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Effect of Financial Innovation on Money Demand in Kenya

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Abstract

The demand of money is crucial in the determination of the effectiveness of monetary policy. Key financial innovations have taken place in Kenya due to the Structural Adjustment Programs and the technological advancements which have affected demand for money. Previous Studies used number of M-pesa and ATMs as a measure of financial innovation which did not give accurate results since not all registered M-pesa users carry out financial transactions and not all ATM card holders use their cards in doing transactions. This study therefore aimed at overcoming these challenges by using the Volume of M-pesa transactions and volume of ATMs transactions since it would capture the actual effect of financial innovation in the economy by factoring in all the transactions carried out through M-pesa and ATMs. The general objective of the study was to establish the effect of financial innovation on money demand in Kenya while the specific objectives were: To investigate the effect of the volume of M-pesa transactions on money demand, to determine the effect of the volume of ATMs transactions on the money demand. According to the World Bank, Kenya is leading in financial innovation in East Africa in terms of money transfer thus warranting this study. Study period was 2008-2016 based on data availability since data on volume of M-pesa transactions was available beginning the year 2008. The study was based on Keynesian Theory of Demand for Money. This study used secondary data drawn from Kenya National Bureau of Statistics (KNBS), World Bank (WB) Central Bank of Kenya (CBK) and Safaricom. VECM model was employed in the analysis since some variables were found to be non-stationary after unit root test. Unit root test was conducted using the augmented Dickey Fuller test. Johansen Co-Integration Test was conducted and the results showed co-integration which was later addressed using Vector Error correction model. Autocorrelation was tested using Breausch-Godfrey LM test in which two lags were applied to correct its effect in the model. The study found positive correlation between financial innovation and money demand which was statistically significant at 5% significant level. This study recommended that the government should regulate volume of transactions done through means such as mobile money and ATM cards. Government should regulate credit accessibility via mobile phones and ATMs. Government should also regulate Financial sector by setting minimum interest rate charged by all money lenders irrespective of the sector and means. This would ensure a stable monetary system and a stable economy. Inclusion of other mobile money such as Airtel money, Orange money and equitel money in the study of financial innovation was recommended as the area of further research.
Keywords: Automated Teller Machine, Money Demand, M-pesa, Financial innovation, Vector Error Correction Model

1. Introduction

To understand the functions of money better and to obtain an idea over the forms money has taken over time, it is better to understand the evolution of the payment system. The payment system has been changing and evolving over time, together with the forms of money. Gold served as the main form of money. Later, paper assets, such as cheques and currency were used as money. The coins and notes which are used in most economies today are called fiat money. It is worth exploring the evolution of the payment system, since the direction the payment system has been heading to has an important influence on how money will be defined in the future (Mishkin, 1992).

1.1 Fiat Money Development

In the past, most societies used a commodity with some intrinsic value for money. In order to function as money, the commodity had to be widely acceptable, which meant that everyone had to be willing to accept it as a payment for goods or services. Early forms of commodity money were, for example, animal skins in Alaska, salt in Nigeria, cattle in East Africa, tobacco in America, or shells in Thailand. Objects like these were not only used to buy goods, but also to pay for marriages, fines, and debts. Although everyday objects were extremely practical forms of money, they nevertheless had disadvantages as well. Firstly, it was a problem to store some of them for a long time. Secondly, the accurate measurement of their value was not easy. Difficulties arose when using these objects to plan financial activities for the future or when splitting commodities into smaller amounts or units. For the above reasons, some societies started to use precious metal, such as gold and silver. They have been popular commodity monies because they could be used for various purposes such as jewelry, dental fillings as well as transactions. People in Mesopotamia began using such metals about 4,500 years ago. Later, these metals were

also used in Ancient Egypt, China and elsewhere. At that time, they were not exactly coins yet, because they had no fixed shape. Around 2,700 years ago the first coins were produced in the ancient kingdom of Lydia. They were made of a mixture of silver and gold. These metals functioned as a medium of exchange in most societies, except for the most primitive ones. This new metal money was an important advance, since it was easier to carry and lasted for a long time. This money could be divided into different values, and it made planning for the future easier. When people only used gold as money, the economy was said to be on a Gold Standard. The Gold Standard was common throughout the world during the late nineteenth century (Mankiw, 1999).

Despite the advantages of metal money, these metals were still quite heavy and it was hard to transport bigger sums. It was also easy to steal them. Furthermore, some countries only had limited amounts of precious metals. They could not use all their resources to make coins. Other problems with gold and silver occurred when governments debased them. In ancient Rome, for example, the commodity money was based on gold and silver. Emperors in the second and third centuries often reduced the amount of gold and silver in their coins if they needed more funds. Consequently, at the end of the third century, these coins did not contain any precious metal at all and the Roman Empire had serious inflation as only worthless coins were produced (Schenk, 1997). Due to the above mentioned disadvantages of gold and silver, banks evolved in 16th and 17th century in England. Merchants used to store their gold there and in return received a statement indicating how much they had deposited. This statement could be signed over to other persons when the merchants wanted to buy something. As a result, paper currency, which are pieces of paper that function as a medium of exchange, developed (Schenk, 1997). Initially, paper money was guaranteed to be convertible into an adequate quantity of precious metal or coins. In most countries this system has evolved into paper currency that is issued by the government's decree (fiat). This means that this currency has to be accepted as legal tender. It is called fiat money which is not convertible into precious metal anymore and has no intrinsic value. For instance, today's coins only have a token value, that means the face value exceeds the value of the metal. The value of fiat money derives from the perceived authority and credit worthiness of the issuer. Fiat money is the norm in most societies today. National currencies are issued and managed by the central bank. Central Banks are institutions which control the money supply of the country. If the monetary authorities are both competent and honest, fiat currencies will be stable, reliable and efficient.

1.2 Development of New Payment Technologies

Paper currency and coins can easily be stolen and can be expensive to transport because of their size. As a consequence, with the development of modern banking, cheques were invented. Cheques are payable on demand that allowing transactions without the use of currency. They can also be written for any amount up to the balance in the account. This simplifies the transactions for large amounts of balances. As a result, it reduces transportation costs and therefore, improves economic efficiency (Mishkin, 1992).

Despite the advantages of using cheque, it is very time consuming to trade a cheque for currency. This may result in difficulties if something has to be paid quickly. Furthermore, it takes a few days until the bank will credit the account with a cheque that a person has deposited. To process cheques is also costly. For example, it has been estimated that it costs over 5 billion U.S. Dollars per year to process cheques written within the USA (Mishkin, 1992).

Due to the development of the computer and advanced telecommunication technologies, new advances in the payment system were made such as the invention of the electronic funds transfer system (EFTS). This technology introduced individual access to the payment system by means of a debit card reader or a personal computer. Deposits are simply transferred from payer to payee using electronic devices. Nowadays, for example, central banks, commercial banks, or corporations can transfer funds to other institutions by using EFTS. The whole paperwork can be eliminated by converting it to the EFTs. It is much more efficient than payment systems based on paper, because it reduces the cost of transferring money and, therefore, decreases the frequency of using cheques and paper money. During the last years, people have begun to use EFT more and more in daily life The emergence of computer technology in banking and financial services is well documented. Whether it be through an Automated Teller Machine (ATM), an Electronic Fund Transfer (EFT) from one account to another, or an instant computer credit check for loan purposes, technology's effects on the way we do business through the banking structure is highly significant. The number of Kenyans using debit cards has risen to over 10 million as banks and commercial giants push for adoption of the cashless documents. This is an increase of close to 400,000 users according to new data from Central Bank of Kenya (CBK, 2015).

The significant growth of the cards is attributed to banks, mobile phone companies and fuel stations pushing for the use of the multifunctional documents. Some banks have stopped the issuance of ATM cards and are replacing

them with debit cards, thus pushing for their use. Unlike automated teller machines (ATM), cards whose main work is to withdraw cash, debit cards are also used to pay bills including in supermarkets and fuel stations, top up mobile airtime and access funds both locally and internationally. Using the cards is no different from paying cash as one uses money that is in his bank account. This is the opposite of credit cards, where one is allowed to purchase goods and services and pay later, often with interest. Understanding the demand for money in an economy is an important prerequisite for formulating and conducting monetary policy. A change in monetary aggregates influences national output, interest rates and general price levels. These are important variables that affect the production and consumption decisions in an economy. Demand for money is the desired holding of financial assets in the form of cash or bank deposits Goldfeld and Sichel, (1990). Economic agents are motivated to hold money to facilitate transactions, precautionary and for speculative purposes. Different measures of money supply exist and they include M0, M1, and M2. These classifications depend on countries, either because of institutional framework or arbitrary specifications. The Central Bank of Kenya (CBK) defines M1 as including coins and notes circulating in the economy and other money equivalents easily convertible into cash. M2 includes M1 and short time deposits in banks and 24-hour money market funds. M3 consists of M2 and includes longer-term time deposits and money market funds with more than 24 – hour maturity. M1 is also referred as narrow money while broad money describes M2 and M3. Money serves as a medium of exchange, as a store of value and as a unit of account. Money underpins all sectors of the economy and ensures operation of economies.

In an economy, the aggregate demand for money is a result of money demanded by households, firms and government, each with distinct money demand function. Money provides liquidity by facilitating transactions and can earn interest. The demand for money is mainly influenced by the level of prices, the level of interest rates, and the level of real national output (real GDP) and the pace of financial innovation (Barro, 1997). The demand for money has direct relationship with the general price levels. Generally, nominal demand for money has direct relationship with nominal output (such as gross domestic product), and an inverse relationship with interest rate. The European Central Bank describes financial innovation as the technological advances which facilitate access to information, trading and means of payment, and to the emergence of new financial instruments and services, new forms of organization and more developed and complete financial markets.

1.3 Monetary Policy Framework in Kenya

The Central Bank of Kenya was established in 1966 following the dissolution of the East African Currency Board. The main mandate of the Central Bank was formulation and implementation of monetary policy directed to achieving and maintaining stability in the general level of prices. Pursuance of this mandate is based on the presumption that money matters, that the behavior of monetary aggregates has major bearing on the performance of the economy (Kinyua, 2001). The Central Bank was formed with the mandate of developing and maintaining a sound monetary system in the country as well as maintaining a desirable level of foreign exchange. To achieve these objectives, the CBK's preferred monetary policy strategies included controls on interest rate, credit expansion and money supply growth (Kinyua, 2001).

An analysis of the evolution of the monetary policy in independence Killick and Mwega (1990) indicated that the period after independence was characterized by stable macroeconomic environment. The decade of 1970 was however characterized by unstable macroeconomic situations emanating mainly from balance of payment deficits and inflation pressures, occasioned by the collapse of the Bretton Woods system of fixed exchange rates in 1971and the 1973 oil crisis. For instance, inflation rose to double digits in 1973 and remained so well into the 1980s.

Mwega (1990) explained that the 1980s saw the country's economy affected by external and exogenous shocks emanating from changes in import and export prices, adverse weather conditions, Bretton Woods's structural adjustment programs (SAPs) and increasing external debt. This period was characterized by controls on interest rates, fixed exchange rates and prices.

In the 1990s, the implementation of the SAPs provided framework for liberalized trade (unlike the post-colonial import substitution) as well as market determination of the exchange rate (Gertz, 2008). This period was also characterized by elimination of price controls, privatization of state-owned business entities and financial sector reforms, especially of the non-bank financial institutions (Gertz, 2008). The country also witnessed macroeconomic disturbances in the run up to the general elections of 1992 when the inflation shot up to about 50 percent. The decade also saw the tightening of external budgeting and subsequently fiscal control measures Ndung'u, (1999).

2.0 Literature Review

2.1 Quantity Theory of Money

The classical economists view of monetary policy is based on the quantity theory of money. According to this theory, an increase in the quantity of money leads to a proportional increase in the price level and vice versa. All markets for goods continuously clear and relative prices adjust flexibly to ensure that equilibrium is reached. Therefore, the economy is assumed to be always at full employment level, except for temporary deviations caused by real disturbances (Pigou, 1927).

The role of money is simply to serve as the unit to express prices and values. Money facilitates the exchange of goods and services. Its use satisfies double coincidence of wants, that is, it acts as medium of exchange. Money is neutral; it does not influence the determination of relative goods prices, real interest rates and aggregate real income. The role of money as a store of value is regarded as limited under the classical assumption of perfect information and negligible transaction costs. The classical economists still recognized that some particular quantity of real money holdings would be needed by the economic entities under certain special circumstances. This consequently led to the formulation of the quantity theory of money (Pigou, 1928).

The quantity theory of money explains the role of money as a medium of exchange. In the classical work, it is stated that money affects nothing but the price level. The theory postulates a direct and proportional relationship between the quantity of money and the price level. The clearest exposition of the classical quantity theory approach is found in the work of Irving Fisher in his influential book: The Purchasing Power of Money, published in 1911. He examined the relationship between the total quantity of money M (the money supply) and the total amount of spending on final goods and services produced in the economy P×Y, where P is the price level and Y is aggregate income for the economy. Velocity (V) of money provides a link between M and P×Y. It simply represents the average number of times per year that a unit currency is spent in buying the total amount of goods and services produced in the economy. The linkage is shown below.

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

In this expression, P denotes the price level, and Y denotes the level of current real GDP. Hence, PY represents current nominal output; M denotes the supply of money over which the Central Bank has some control; and V denotes the velocity of circulation, which is the average number of times a dollar is spent on final goods and services over the course of a year. The classical economists believe that the economy is always at or near the natural level of real output. As a result, classical economists assume that the equation of exchange is fixed, at least in the short-run. Furthermore, classical economists argue that the velocity of circulation of money tends to remain constant so that can be regarded as fixed. They believe that causation runs from money to price. Assuming that both Y and V are fixed, it follows that if the Central Bank was to engage in monetary policy, the effect of an increase in money supply can only increase the price level (Laidler, 1993).

An increase in M, only affects an increase in the price level P in direct proportion to the change in M and the opposite is true with a decrease in M. In other words, expansionary monetary policy can only lead to inflation. Contractionary monetary policy can only lead to the deflation of the price level. Thus, as far as the stabilization policy is concerned, fiscal policy has no role. It has no influence whatsoever on the price level. The only effect is felt on the interest rate and real magnitudes. The role of monetary policy is also limited. It has no influence on the real side of the economy but it exerts influence on the price and nominal magnitudes (Tsheole, 2006).

However, the quantity theory has a number of weaknesses. First, the quantity theory does not explain unemployment because it assumes away adjustment problems. It assumes that production is determined by resources, and since money is not a resource, changes in money should not change production. It is widely accepted that a well anticipated monetary changes has no effect on unemployment but only affect prices. While in actual fact the adjustment process of monetary disturbances also affects unemployment not just prices. Secondly, the classical quantity theory assumes that there is a correlation between changes in the amount of money and changes in spending.

In this case, the changes in money supply are the cause of spending. Critics of the quantity theory have suggested that this correlation exists because changes in the amount of money in circulation are caused by, rather than the cause of, changes in business activity. In other words, the critics argue that changes in money are the effect, not the cause. Finally, the quantity theory assumes that changes in the amount of money in circulation do not alter velocity. The assumption was dismissed by the Keynesians, who instead, come out with an alternative assumption, that changes in money tend to be offset by changes in velocity (Tsheole, 2006).

According to Keynes, “The quantity theory of money is a truism.” Fisher’s equation of exchange is a simple

truism because it states that the total quantity of money (MV+M'V') paid for goods and services must equal their value (PT). But it cannot be accepted today that a certain percentage change in the quantity of money leads to the same percentage change in the price level.

According to Crowther (1997), the quantity theory is weak in many respects. First, it cannot explain why there are fluctuations in the price level in the short run. Second, it gives undue importance to the price level as if changes in prices were the most critical and important phenomenon of the economic system. Third, it places a misleading emphasis on the quantity of money as the principal cause of changes in the price level during the trade cycle.

Prices may not rise despite increase in the quantity of money during depression; and they may not decline with reduction in the quantity of money during boom. Further, low prices during depression are not caused by shortage of quantity of money, and high prices during prosperity are not caused by abundance of quantity of money. Thus, the quantity theory is at best an imperfect guide to the causes of the trade cycle in the short period (Crowther, 1997).

2.2 Money and Monetarism

Monetarism has several essential features, with its focus on the long-run supply-side properties of the economy as opposed to short-run dynamics. Friedman (1959) coined the term Monetarist and emphasized on several key long-run properties of the economy.

The Quantity Theory of Money linked inflation and economic growth by simply equating the total amount of spending in the economy to the total amount of money in existence. Friedman proposed that inflation was the product of an increase in the supply or velocity of money at a rate greater than the rate of growth in the economy. Friedman also challenged the concept of the Phillip's Curve. His argument was based on the premise of an economy where the cost of everything doubles. Individuals have to pay twice as much for goods and services without complains because their wages are also twice as large. Individuals anticipate the rate of future inflation and incorporate its effects into their behavior. Economists call this concept the neutrality of money. Neutrality holds if the equilibrium values of real variables including the level of GDP are independent of the level of the money supply in the long-run (Friedman, 1970).

Super neutrality holds when real variables - including the rate of growth of GDP are independent of the rate of growth in the money supply in the long-run. If inflation worked this way, then it would be harmless. In reality however, inflation does have real consequences for other macroeconomic variables. Through its impact on capital accumulation, investment and exports, inflation can adversely impact a country's growth rate. In summary, Monetarism suggests that in the long-run, prices are mainly affected by the growth rate in money, while having no real effect on growth. If the growth in the money supply is higher than the economic growth rate, inflation will result (Friedman, 1985).

Growth in the money supply is erratic due to structural change in economy making controlling the money supply meaningless. Controlling Money supply can lead to recession. For example, in the 1980s, the UK pursued strict Money supply targets but this caused a deep recession. This was because monetary policy was too tight trying to meet artificial money supply targets. To control inflation, it makes more sense to target inflation directly rather than through the intermediary of the money supply (Laidler, 2010).

2.3 The Baumol-Tobin Theory of Transaction Demand for Money

The theoretical work on the transaction demand for money by Baumol and Tobin (1958) seeks to draw more precise implications about the variables that determine the segment of the demand for money than Keynes' analysis did. They explained that individuals hold money or bonds at a time due to uncertainty of interest rate fluctuations. They highlight that an increase in income will lead to larger investments in bonds and the investor will enjoy the benefits of economies of scale. They assumed that the individual agent receives an income payment once per period and that the entire receipts of the agent are expended at a constant rate over the period. Then, the agent will hold some assets at every time period, except the final time period when last expenditure is made. The agent incur a brokerage fee every time wealth is switched between assets (money and bond only) and that the aim of the individual is to determine that level of bond holdings, which will jointly maximize the returns from interest income and minimize brokerage cost (Baumol, 1952).

2.4 McKinnon and Shaw Theory of Demand for Money

McKinnon and Shaw (1973) challenged the dominant theoretical positions of Keynes, and the structuralist economists on the ground that the crucial assumptions in these models are erroneous in the context of developing countries. They, therefore, advocated financial liberalization and development as growth enhancing economic policies. They argued that policies such as interest rate ceiling, higher reserve requirement, directed credit policies, and discriminatory taxation of financial intermediaries had harmful effects on economic growth. McKinnon and Shaw theory stated that, a low or negative real rate of interest discourages savings and hence reduces the availability of loanable funds, constrains investment, which in turn lowers the rate of economic growth. On the contrary, an increase in the real interest rate may induce the savers to save more which enables more investment to take place and positively affects economic growth (Fry, 1995).

McKinnon and Shaw (1973) advanced the theory of financial liberalization as an alternative to the harmful restrictive policies. The financial liberalization policies were aimed at liberalizing interest rates by switching from an administered interest rate setting to a market based interest rate determination; reducing controls on credit by gradually eliminating directed and subsidized credit schemes; developing primary and secondary securities markets; enhancing competition and efficiency in the financial system by privatizing nationalized commercial banks. It suggested a basic complementarity between the accumulation of money balances and physical capital accumulation.

According to McKinnon-Shaw (1973) model, the success of the financial liberalization process depends on the following hypothesis: (i) the effective deepening of the financial sector, (ii) a positive correlation between savings and the real interest rate, and (iii) a perfect complementarity between the money demand and investment. The argument is that potential investors must accumulate money balances prior to their investment. The lower the opportunity cost of accumulating real money balances or the higher the real deposit rate of interest, the greater is the incentive to save.

The McKinnon's complementarity hypothesis is reflected in the demand for money function below:

$$M/P = f(Y, I/Y, d-\pi^e) \quad (2.2)$$

Where: M is the money stock, P is the price level, Y is real Gross National Product (GNP), (I/Y) is the ratio of gross investment to GNP, and ($d-\pi^e$) is the real deposit rate of interest.

The ratio of gross investment to GNP can also be expressed as:

$$I/Y = f(r, d-\pi) \quad (2.3)$$

Where; r -is the average return on physical capital, thus, the complementarity is expressed as;

$$\frac{\partial(M/P)}{\partial(I/Y)} > 0 \quad (2.4)$$

$$\frac{\partial(M/Y)}{\partial(d-\pi e)} > 0 \quad (2.5)$$

Equations (2.4) and (2.5) suggests that it is not the cost of capital, but the availability of finance that constrains investment in financially repressed economies. The partial derivative of equation (2.4) represents the money demand for investment, an increase in investment rate lead to an increase in money demand, while the partial derivative of equation (2.5) demonstrates that an increase in real deposit rate lead to an increase in investment because financial constraints are relaxed (Fry, 1995).

Shaw (1973) on the other hand discarded Keynes' finance motive and the neoclassical monetary growth model in favor of the debt-intermediation view. There are significant differences in the financial systems in developed and developing countries. For instance, developed countries possess sophisticated financial institutions, which facilitate intermediation between savers and investors, contrary to developing countries. Therefore, Shaw (1973) constructed a monetary model, in which money is backed by productive investment loans to the private sector and that the amount of money stock, in relation to the level of economic activity, is positively related to the extent of financial intermediation between savers and investors through the banking system. He concluded that improved financial intermediation through financial liberalization and financial development increases the incentive to save and invest thereby raising the average efficiency of investment (Fry, 1995).

2.4 Financial Innovation and Demand for Money

The theoretical literature on financial innovation of demand for money emerged from empirical work of financial innovation by Goldfeld and Sichel, (1990). The years in which standard money equations broke down witnessed the creation of a number of assets that appeared to be very close substitutes of demand deposit, including accounts and security repurchase agreements, as well as the development of a variety of new cash management techniques used by firms to economize on their real balances. As a result, Goldfeld and Sichel findings launched an extensive program directed at repairing the conventional specification by taking the effects of financial innovations on the demand for money into account (Ireland, 1992).

There are major financial innovations and theories that emphasize specific sources of financial innovation. Lewis and Mizen (2000) explained that the effect of financial innovation on the demand for money depends on the sort of innovation taking place. They provided three reasons, which explained how financial innovation impacts the demand for money. First, they indicated that some innovations change the absolute and the relative costs of holding various financial assets, as well as reducing the transaction costs associated with exchanging of a financial asset for another. Secondly, financial innovation had eroded the distinction between banks and other financial intermediaries and between intermediated transactions and market ones. Thirdly, some new financial assets created by innovation are close substitutes for the traditional medium of exchange assets, which is included in the definition of money. As a result, the elasticity of substitution for money rises thereby increasing the interest elasticity of demand.

2.5 Empirical Literature Review

Several studies have been conducted examining the impact of financial innovation on money demand and supply in the developed and developing countries. Sims, (1980) applied statistical techniques for causality testing by first separating the variations in money and money income into the part that could be predicted from the past values of that variable, and the remainder which could not. Using US data, Sims reached the conclusion that causality was unidirectional from money to income rejecting the hypothesis that causality is from income to money.

Odularu and Okunrinboye (2009) assessed the impact of financial innovation on the demand for money in Nigeria using the Engle and Granger Two-Step Cointegration technique. The results show that financial innovations have not significantly affected the demand for money in Nigeria.

Godslove, (2011) investigated interest rates and the demand for credit in Ghana between 1970 and 2007 using a vector autoregressive model. The study suggested that repressive high interest rates in the 1980s in Ghana disrupted effective financial intermediation. Even though the interest rates were still high since the year 2000, it was lower than that of previous decades. The results indicated that interest rates have a positive impact on domestic credit in the short-run and a negative impact in the long- run. He concluded that while increases in real lending rate may not immediately hamper the demand for credit, they might eventually lead to a fall in the demand for credit in the long run.

Mannah-Blankson and Belnye (2004) examined the impact of financial innovation, resulting from the Financial Sector Adjustment Program (FINSAP) in Ghana on money demand using cointegration and error correction modelling. The findings from the study showed a long run demand for real money balances in Ghana, driven by income, inflation, exchange rate and financial innovation, with financial innovation exerting a positive influence on the money demand in the long-run.

Bilyk (2006) Using the Vector error correction model (VECM) investigated and estimated the relationship between financial innovations and the demand for money in Ukraine, using monthly data from 1997-2005. The results revealed the significance of financial innovations on both narrow and broad money (M1 and M2) respectively. The impulse-response analysis indicated that the impact of financial innovations was stronger in the narrow demand for money specifications. In addition, the study found a positive impact of financial innovations on money demand in Ukraine in the long run and a negative impact in the short-run.

Maniragaba (2011) examined the effects of financial liberalization on the money demand and economic growth using yearly data from 1978-2008 in Uganda. The study investigated financial sector reforms in Uganda following financial liberalization measures, like interest rate deregulation, reduction in direct credit, implementation of prudential rules, privatization of state owned banks, reduction in entry requirements, liberalization of securities markets and international financial liberalization. Employing the error correction method, the study found a positive long-run effect of financial liberalization on the demand for money in

Uganda.

Mabuku (2009) investigated the stability of money demand in Namibia for the period 1993-2006 using the Engle Granger and co-integration technique. Key determinant variables, such as real output, which is a proxy for income, inflation, exchange rates and interest rates as opportunity cost variables were utilized. (Mabuku, 2009) concluded that interest rates and inflation rates had negative significant impacts on money demand, while income and exchange rates had significant positive effects on money demand. The analysis was more on co-integration between two or more-time series and missed the estimation of indigeneity among the variables of interest.

Khan and Hye (2011) estimated the role of financial liberalization on the demand for money in Pakistan using annual data for the years 1971 – 2009.To capture the effect of financial liberalization in the model, the study used time trends instead of dummy variables that capture structural breaks. Using the cointegration and auto regressive distributed lag (ARDL), the study estimated long run equilibrium relationship between broad money and composite financial liberalization index along with other determinants of demand for money such as GDP, real deposit rate and exchange rate. Results indicated existence of a long run money demand function in respect of broad money and that financial liberalization positively affected the demand for money in the long-run as well as short-run.

Misati *et al*. (2010) examined the role of financial innovation on the monetary policy transmission in Kenya using Two Stage Least Squares (2SLS) and monthly data covering the period, 1996-2007. He established that financial innovation dampens the interest rate channel of monetary transmission mechanism. The paper was motivated by the fact that the rapid financial innovation in the country could have contributed to possible implications on monetary transmission mechanisms, which would necessitate constant revision of policy and instruments, targeting frameworks and operating procedures to enhance monetary policy effectiveness. The study focused on the interest rate channel through which the Central Bank implements monetary policy which significantly changes from including the financial innovation variable in a money demand function.

Suliman and Dafaalla (2011) estimated the determinants of narrow money demand in Sudan and found both long-run and short-run relationship between real money balances and real GDP, rate of inflation, and exchange rates in Sudan using annual observations for the period between 1960 and 2010.The study applied both cointegration and error correction model to test the relationship. The use of narrow money has some advantages such as amenability to control and appropriate in countries with weak banking system and undeveloped markets. However, it is not easy to distinguish M1 from other categories of money balances because of shifting boundaries and the estimation results using M1 are less useful in policy since its relationship with nominal income varies considerably.

King'ori (2003) studied the determinants of money velocity in Kenya for the period 1992 – 2002 by determining four velocity functions of money as currency in circulation, narrow money, broad money and extended broad money. Using the cointegration and error correction models, the study established long-run relationship and short run dynamics. The results of the study revealed that short run money velocity as highly influenced by financial innovations and the exchange market; while real interest rate had lesser effect. Inflation rate did not have any significant effect on money velocity. The real per capita income had inverse relationship with money velocity.

Kasekende and Nikolaidou (2014) investigated the development of financial innovation and its impact on money demand in the region using panel data estimation techniques for 34 Sub-Saharan Africa countries between 1980 and 2013.They found that mobile money not only has a positive effect on money demand but also leads to a decrease in the interest rate elasticity of demand.

2.6 Theoretical Framework

This study was based on the Keynesian Theory of Demand for Money. Keynes criticized the Cambridge equation because it neglects the role of interest rates in determining the demand for money. He proposed an alternative expression of the demand for money, which he named the liquidity preference. Keynes identified three motives why people demand money, which are transaction motive, precautionary motive and speculative motive. According to the Keynesians, the transaction motive describes the necessity of holding cash to bridge the gap between receipts and planned regular payments. The Keynesians suggested that people also hold some cash for unplanned activities, such as paying unexpected bills, and this is known as the precautionary motive of holding money. The Keynesians suggested that both transaction and precautionary motives depend on the level of income. The last motive of holding money identified by Keynes is the speculative motive, of which individuals

demand money if they expect the market value of alternative assets to fall. Hence the speculative motive for holding money arises from the desire to maximize wealth and it depends on the rate of interest (Laidler, 2010). Therefore, Keynes theory is useful in this study since people requires money for the above three motives as highlighted. The three motives namely: transaction, precautionary and speculative are the main factors which influence people in spending money either by use of Mpesa, ATMs or both hence affecting money demand and supply in the economy.

Keynes specified the demand for money as follows:

$$Md = k(Y) + L(r) \qquad (2.6)$$

Where: M^d is demand for money, k(Y*)* is the transaction and the precautionary motive which depends on the level of income (*Y*), *L* (*r*) is the speculative motive which depends on interest rate (*r*). Keynesians stress that the demand for real money balances is negatively related to interest rates, which implies that the demand for real money balances increases with a decrease in interest rate. However, the demand for real money balances is positively related to real income and demand for real money balance increases with an increase in real income.

3.0 Methodology

3.1 Research Design

The historical research design was adopted as the study's design. Wiersma (1986) stated that historical research is the type of research design that deals with critical inquiry into past events. This helps to produce an accurate description and interpretation of those events.

3.2 Study Area

The area of the study was Kenya covering the period of 2008-2016. This time period was chosen based on data availability. M-pesa was first introduced in Kenya in 2007 and the first financial report was released in 2008. According to The Master Plan Study for Kenyan Industrial Development (2007), Kenya lies astride the equator in Eastern Africa between Somalia and Tanzania and bordering the Indian Ocean.

Kenya was of specific interest in this study because it was the first country to introduce mobile money and it has the largest number of mobile money users in the world (World Bank, 2010). Davidson and Pénicaud (2012) worldwide mobile money survey indicates that 80 percent of 2011 mobile money transactions were processed in East Africa. Moreover, Kenya, Uganda, Madagascar and Tanzania have more registered mobile money users than bank accounts. The study was also interested in country specific policies.

3.3 Data Analysis and Presentation

Data is quantitative and therefore descriptive and inferential statistics was employed in the analysis. Diagnostic tests such as Unit root test and Cointergration were carried out as well as post-diagnostic tests. Vector error correction model was employed in the analysis. Oso and Onen (2009) explained that inferential analysis is used to draw conclusions concerning the relationships and differences found in research results. The results obtained were presented in tables. They described tables and figures as useful in presenting findings because they can summarize a lot of information in a small space.

Kothari (2004) explained descriptive statistics to mean a design that describes the state of affairs of phenomenon. He implied that descriptive statistics allows a researcher to observe a phenomenon. Isaac and Michael (1977) stated that a descriptive research systematically describes the facts and characteristics of a given population or area of interest, factually and accurately.

Figure 3.1 Map of Kenya
Source:www.mapsopensource.com accessed on 24 May 2017.

3.4 Model Specification

Theoretical model was informed by the Keynesian demand for money equation as discussed in Chapter two given as:

$$Md = k(Y) + L(r) \quad (3.1)$$

Where M^d is demand for money, k (Y) is the transaction and precautionary motive, which depend on the level of income (Y). L (r) is the speculative motive which depends on interest rate (r).

Vector Error Correction Model

The cointegration regression only considers the long-run linkages between the level series of variables, while the Error Correction Model (ECM) is developed to measure any dynamic adjustments between the first differences of the variables. A simple error correction term is defined by:

$$\varepsilon = y_t - \beta X_t \quad (3.2)$$

where β is the cointegrating coefficient, and ε_t is the error term from the regression of y_t on x_t Then the Error Correction Model (ECM) is simply defined as:

$$\Delta y_t = \alpha \varepsilon_{t-i} + \gamma \Delta x_t + u_{it} \quad (3.3)$$

where u_t is *i.i.d.* and the first difference of y_t can be explained the lagged ε_{t-i} and $\Delta x_t . \varepsilon_{t-1}$ is the one period lagged value of the residuals from estimation of equilibrium error term, or in another word, a disequilibrium error term occurred in the previous period. For cointegrated series, the error correction term ε_{t-1} which represents the speed of adjustment toward the long-run values, offers an added explanatory variable to explain the first difference of y_t. The equation above is a single equation of ECM which can be also used in multivariate system. The error correction model (ECM) can be extended to the following equations:

$$\Delta LnMD_t = \alpha_o + \alpha_1 \Delta LnMD_{t-i} + \alpha_2 \Delta LnMPS_{t-i} + \alpha_3 \Delta LnATM_{t-i} + \alpha_4 \Delta LnINTER_{t-i} +$$

$\alpha_5 \Delta LnINFL_{t-i} + +\alpha_6 \Delta LnGDP_{t-i} + ECT_{t-i} + u_{it}$ (3.4)

Equation (3.4) presents the ECM, in which each variable is explained by itself and other variables of concern in the model. Where;

$LnMD_t$ is natural log of real money demand; $LnMPS_{t-i}$ is natural log of Volume of M-pesa transactions; $LnATM_{t-i}$ is natural log of Volume of ATMs transactions; $LnINTER_{t-i}$ is natural log of interest rate, $LnINFL_{t-i}$ is natural log of inflation, $LnGDP_t$ is natural log of GDP, ECT_{t-1} is the lagged error correction term departure from the long-run cointegrating relations between these four variables. μ_{it} error term and (i=1,2…n).

3.5 Diagnostic Tests

3.5.1 Unit root Test

A stochastic process is said to be stationary if its mean and variance are constant over time and the covariance between the two time periods depends only on the lag between the two time periods and not the actual time at which the covariance is computed. In order to avoid spurious and inconsistent results, stationarity test is necessary in time series data. Unit root is a widely popular test of stationarity or non-stationarity over the past several years Gujarati and Porter, (2009). The following hypothesis was tested; $H_0 : \delta = 0$ was used to indicate unit root exists (time series is non-stationary) $H_1 : \delta < 0$: time series is stationary. The study adopted Augmented Dickey Fuller test (ADF) in testing for the unit root. Data was de-trended by differentiating thus making it stationary.

3.5.2 Johansen Cointegration Test

Cointergration refers to the long-run linear movement of two non-stationary variables integrated on the same order. Cointergartion test establishes whether there are non-stationary variables move together in the long-run. Variables will be cointegrated if they have a long-term or equilibrium relationship between (or among) them. This study applied Johansen-Cointegration test. (Ssekuma, 2011) argued that Johansen procedure builds cointegrated variables directly on the maximum likelihood estimation instead of relying on OLS estimators and is able to detect more than one cointegrating relationship if present. The number of cointegrating vectors in Johansen procedure were detected by the use of two likelihood ratio tests namely; the trace test and the maximum eigenvalue.

Cointegration portrays long-run association among variables. The nature of the equation plays a role in testing for co-integration in a single equation. Johansen approach was utilized as it shows the number of co-integrating equation in a system.

The starting point of the Johansen's method in a VECM model of order *p* is given by;

$$Yt = \mu + A1Yt - 1 \ldots + ApYt - p + \varepsilon t \quad (3.5)$$

Where Y_t is an $n\chi 1$ vector of variables that are integrated of order one I (1) and is a vector of innovations.

The Trace and the Maximum Eigen values tests under the Johansen method are shown in equation 3.5 and 3.6 respectively.

$$J_{trace = -T} \sum_{i-r+1}^{n} \text{Ln}\,(1 - \lambda i) \quad (3.6)$$

$$J_{max} = -T\,(\text{Ln} - \lambda i) \quad (3.7)$$

Where T is the sample size and λi is the *ith* largest canonical correlation. The trace test tests the null hypothesis of *r* co-integrating vectors against the alternative hypothesis of *n* co-integrating vectors. The maximum eigenvalue test, on the other hand, tests the null hypothesis of *r* co-integrating vectors against the alternative hypothesis of co-integrating vectors.

3.6 Justification of the Variables, Measurement and Sources of Data

This study used secondary data, collected from Central bank of Kenya, Kenya national bureau of statistics Safaricom and World Bank. These institutions are the major sources of information concerning most Macroeconomic data on Kenya.

3.6.1 Money Demand (MD)

The real money demand was computed by dividing the nominal money demand (M2) with average prices (CPI). M2 was used as a measure of money demand because a broader measure of money is more appropriate for modeling purposes because it is less distorted by financial deregulation and innovations and has a more reliable relationship with income (Subbaraman, 1993). Data was obtained from the World Bank.

3.6.2 Volume of M-pesa Transactions

The variable M-pesa was used based on the fact that a large percent of Kenyans is using it as a means of banking hence influencing money demand and supply in the economy. M-Pesa's users in April 2011 reached 14 million

(40 percent of Kenya's population) and mobile phone-based transfers were equivalent to 11 percent of GDP (The Economist, June 2010). Data was obtained from Safaricom.

3.6.3 Volume of ATMs Transactions

ATMs facilitate the access to money since a person can deposit or withdraw money at any time without being restricted. This influences the amount money demand and supply in the economy. Sichei and Kamau (2012) captured the effect of financial innovation on money demand using the number of ATMs as a proxy for financial innovation. Majority of Kenyans have adopted ATMs as a means of making transactions. Data was collected from Central Bank.

3.6.4 Interest Rate

The interest rate indicates the rate at which people borrow money from the commercial bank. Interest rate was used in money demand since it influences money demand. The demand for money is mainly influenced by the level of prices, the level of interest rates, and the level of real national output (real GDP) and the pace of financial innovation Mankiw (2008). Data was obtained from World Bank.

3.6.5 Inflation

Consumer price index (CPI) –annual % was adopted as a measure of inflation in Kenya. According to Patnaik (2010) CPI is a statistical time-series measure of a weighted average of prices of a specified set of goods and services purchased by consumers. It is a price index that tracks the prices of a specified basket of consumer goods and services, providing a measure of inflation. Data was obtained from Central Bank.

3.6.6 Gross Domestic Product

Gross Domestic Product measures the final value of goods and services produced in a country within a year. The study used GDP as a proxy for income, income is considered as a scale variable in the specification of the money demand equation. (Bilyk, 2006) empirical evidence indicated a positive effect of income on the demand for money function in Ukraine. Data was obtained from Kenya national bureau of statistics.

3.7 Post Estimation Diagnostic Tests

3.7.1 Test for Autocorrelation

Autocorrelation or serial correlation refers to the case in which the error term in one-time period is correlated with the error term in any other time period. Classical linear regression assumes that such correlation does not exist. As a result of a crucial limitation of Durbin-Watson (DW) statistic, that it becomes invalid when applied to a regression equation which includes a lagged dependent variable among its regressors and cannot test for higher order autocorrelation, the Breusch-Godfrey (LM) test was employed. The null hypothesis states that there is no autocorrelation of error terms of different time periods. The alternative hypothesis states that there is autocorrelation of error terms of different time periods. Problem of autocorrelation was corrected by use of the general linear squares (GLS).

3.7.2 Test for Heteroscedasticity

Heteroscedasticity occurs when the variance of the error term is not constant. The problem can be due to measurement errors. Though heteroscedasticity does not lead to biased parameter estimates, it can cause standard errors to be biased resulting to biasness in test statistics and confidence interval. This This study employed Modified Wald test for Heteroscedasticity Test.

3.7.3 Test for Multicollinearity

Multicollinearity refers to a case in which two or more explanatory variables in the regression model are highly correlated making it difficult to isolate their individual effects on the dependent variable. Variance Inflation Factor (VIF) was used in detecting multicollinearity. Gujarati and Porter, (2009) argued that the rule of thumb is that if Variance Inflation Factor (VIF) exceeds 10, that variable is said to be highly collinear.

4.0 Results

4.1 Descriptive Statistics

Table 4.1 below represents descriptive statistics of selected variables. The following statistics were generated namely mean, minimum, maximum and standard deviation.

Table 4.1: Descriptive Statistic of Selected Variables.

	lnmd	lnmps	lnatm	Lnint	lninfl	lngdp
Valid	9	9	9	9	9	9
Mean	1.57	2.66	7.19	2.79	1.98	8.20
Minimum	0.32	1.08	5.01	2.61	1.16	7.93
Maximum	2.38	4.51	8.2	3.00	2.89	8.89
Standard Deviation	0.60	1.08	1.25	0.143	0.56	0.28

Where;

LnMD = natural log of Money demand
LnMPS = natural log of Volume of M-pesa Transactions
LnATM = natural log of Volume of ATM Transactions
LnINT = natural log of Interest rate
LnINFL = natural log of Inflation
LnGDP = natural log of Gross domestic product

Table 4.1 above shows that volume of M-pesa transactions and Volume of ATMs transactions have relatively larger variation compared to the other variables. Volume of M-pesa transactions ranges between 1.08 and 4.51 while volume of ATMs transactions ranges from 5.01 and 8.2. This means that volume of M-pesa Transactions has relatively high volatility compared to other variables hence most likely to affect money demand. This may be attributed to easy access to money either through mobile phones hence increasing money demand in the economy.

On the other hand, results from the table shows that volume of ATMs transactions has relatively high volatility. This may be attributed to the facts that money is accessible through ATM cards without any restrictions. An individual can access money from the bank at any time and any place as long as there is ATM machine.

4.2 Correlation Matrix

A correlation coefficient indicates whether there is a linear relationship between two variables and its absolute value ranges from 0 to 1. A value of 0 indicates that there is no relationship whereas a value of 1 indicates that there is a perfect correlation and the two variables vary together. The sign of the correlation coefficient will be negative or positive depending on whether the two variables move in same direction or in opposite direction.

Table 4.2 Correlation Matrix Showing the relationship between the Dependent Variable and the Independent Variables.

	lnmd	Lnmps	lnatm	lnintr	lninf	Lngpd
LnMD	1					
LnMPS	-0.50*	1				
LnATM	0.02*	-0.59	1			
LnINTR	-0.38*	0.22	0.77	1		
LnINFL	-0.06*	-0.21	-0.09	-0.17	1	
LnGDP	0.38*	0.91	-0.77	0.06	0.17	1

Where:

Key:

**** = Significant at 10% Significance level (2-tailed)**

*** = Significant at 5% Significance level (2-tailed)**

From table 4.2 above, LnINT has weak negative correlation of 0.38 with LnMD at 5%significance level. As the interest rate reduces money demand increases and vice versa. If interest rates are low, bond prices will rise. When bond prices are high, financial investors will become concerned that bond prices might fall hence keeping their wealth inform of cash. That suggests that high bond prices and low interest rates would increase the quantity of money held for speculative purposes. Conversely, if bond prices are relatively low, it is likely that fewer financial investors will expect them to fall still further. They will hold smaller speculative balances. Therefore, it expected that the quantity of money demanded for speculative reasons will vary negatively with the interest rate.

LnINFL has weak negative correlation of -0.06 and -0.19 with LnMD at 5% significance level respectively. This shows that as inflation increases money demand also decreases and vice versa. This is attributed to government activities in trying to control inflation in the economy hence reducing amount of money in circulation.

LnGDP has weak positive correlation of 0.38 with LnMD at 5% significance level. This shows that as gross domestic product money demand also increases. This is due improvement in country's GDP hence leading to increase in national income. Increase in national income stablelizes the economy hence leading to an increase government spending and subsequent increase in money demand.

LnMPS exhibits a strong positive correlation with LnMD having correlation coefficient of 0.50. The correlation is statistically significance at 5% significance level. This implies that as volume of M-pesa transactions increases money demand also increases. This is attributed to easy access to credits and liquid cash through mobile phones. There exists a weak correlation of 0.02 between LnATM and LnMD which is significance at 5% significance level. This means that as volume of ATM transactions increase, money demand also increases. This is due to reduction in transaction cost with reduced travel distance and waiting time. Thus individuals in country will have to desire to keep money in cash since they can get any time the need arises through ATM cards.

4. 3 Econometric Tests

4.3.1 Unit root Test

The Augmented Dickey Fuller stationarity test was conducted in the model using the equation with a constant and a trend and the results presented in the table 4.3 and 4.4 respectively.

Table 4.3 The Augmented Dickey Fuller (ADF) Test results

Variable	T-statistics	Critical values (5%)	P-value
LnMD	-4.770	-3.7500	0.0001
LnAMPS	-0.6490	-3.7500	0.8594
LnATM	-0.3380	-3.7500	0.9200
LnINTER	-2.7980	-3.7500	0.0586
LnINFL	-5.1110	-3.7500	0.0000
LnGDP	1.3920	-3.7500	0.9971

Table 4.4 The Augmented Dickey Fuller (ADF) test results in first difference

Variable	T-Statistics	Critical Values (5%)	P-Value	Order of integration
ΔLnMD	11.4600	-3.7500	0.0000	I(1)
ΔLnMPS	3.2950	-3.7500	0.0000	I(1)
ΔLnATM	7.7100	-3.7500	0.0000	I(1)
ΔLnGDP	-1.7270	-3.7500	0.0000	I(1)

From table 4.3, only LnMD and LnINFL were found to be stationary at 5% significance level. The remaining variables LnMPS, LnATM, LnINTER and LnGDP were all non-stationary. They were to be differentiated once to remove unit root after which they were tested again and found to be stationary at 5% significance level as shown in Table 4.4.

4.3.2 Johansen Cointegration Test

Variables LnMPS, LnATM, LnINTER and LnGDP were found to be non-stationary during unit root test and any estimation done using them would suffer the problem of spurious results. Therefore, data was subjected to cointergration test for assessment of the suitability of the selected estimation methods. The goal of cointergration test was to establish whether two or more non-stationary variables moved together in the long-run. Since only two variables were found to be stationary, all other variables (LnMPS, LnATM, LnINTER and LnGDP) which exhibited non-stationarity properties were subjected to cointergration test using Johansen cointergration test. (Ssekuma, 2011) argued that Johansen procedure builds cointegrated variables directly on the maximum likelihood estimation instead of relying on OLS estimators and is able to detect more than one cointegrating relationship if present. The number of cointegrating vectors in Johansen procedure were detected by the use of two likelihood ratio tests namely; the trace test and the maximum eigenvalue.

The test for cointegration implemented in vecrank was based on Johansen's method. If the log likelihood of the unconstrained model that includes the cointegrating equations is significantly different from the log likelihood of the constrained model that does not include the cointegrating equations, we reject the null hypothesis of no cointegration. The results were presented in the table 4.5.

Table 4.5 Unrestricted Cointegration Rank Test (Trace)

Max rank	Eigen Value	Trace Statistic	Critical value
0	-	63.3465	29.68
1	0.9973	21.8474	15.41
2	0.9465	1.3580*	3.76
3	0.1763		

Table 4.5 presents the findings of cointegration tests under the assumption that the underlying trends are of a deterministic nature. In order to assess the sensitivity of cointegration analysis to the alternative specification of the trend parameter, especially, given that unit root tests provide supporting evidence of plausible stochastic trends, the sample series cointegration test was also performed. This was under the assumption that the underlying trends in the variables are of stochastic nature. The qualitative outcome of the cointegration analysis remained the same and did not hinge on the choice of the trend parameter. From table 4.5, when R=0 Trace statistics is 63.3465 which is greater that critical value of 29.68. When R=1, Trace statistics is 21.8474 which is greater than critical value of 15.41 and therefore rejecting the null hypothesis of no cointegration at 5% significance level. Conclusion was that there was no longer a long-run relationship among the dependent variables (LnMD, LnMS) and the non-stationary variables (LnMPS, LnATM, LnINTER, LnBR, and LnGDP). An error correction model, which reconciled the long-run relationship with a short-run association was run.
Table 4.6 below presents regression results obtained after subjecting money demand model to a vector error correction process.

Table 4.6 Overall Regression Results of Money demand Based on VECM.

Variable	Coefficient	Std.Error	T-statistics	P-value
LnMPS	-0.2130	0.0796	-2.6759	0.0000
LnATM	1.5534	0.7499	2.0715	0.0010
LnINTER	-0.7918	0.2978	-2.6600	0.0000
LnGDP	0.0140	0.0071	1.9618	0.0021
	R-Squared = 0.6875			
Breausch-Godfrey	AR (1) process: Chi-Squared = 7.00			
LM test of autocorrelation:	Prob > Chi-Squared = 0.0082			
	AR (2) process: Chi-Squared = 0.358			
	Prob > Chi-Squared = 0.8042			
Modified Wald test for Heteroscedasticity:	Chi-Squared (1) =1.29			
	Prob> Chi-Squared = 0.000			
Variance Inflation Factor (VIF) Test for Multicollinearity:	Mean VIF= 2.52			

4.4 Regression Results and Discussion

4.4.1 Volume of M-pesa Transactions and Money Demand

From table 4.6, Coefficient of volume of M-pesa transactions is -0.2130 and statistically significant at 5% significance level. A unit decline in volume of M-pesa transactions leads to 0.2130% increase in money demand. Volume of M-pesa transactions is inversely proportional to money demand and an increase in volume of M-pesa transactions subsequently leads to a decline in money demand. M-Pesa encourages people to feel safe about keeping funds in their M-Pesa accounts for fairly extended periods of time. Mobile money also affords an easy and cost friendly means of moving money. This explains a decline in money demand every time there is an increase in volume of M-pesa transactions. M-Pesa transactions increase cash in circulation and hence individuals move away from holding money in form of liquid assets (M1) into to less liquid assets (M2 or M3) and as a result the demand for money is reduced. The findings are consistent with those of Kasekende and Nikolaidou (2014). The results are also in line with Keynesian theory of money demand and specifically transitionary demand for money. The transactions demand for money arises from the medium of exchange function of money in making regular payments for goods and services. According to Keynes, it relates to the need of cash for the current transactions of personal and business exchange. It is further divided into income and business motives. The income motive is meant to bridge the interval between the receipt of income and its disbursement. Similarly, the business motive is meant to bridge the interval between the time of incurring business costs and that of the receipt of the sale proceeds. If the time between the incurring of expenditure and receipt of income is small, less cash will be held by the people for current transactions, and vice versa. There will, however, be changes in the transactions demand for money depending upon the expectations of income recipients and businessmen. It is for the above reason that M-pesa has contributed to decline in money demand since people can easily access cash through phone any time a need arises without incurring time and travel expenses.

4.4.2 Volume of ATM Transactions and Money Demand.

Table 4.6 results shows a positive coefficient of 1.5534 of Volume of ATM transactions on money demand at 5% significance level. This is consistence with the expected results since an increase in volume of ATM transactions is expected to lead to an increase in demand for money. A unit increase in volume of ATM transactions leads to an increase in money demand by 1.5534%. Volume of ATM transactions affect money demand positively and therefore they are directly proportional. Increase in number of ATMs significantly increases the frequency of money demand. ATM transactions affect optimal cash holding in the sense that it reduces waiting and time cost. Therefore, people with ATM cards will be willing to spend money since it readily accessible. This will lead to increase in demand for money in cash balances hence increasing aggregate money

demand in the economy. The results obtained in contrast those obtained by Kipsang (2003) in which he found that number of ATM transactions did not have significant effect to the money demand. This could be attributed to the fact that he used number of ATM transactions as opposed to the volume of ATM transactions.

4.4.3 Interest Rate and Money Demand

Table 4.6 results shows that the coefficient of Interest Rate is -0.7918 for the money demand. The coefficient is statistically significant at 5% significance level. This means that 1% increase in Interest Rate leads to 0.7918% decline in money demand. This is true for the speculative demand for money as highlighted by Keynesian. In the General Theory, Keynes argued that expectations about future bond prices tend to be sticky. A rise in bond prices causes more investors to join the bear brigade and so increases the aggregate demand for money. Speculative demand for money is inversely related to the rate of interest. The higher the rate of Interest, the smaller will be speculative demand for money and vice versa. If market rate of interest is very high and everyone expects it to fall in the future (rise in price of bond) thereby anticipating capital gain from bond holding, people will convert their money into bonds. This will lower speculative demand for money. On the contrary, if the rate of interest is low and people expect it to rise in future (fall in price of bond) anticipating capital loss from bond holding, people convert their bonds into money in order to avoid future capital loss. They hold up money balance thinking that income from non-monetary assets like bond will be low and so the cost of money holding will also be low. Thus, speculative demand for money becomes very high so much so that when the rate of interest declines to minimum, say, 3%, speculative demand for money becomes infinite (perfectly elastic). This pushes the economy into liquidity trap and the speculative demand curve becomes flat. Thus the results are consistent with Keynesian theory of speculative demand for money. The results obtained are consistent with the findings of Mabuku (2009) in which he found that interest rate had negative significant impacts on money demand.

4.4.4 GDP and Money Demand

From the regression results in table 4.6 the coefficients of GDP in relation to money demand is positive 0.0140 which is statistically significant at 5%significance level. This means that 1% increase in GDP leads to 0.0140% increase in money demand. An increase in real GDP increases incomes throughout the economy. The demand for money in the economy is therefore likely to be greater when real GDP is greater. Transaction demand for money rises with an increase in nominal GDP. Thus if the amount of goods and services produced in the economy rises while prices of all products remain the same, the total GDP will rise and people will demand more money to make the additional transactions. On the other side if the average prices of goods and services produced in an economy, then even if the economy produces no additional products, people will still demand more money to purchase the higher valued GDP, hence the demand for money to make transactions will rise. The results of this study are in agreement with the findings by Kipsang, (2003). GDP is a key determinant of the money demand in Kenya.

From regression results presented in the Table 4.6, coefficient of determination (R^2) of money demand is 0.6875 which is 68.75%. This means that 68.75 changes in the money demand is accounted for by volume of M-pesa transactions, volume of ATM transactions, interest rate, inflation and GDP. The remaining 32.25% changes in money demand is explained by other factors outside the model. The model is good since high percentage of changes is explained by factors in the model.

Breausch-Godfrey LM test of autocorrelation for AR (1) process results presented in the table 4.6 shows a Chi-Squared of 7.00 and P-value of 0. 0086. Chi-Squared value is greater than P value hence rejecting null hypothesis of no correlation. This confirmed presence of serial correlation. Model was refitted with two lags included as regressors and then Breausch-Godfrey LM test was run after which AR (2) process indicating that the null hypothesis of no autocorrelation is accepted since P-value is greater than Chi-Squared value. A modified Wald test was carried out to test for heteroscedasticity and the results presented in Table 4.6. Robust standard errors model was run before the test was carried to solve for the problem of Heteroscedasticity. The P-value for the modified Wald test is 0.000 which is less than 0.05 implying that the null hypothesis is rejected and therefore the residuals are homoscedastic. Multicollinearity test was done by use of Variance Inflation Factor (VIF). Gujarati and Porter, (2009) argued that the rule of thumb is that if Variance Inflation Factor (VIF) exceeds 10, that variable is said to be highly collinear and vice versa. Table 4.6 shows multicollinarity test results for the model. Mean VIF is 2.52 which is much far from 10. The study therefore found no multicollinearity though present but a small amount of it since it cannot be fully eliminated.

5.0 Conclusion

This study established that Volume of M-pesa Transactions had influence on money demand in the Kenyan economy. The results showed a negative relationship between volume of M-pesa transactions and money demand indicating that the people with M-pesa accounts are likely not to be interested in holding money in cash since they can easily access money from their phones whenever need arises. This is in agreement with Keynesian argument that people would require money for three motives namely: Speculative, transitionary and precautionary. The same motives remain but people are not worried since they can access money from their phones easily. This reduces the transitionary costs, time cost as well as the transportation cost incurred when travelling to the banking halls. This explains why people are not excited in holding cash balances.

Volume of ATM transactions had a positive relationship with money demand. This means that Increase in volume of ATM transactions increases money demand in the economy. Increase in number of ATMs significantly increases the frequency of money withdraw and hence increasing money demand among individuals in the country. ATM transactions affect optimal cash holding in the sense that it reduces waiting and time costs. Therefore, people with ATM cards will be willing to spend money since it is readily accessible. This will lead to increase in demand for money in cash balances hence increasing aggregate money demand in the economy. Increase in money demand can result to inflation and is for this reason that it needs to be controlled.

Interest rates had a negative effect on money demand. One of the motive of holding money identified by Keynes is the speculative motive. Individuals demand money in cash balances if they expect the market value of alternative assets to fall. Hence the speculative motive for holding money arises from the desire to maximize wealth and it depends on the rate of interest. Money demand is therefore affected by the interest rate and this affects investments. This could be due to the investor wanting to keep their wealth inform of bonds.

Results showed that GDP had a positive relationship with both money demand. Transaction demand for money rises with an increase in nominal GDP. Thus if the amount of goods and services produced in the economy rises while prices of all products remain the same, the total GDP will rise and people will demand more money to make the additional transactions. On the other side if the average prices of goods and services produced in an economy, then even if the economy produces no additional products, people will still demand more money to purchase the higher valued GDP, hence the demand for money to make transactions will rise.

Recommendations

Based on the results obtained from this study, it is clear that financial innovation has a great impact on money demand in Kenyan economy. This is attributed to large number of people with M-pesa accounts thus doing huge M-pesa transactions and as a result affecting both money. The government therefore needs to come with some policies on how it can regulate the amount transactions through means such as ATMs and M-pesa. This will ensure that money demand in the economy is controlled hence the economy will remain stable.

Government should also develop policies to regulate money accessibility inform of credits through mobile phones and credit cards. There should be a standard rate of interest which should be charged to all customers borrowing loans through mobile phones and credit cards. High interest rate will reduce the number of people borrowing loans hence reducing money supply in the economy as a result of increased money demand.

Government should also put policies in place to deepen the financial market as a way of promoting financial innovation and use of technology in the banking sector so as to encourage more people to be savers and investors through the mobile banking. This will lead to money market stability as a result of reduced money demand and subsequent increase in investments.

Areas of Further Research

This study concentrated on the effect of financial innovation on money demand. The study improved from the previous ones since it used the volume of M-pesa transactions and volume of ATMs transactions as opposed to earlier studies which had used number M-pesa and ATMS respectively as proxy for financial innovation.
However, this study was not able to incorporate other mobile money such as Airtel money, Orange money and Equitel because by the time of the study there was no data available. Therefore, a further research that incorporates Airtel money, Orange money and Equitel needs to be considered in future. This study also studied effect of financial innovation on the aggregate economy. A further study to establish effect of financial innovation on individual persons is also recommended.

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