (1952). The transactions demand cash: An inventory theoretic approach. The Quarterly Journal of Economics, 66(4), 545-556.

Bilyk, V. (2006). Financial innovations and the demand for money in Ukraine. Unpublished Master's thesis, National University Kyiv.

Chipeta, C., & Muthinja, M. (2018). Financial innovations and bank performance in Kenya: Evidence from branchless banking models. South African Journal of Economic and Management Sciences, 21(1), 1-11.

Chukwunulu, J. (2019). Effect of financial innovation on the Nigerian economy. World Journal of Innovative Research, 6(5), 15-21.

Dunne, P., & Kasekende, E. (2018). Financial innovation and money demand: Evidence from Sub-Saharan Africa. South African Journal of Economics, 86(4), 428-448.

Enders, W. (1995). Applied Econometric Time Series. John Wiley and Sons Inc.

Fischer, A. (2007). Measuring Income Elasticity for Swiss Money Demand: What do cantons say about financial innovation? European Economic Review, 51(7), 1641-1660.

Frame, W., & White, J. (2014). Technological change, financial innovation, and diffusion in banking. SSRN, 1-5.

Friedman, M. (1956). The Quantity Theory of Money: A Restatement. In: Friedman, M., Ed., The Optimum Quantity of Money, Aldine Publishing Company, Chicago, 3-41.

Gisore, M. (2014). Effect of government expenditure on economic growth in East Africa: A disaggregated mode. Unpublished Master's Thesis, Egerton University.

GSMA (2022). State of the Industry Report on Mobile Money 2022. Global System for Mobile Communications.

Gujarati, D. (2004). Basic Econometrics. (4th edition), The McGraw-Hill Companies.

IMF (2022). Use of Financial Services, Mobile Banking: Value of Mobile Money Transactions for Kenya, Rwanda, Uganda and Tanzania. International Monetary Fund.

Hausman, J. (1978). Specification tests in econometrics. Econometrica: Journal of the econometric Society, 46(6), 1251-1271.

Kaboro, J., & Mose, N. (2019). Does Inflation Rate Convergence Spur Exchange Rate Volatility? Empirical Evidence from Sub-Saharan Africa. *Asian Journal of Economic Modelling*, 7(2), 95-109.

Kasekende, E. (2016). Financial innovation and money demand in Sub-Saharan Africa. Unpublished Doctoral Dissertation, University of Cape Town.

Kasekende, E., & Nikolaidou, E. (2018). Mobile Money and Money Demand in Kenya. Macroeconomic Discussion Paper Series (2018-11), University of Cape Town.

Kevrekidis, C., Ruthensteiner, B., Cerwenka,F., Penk,S., & Reichenbacher., B. (2020). New cichlid fossils from the middle-late Miocene alkaline lakes of Africa. Journal of Vertebrate Paleontology, 1-23.

Keynes, J. (1936). The general theory of employment, interest, and money. London: Macmillan.

Kipchirchir, E., & Mose, N. (2024). Foreign Direct Investment and Economic Growth in Kenya: A Comprehensive Analysis. *Asian Journal of Economics, Business and Accounting*, *24*(2), 1–13.

Kipsang, J. (2013). Determinants of money demand in Kenya. Unpublished Master's Thesis, University of Nairobi.

Makunika, N., Manyange, L, Nyoni, T., & Waweru, D. (2021). An analysis of the household choice and determinants of livelihoods diversification activities of the Galo tribal people. Journal of Research in Humanities and Social Sciences, 9(7), 04-10

Mankiw, G., & Summers, H. (1986). Money demand and the effects of fiscal policies. Journal of Money, Credit and Banking, 18(4), 415-429.

Mawejje, J., & Lakuma, P. (2019). Macroeconomic effects of Mobile money: evidence from Uganda. Financial innovation, 5(1), 1-20.

Mlambo, C., & Msosa, S. (2020). The effect of financial technology on money demand: Evidence from selected African States. International Journal of Economics and Business Administration, 8(1), 366-373.

Mohamed, A.A. & Nor, M.I. (2023). The macroeconomic impacts of mobile money: empirical evidence from EVC plus in Somalia. *Journal of Financial Economic Policy*, 15 (1), 1-15.

Mose, N., & Kipchirchir, E. (2024). Determinants of Money Demand: An Empirical Examinations. International Journal of Economics Management, 1(2). 42-53.

Mwangi, G. (2014). Effects of financial innovations on money demand in Kenya. Unpublished Master's Thesis, Kenyatta University.

Nakamura, M. (2014). The effect of financial innovation on money demand in Uganda Unpublished Master's Thesis, Makerere University.

Serletis, A. (2007). The demand for money: Theoretical and empirical approaches (2nd ed.). New York: Springer Science.

Shirono, K., Das, B., Fan, Y., Chhabra, E., & Carcel-Villanova, H. (2021). Is Mobile Money Part of Money? Understanding the Trends and Measurement. IMF Working Paper No. 2021/177, International Monetary Fund, Washington, DC.

Tanchev, S., & Mose, N. (2023). Fiscal policy and economic growth: Evidence from European Union countries. Economic Studies Journal, 32(3), 19-36.

Tiriongo, S., & Wamalwa, P. (2020). The Effect of Mobile Money on Banking Sector Stability in Kenya. Working Paper Series, WPS/05/20, 1-26.

Tobin, J. (1956). The interest-elasticity of transactions demands cash. The Review of Economics and Statistics, 38(3), 241-247.

Wahyunda, M. (2021). The Effect of Financial Innovation on Money Demand in Indonesia. Unpublished Master's Thesis, University of Andalas.