EFFECTS OF THE MOBILE MONEY TRANSACTIONS ON PRIVATE SAVINGS RATIO IN KENYA FROM 2007 TO 2017

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Submitted in partial fulfillment of the requirements for the Degree of Bachelor of Business Science in Financial Economics at Strathmore University

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[December, 2017]

DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Project contains no material previously published or written by another person except where due reference is made in the Research Project itself.

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This Research Project has been submitted for examination with my approval as the Supervisors.

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ABSTRACT

Mobile money has received a lot of attention since the successful introduction of Mpesa in Kenya in 2007. Many economies in Africa have adopted the technology and it has evidently altered the lives and behaviors of those who use it and subsequently, respective economies. This has been attributed to the ease of access of financial services through the technology. Private savings, one of the variables that the innovation has directly and indirectly affected, is a key financial and economic aspect for micro and macroeconomic stabilization in developing countries. Despite this, recent findings have shown that savings in Kenya have perpetually been on the decline as compared to other regions.

Most studies have approached the topic of mobile money and savings on a financial inclusion to the previously unbanked basis but have failed to take account of post-adoption saving responses of users of the technology, which this study aims to consider in a macroeconomic perspective. This study uses co-integration analysis to identify the long run relationship between mobile money transactions and private savings relative to GDP in Kenya from 2007 to 2017. The findings of this study are presence of a long run relationship but the nature of the relationship being inconclusive. This implies that the technology may have affected private savings ratio positively due to the increased financial inclusion but may have also had a negative effect due to the increase of fast access of financial services due to the technology.

Contents

1. INTRODUCTION

1.1 Background of the study

Technology may alter lifestyles and behaviors in one way or the other as they make work simpler, lives more comfortable, influence savings of those who want to purchase them as well as increase productivity, income and spending (Maurer, 2012).Though various technologies have been introduced over centuries, one technology that has revolutionized the world and has in particular penetrated the lifestyles of consumers is the mobile phone technology (Jack & Suri, 2011).

Mobile money has increased access to financial services in the Sub-Saharan region by about 16% (Demirguc-Kunt & Klapper, 2012). It has also financially included the young and poor in developing countries (Demombynes & Thegeya, 2012). According to the GSMA report 2016, there are more than 170 million active mobile money accounts in the world, where almost one in three is a Kenyan. FSD Kenya (2016) reports that Mobile money continued to be a major driver of financial inclusion in the country with by over 71% of adult usage. However, there remains a gap in the literature on post-adoption savings behavioral responses of users of the technology. This study therefore aims to study on a macro-economic level the long run relationship of private savings ratio and mobile money technology.

1.1.2 Private Savings Ratio in Kenya

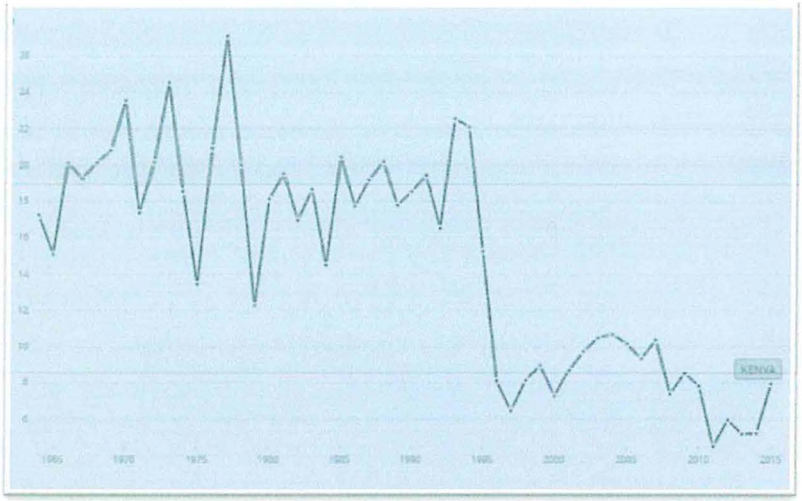
By definition, saving is income minus spending. Private savings is disposable income less consumption, or, income that is not used for consumption or taxes. National savings is the sum of public and private savings. In context of this paper, private savings ratio is private savings as a ratio of a county's, in this case Kenya's, GDP. Savings, commonly referred to as 'postponed consumption', is not only considered important for investment but it is also an important aspect for macroeconomic stabilization (Kivindu, 2015). Saving is one of the key aspects of financial practices that any individual has to assume himself instead of relying on someone else or relatives. (Ky & Rugemintwari, 2014).

Much of disparity in the growth performance between countries is often attributed to the differences in the rates of saving and investment. The Harrod Domar Model suggests that

economic growth rates depends on level of savings which yield to investments (Harrod, 1939) (Domar, 1946). Therefore low domestic saving rates may maintain low growth levels (Ndirangu, 2013).

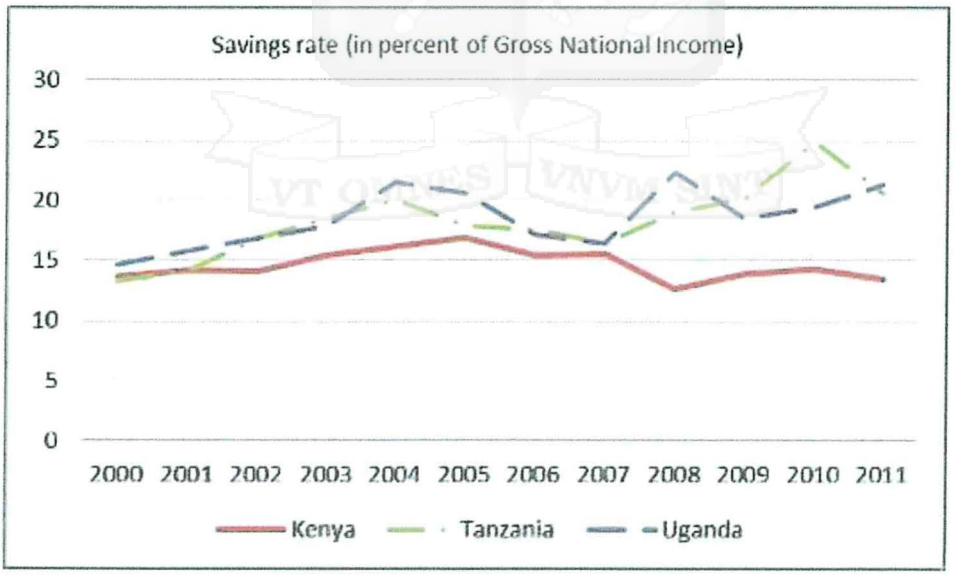
For most developing countries, foreign sources have been constrained by existing external debt and unpredictable foreign debt. This has necessitated greater attention to the mobilization of domestic savings (Makau, 1995). A 1996 survey by the World Bank and the United Nations Development Program (UNDP) ranked domestic savings top as an issue for institutional development in developing countries. In line with the UNDP survey, the developing East Asian economies put great emphasis on fiscal discipline and on building a strong, effectively supervised financial sector able to mobilize private savings and allocate them to efficient investment (World Bank, 1993). Drastic increases in domestic private savings in the East Asian countries was achieved through the institution of financial sector reforms and the fiscal discipline which facilitated sustainable economic growth rates. (World Bank, 1993) (Makau, 1995).
Unfortunately, savings in Africa has perpetually been the lowest compared to other regions. In Kenya, particularly, the savings rates as a share of the country's disposable income has remained at below 15 per cent over the past two decades, as obtained from the World Bank Kenya country economic memorandum.

Data on household savings are not available, but analysis implies that households have been saving less over the past eight years at least. The last household budget survey was conducted in 2005/06; hence, there are no primary data to show trends in saving since then. However, the fact that national savings have been falling since 2005, while corporate and public savings have increased marginally, implies a reduction in household saving. One of the explanations for this could be the increased borrowing by households as access to credit has become easier. Commercial banks' credit to households rose fivefold between 2005 and 2013, to over 5 percent of GDP. Evidently, Kenyans can no longer live on their income and have resorted to draining their savings and borrowing to survive. (World Bank, 2016).
The graph1 graphically shows the gross domestic savings in the country.



Graph 1: Gross Domestic Savings 1965 to 2015 (Data from World Bank)

Moreover, Kenya saves less than many of its peers with around 13-14 percent of GDP over the last five years. (World Bank, 2016) This is half of the average for all low-income countries (26 percent of GDP). By contrast, neighboring Uganda and Tanzania have already crossed the 20 percent mark even though their per capita income is significantly lower. With this, Tanzania and Uganda have achieved remarkable investment rates, and high saving rates are a large contributor to this success. (World Bank, 2016) This is seen in the figure below.



Graph 2: A comparison of East Africa savings from 2000 to 2011 Source: World Development Indicators

Kenya's development road map dubbed the vision 2030 stipulates that by the year 2030, Kenya shall be a high middle income economy and one of the ways of achieving this is to encourage savings among the Kenyans. (Ndirangu, 2013). The Second Medium-Term Plan in Kenya's vision 2030 aims to increase local and domestic savings in order to promote macroeconomic stability, reduce government contingent pension liabilities and reduce vulnerability of the country. However, the current level of savings in the country would not yield the Vision 2030 and Second Medium-Term Plan (Kenya Vision 2030) growth targets. The MTP-2 sets an ambitious target investment rate to reach 31 percent of gross domestic product (GDP) by 2018, and this target is accompanied by an anticipated jump in savings from the current rate to 30 percent by that time. (World Bank, 2016)

1.1.3 Mobile Money in Kenya

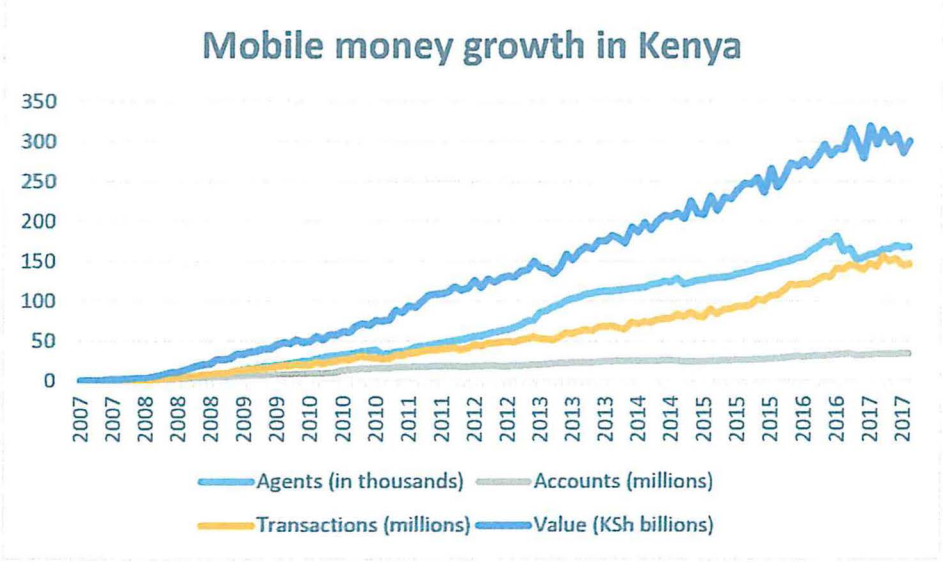
Mobile money refers to financial transaction services, including credit and savings products, potentially available to anyone owning a mobile phone (Aron & Muellbauer, 2015).Mobile network operators began exploring the concept of mobile payments in 2000 and was first launched in the Philippines in 2001. (Ernst & Young, 2009) Providers saw the opportunity to leverage mobile technology to reach millions of financially excluded people. By 2006, a total of six services had launched in four countries, primarily in the East Asia and Pacific region. While these services came to reinvent themselves in the latter part of the decade, customer activity in the early days was limited. That year, just 8.8 per cent of the 6.6 million registered mobile money accounts around the world were active (transacting once at least every 90 days). It was not until the 2007 launch of Mobile Money in Kenya, and its sudden and dramatic growth, that the potential of mobile money to transform lives became clear. (GSMA, 2016)

Kenya has undergone a remarkable information and communications technology (ICT) revolution. At the close of the 1990s, less than 3 percent of Kenyan households owned a telephone, and fewer than 1 in 1,000 Kenyan adults had mobile phone service. By the end of 2011, 93 percent of Kenyan households owned a mobile phone. (Demombynes and Thegeya, 2010). The Mobile Money technology was first introduced in Kenya in March 2007 when Safaricom, the leading cell phone company in Kenya, launched Mpesa ("M" for mobile, "Pesa" for "money" in Swahili). The service allows users to deposit money into an account stored on their cellphones, to send balances using

SMS (short message service) technology to other users (including sellers of goods and services), and to redeem deposits for regular money. Charges, deducted from users' accounts, are levied when e-float or e-money (the currency in which balances are denominated) is sent, and cash is withdrawn. (Jack & Suri, 2011) The mobile phone application has facilitated a variety of financial transactions for its users, such as purchasing airtime, transferring money, and paying bills. (Aker & Mbiti, 2010)

Within eight months of its inception in March 2007, over 1.1 million Kenyans had registered to the network, and over US$87 million had been transferred over the system (Safaricom, 2007). By September 2009, over 8.5 million Kenyans had registered to use the service and US$3.7 billion (equivalent to 10 percent of Kenya's GDP) had been transferred over the system since inception (Safaricom, 2009). (Mbiti W. , 2016, pp. 247-295). Currently, Kenya has 25.4 million mobile money subscribers who transact on six main platforms — Safaricom's M-Pesa, Equitel (accountable for a fifth of Kenya's mobile money transactions), Airtel Money (launched in February 2009), yuCash (launched in December 2009), Orange Money (launched in November 2010), MobiKash and Tangaza Pesa — backed by a network of about 150,000 agents, according to the latest data from the Central Bank of Kenya. By contrast, Kenya has only 491 bank branches, 500 Postbank branches, and 352 ATMs. (Jack & Suri, 2011) These platforms are often likened to simple bank accounts, although a basic mobile money system does not pay.

The graph below shows the increase in mobile money transactions, value, transactions and accounts in Kenya since the introduction of the technology.



Graph 3: Mobile Money Growth in Kenya from 2007 to 2017 (Data from the Central Bank of Kenya)

By the end of 2013, the mobile money industry had expanded beyond Kenya and East Africa. A total of 12 services had achieved critical mass, including services in Asia, Latin America and the Caribbean, West Africa, and the Middle East and North Africa region. Strikingly, the number of successful services almost doubled only one year later—23 services had more than a million active accounts in 2014. By 2016, a record total of 35 services had reached this milestone. While more than half of these are in Sub-Saharan Africa, the mobile money industry has proven that scale is possible in diverse geographies. (GSMA, 2016)

Data from the KNBS Economic Survey 2017 shows that Kenya tops the list of African countries with ease of access to financial services thanks to its high uptake of mobile money placing the country ahead of economic giants such as South Africa, Nigeria and Ghana. Kenyans benefit from the ease of use of technology and financial products and mobile payments making industry very explosive. This proves the acceptance of the mobile money technology to Kenyans.

Mobile money has reached a scale where it can also be seen as a network infrastructure and platform facilitating the exchange of cash and electronic value between various economic actors including clients, businesses, the government, and financial service providers (Kendall, Maurer, Machoka, & Veniard). The technology continues to grow and is overtaking other payment methods like payment cards due to: accessibility, affordability, simplicity, acceptance of smaller

transactions unlike banks; speed, instant transfers, convenience and received international recognition (GSMA, 2016). Donner & Tellez 2008 find that most businesses in Sub Saharan Africa do not accept credit cards for payment of goods and services, and that, the "cash-and-carry system" is largely upheld in developing countries. However, mobile money is readily accepted as means of payment for goods and services in Kenya (Jack and Suri, 2010).

Additionally, a wide range of mobile money applications have developed since then that have brought together different industry groups, such as banks, operators, businesses and a multitude of market segments. Some major categories include:

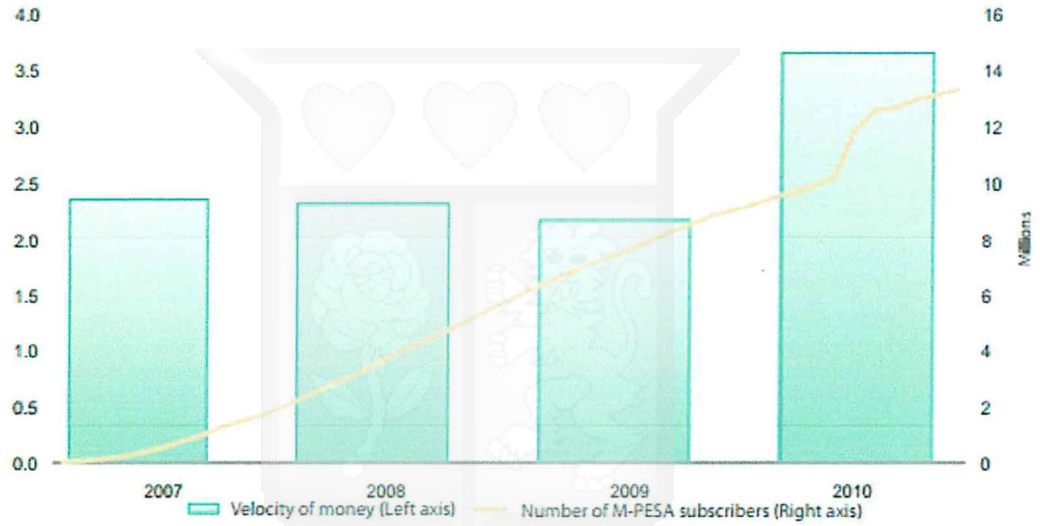
1. **Mobile money transfer (remittance)** — a peer-to-peer (P2P) application making use of a mobile phone to send money to family or friends.
2. **Mobile commerce (payment) —** use of a mobile phone to perform financial transactions for purchases or sales, either remotely or on-site, retrieve promotion information.
3. **Mobile banking** — use of a mobile phone to remotely access a bank account, primarily for account balance checkup and bill payment services

The growth of mobile money in Kenya has as well facilitated the expansion of branchless banking in the country whereby banks increase the financial reach using agents as intermediaries to provide services to clients in rural and remote areas where the fixed costs of opening a branch would be prohibitive. (Mbiti W. , 2016) Evidence is found to support the hypothesis that mobile banking in Kenya is overcoming the tyranny of distance to bank infrastructure for financial inclusion. (King, 2012)

Mobile savings products have increased rapidly: as of December 2010, there were at least seven systems offering some type of bank account access via mobile phone. Most of these are essentially access to a traditional account via a mobile phone and require the customer first to establish a traditional account at a physical bank. Bank-mobile service provider partnerships are not exclusive, and banks are seeking agreements with multiple mobile service providers with the ultimate aim of providing universal access to their diverse client account bases. Additionally, banks are beginning to build their own agent networks in order to assume a more competitive bargaining position in accessing mobile service platforms.

1.2 Mobile Money and Savings

Economic theory defines velocity of money a key indicator of the pace of monetary transactions. It looks at how many times a unit of currency flows through the economy. The faster the money travels, the greater the spending in an economy. Since 2006, the velocity of money has been on the upward trend in Kenya. This increase in velocity is largely due to the financial innovations such as mobile money technology (AfDB, 2011). AfDB, (2011) reports that the transactions velocity of Mobile Money may be three to four times higher than the transactions velocity of other components of money. Hence brings the conclusion that spending has increased since the introduction of mobile money.



Graph 4: Velocity of money vs mobile money subscribers. Source: AfDB computation

On the effect of mobile money and spending, Aron & Muellbauer, (2015) find that, higher mobile balances might signal plans for impending spending and so proxy a short-term demand increase. Also, the advent of mobile money might transfer spending power to households with a higher propensity to spend. Mbiti & Weil, (2011) reason the increased spending to the allowance of easy transferability of money and at any point in time making mobile money is very liquid. To the extent that mobile money transfers adds to recipient's income and reduces sender's income, it cannot be denied that it also can influence spending behaviour of users.

This increased liquidity due to the mobile money technology may therefore lead to increased spending in an economy. Kulikov, Paabut, & Staehr, (2007) state that households with a relatively easy access to liquidity spend more than other households. Easy access to liquidity increases spending in an economy which in the long run reduces the saving rate, while scarce liquidity encourages saving.

1.3 Statement of the research problem

Domestic savings in economies are necessary to promote macroeconomic stability, growth and reduction of foreign dependency. Developing countries face a significant task of increasing savings levels so as so enhance growth. Focus has been made on how mobile money technology should boost savings in an economy through financial inclusion, especially in developing economies. This is done by making financial services cheaper and easier to access to anyone with close reach of a mobile phone. Kenya has been on the forefront of this technology and has received massive attention due to the success of the innovation in the economy.

However, despite the prevalence of the technology in the economy, savings in Kenya have been significantly low and declining over the past 10 years. The increased financial inclusion and financial innovations through the technology have failed to counter the stubborn challenge of low savings in the economy. Evidence shows that the technology has increased the velocity of money in the economy. This may be due to the increased liquidity from the ease of access to financial services through the mobile money technology.

With this increased velocity, savings in the economy may be affected through increased consumption, as the savings rate have been on the constant decline in the country. While looking at mobile money and savings in an economy, most studies have focused on financial inclusion to the unbanked, while failing to focus on other alternatives such as human behavioral response to the new technology. It would be interesting to investigate which effect is predominant. Thus, the purpose of this study is to investigate whether or not the adoption and use of mobile money have influenced the Gross Domestic Savings in Kenya.

1.4 Research Objectives

1.4.1 Overall objective

1. This study aims to establish the effect of mobile money transactions on private savings ratio in Kenya.

1.4.1.1 Sub objectives

1. The study aims to find the long run relationship of the value of mobile money transactions and private savings ratio in Kenya.
2. The study also aims to establish the nature of this relationship i.e. positive or negative long run relationship.

1.5 Research Questions

1. What is the effect of mobile money transactions on private savings ratio in Kenya?

1.6 Justification of the study

The findings of this study hope to establish the savings potential of mobile money services to the economy. This study seeks to contribute to an understanding and give a different outlook on the effects of mobile money technology on private savings in the economy. The study also aimed at informing development practitioners especially for policies that relate to private savings through mobile money in the economy. Academicians and students would find this study useful in learning how mobile money has influenced private savings in the economy. Lastly, it is hoped that the study will contribute to the body of knowledge and be a source of reference materials for future researchers and students on related topics.

1.7 Scope of the study

The scope of this study was limited to a macroeconomic perspectives focused on economic aggregates. Due to time and budgetary constraints, a microeconomic perspective based on household data is not adopted. The study concentrated on private savings ratio in the economy since the introduction of mobile money. The study used data that is publicly available but carefully selected. This scope of the study was selected to ensure that all data related to the aim of the study is captured.

2. LITERATURE REVIEW

2.1 Introduction

This chapter first outlined the theoretical literature about savings and secondly presented empirical literature on a number of studies on mobile money in relation to savings mainly in developing countries. Based on the theory reviewed and the empirical findings, an overview of literature was done and finally a conceptual framework completes the section.

2.2 Theoretical Literature

Different theoretical approaches have been put forward to explain saving behavior: Neoclassical econmic theory, Keynesian/absolute income hypothesis and Relative income hypothesis,

2.2.1 Neoclassical economic theory

The two main theories anchoring the concept of saving are the Life-Cycle Hypothesis and Permanent Income Hypothesis. The life-cycle saving hypothesis was developed by Modigliani & Brumberg, (1954). The hypothesis like the Permanent Income Hypothesis propounds that consumption, is not a function of current income but the expected discounted value of future labor earnings of the individual. The allocation between consumption and savings will be affected by position in the life cycle, and not by the extent of total resources. It assumes that individuals in the same age group have the same preference for allocating consumption overtime and that the factors determining the distribution of income; expectations of income, and net worth over the different age cohorts remain constant.

The permanent income hypothesis (PIH), was put forward by Friedman, (1957). Permanent income is defined as the maximum income that an individual could spend without reducing the real value of his wealth, that is the capitalized present value of his expected future earnings or the real interest rate times the expected value of his wealth, which is defined to include both non human and human wealth. The hypothesis stresses the fact that consumption is proportional to an individual's estimation of his or her permanent income hence people base their spending decisions on expectations of permanent income. When the permanent income changes their consumption patterns responds accordingly.

The two theories assume that human beings are logical in their views or feel about the future as such they balance their present spending according to the effect it will have on their income levels.

They consciously spend their resources in a manner that does not have a negative impact on the resources that they rely on to assist them in the future. Gedela, (2012) observes that most households in developing countries are poor, risk averse and operate in scenarios of uncertainty and imperfect financial markets hence the above theories are deficient in explaining the saving behaviour of such households.

2.2.2 Absolute income hypothesis

Keynes, (1936) regarded savings as a residual after consumption had taken place. He states that savings is a stable and increasing function of the level of income. Keynes envisaged the marginal propensity to save to be governed by what he called objective and subjective factors, and included such factors as the rate of interest, social and institutional changes, and subjective motives for savings. However, it was considered that these factors were relatively constant, and that by far the most important variable which influenced saving (Consumption) was the income an individual 'counts on' (disposable income).In his Theory, Keynes acknowledges that consumers take some time before they adjust their consumption levels to new conditions, such as new technology.

Inspired by the Keynesian doctrian, Harrod (1939) and Domar (1946) developed their models independently but their assumptions and results were similar, leading to the Harrod-Domar model. The model assumes a closed economy in which households consume & save. Firms sproduce both capital goods and consumer goods based on investments. The investment in firms, in turn, is a result of the shortfall between the consumption expenditure that households have and the income the households earn. The income that households earn, is the income generated by firms as a result of investments. The main criticism of the model is the level of assumption, one being that there is no reason for growth to be sufficient to maintain full employment; this is based on the belief that the relative price of labour and capital is fixed, and that they are used in equal proportions.

2.2.3 Relative income hypothesis

Duesenberry, (1949) developed the Relative Income Hypothesis(RIH). This hypothesis states that people are not just concerned about absolute levels of possessions, they are infact concerned about their possessions relative to others and that 'keeping up with the 'joneses' may be a more powerful incentive than the pursuit of wealth for its own sake. The hypothesis argues that an individual's attitude towards consumption, saving and borrowing is guided by his income relative to others than by an abstract standard of living. Duesenberry also states that poor people may consume more

of their income than the rich people because they want to reduce the gap in their consumption levels. This is in contrast to the simple Keynesian consumption and savings function. Hence, with they may end up borrowing to spend more and draining their savings so as to bridge this and ease of access to financial services may prompt "temptation goods" as shown by Banerjee & Mullainathan (2010). The RIH also argues that people have a greater tendency to resist decreases in spending relative to falls in income than they do to increase expenditure relative to increases in income.The reason is that they don't want to alter their standard of living downwards, and hence use the previous peak income to maintain them in the previous levels of consumption.

2.3 Empirical Literature

Empirically, there is evidence that the mobile money technology has influenced the lives and behaviors of its users in one way or the other (Cobla, Osei-Assibey, & Asante, 2015). Some of these works which are relevant and relate closely to the study's objectives are discussed, criticized and analyzed in this section of the study.

The first part of this sections critically examines how various literature have studied how mobile money has influenced various economies. The second part of this section looks at empirical works on savings, spending and liquidity.

2.3.1 Mobile money in economies

Adam & Walker (2015) model the emergence of mobile money by introducing an increasingly advanced remittance payment technology into a Dynamic Stochastic General Equilibrium (DSGE) framework with two sectors: rural and urban producer households. In their paper, they suggest that Mobile Money should increase the macroeconomic stability of the countries in which it is widespread, with benefits going mainly to rural (and thus lower-income) households. They indicate that it can help to increase saving among individuals with little or no access to formal financial services by providing them with a rudimentary bank account by facilitating deposits into informal saving group accounts or by simply allowing users to keep their savings hidden from friends or relatives who might ask them for money. They also state that mobile money gives rural users the ability instantly and securely to send money to pay for goods and services; to contribute to the cost of a funeral; or to provide liquidity to farm tenants who need to invest in new tools potentially helps to channel funds to where they are the most useful, whether it be for consumption or investment purposes.

To add to the argument, Aker and Wilson (2012) investigate whether and how mobile money can promote financial inclusion of the poor, particularly those living in rural areas of northern Ghana. The survey is in two stages: a data collection and a follow-up. It uses four different interventions (each one) designed to partially address some key barriers to mobile money adoption. Per their findings, rural populations are much interested in adopting m-money. In 2 and a half months after the initial intervention, 26 percent more households started to use mobile money with 86 percent of users receiving money transfers via the medium. Moreover, 70 percent of users save on their mobile phones.

Thulani, Kosmas, Collins, & Lloyd, (2011) disagree to this context as they reveal that high usage of mobile money service does not change their saving habits among Zimbabweans. In a similar context, investigate the level of financial inclusion. The study uses both qualitative and quantitative methods to arrive at the results. A sample of 37 households is drawn from eight districts in the Midlands Province. Questionnaires and focus groups discussion are employed to collect the data. Exploratory factor analysis, principal component analysis, Varimax rotation and Kaiser Normalization are conducted. The work depicts very high mobile money usage among the unbanked rural inhabitants for transferring money. However the sample size studied was found to still adhere to their traditional means of saving.

To add on to Thulani et al, Demombynes & Thegeya, (2012) examine the mobile savings phenomenon, using data collected in a special survey in late 2010. They show that the usage of bank-integrated mobile savings systems remains limited and largely restricted to better-off Kenyans. However, what the authors term "basic mobile savings"—the use of simple mobile money systems as a repository for funds—is widespread, including among those who are otherwise unlikely to have any savings.

This is supported by Weil, Mbiti and Mwega (2012) who examine data on the frequency of M-Pesa use from the 2009 FinAccess Survey. Focusing their regression analysis on M-Pesa users, they show that urban users, highly educated users (secondary school graduates and above), and individuals with more assets used M-Pesa more frequently than their rural, less education and poorer counterparts. Their estimates show that, for instance, an urban M-Pesa user conducts six more transaction per annum relative to a non-urban user, while asset poor M-Pesa users conduct 5 fewer transactions per year relative to "non-asset poor" users.

In a similar vein, Gikunju (2009) conducted an empirical examination to examine the effect of mobile money on the revenues of other money transfer companies in Kenya. The study employs a more qualitative analysis approach to arrive at the findings. It is revealed that prior to the introduction of the mobile money technology in developing countries, the rich who can afford to pay the high banking charges and the educated who have better understanding of financial transactions were mainly those who patronized banking products and services. They also formed majority of those who used formal money transfer means to send monies across geographical space. Alternatively, the poor and those with low educational levels largely resorted to informal banking options such as the ROSCAs and mostly used the services of family and friends to send money across geographical space. Shortly after the introduction of mobile money (precisely M-PESA) in Kenya in 2007, revenues and profits on local transfer services including Posta Pay money transfer service declined rapidly. Profits on international transfers such as Western Union and MoneyGram profits also declined over the same period. Gikunju (2009) concludes that though overall spending on money transfers (amount transferred) may not have changed; M-PESA has largely substituted other transfer services in Kenya despite the constant price cuts done by other money transfer service providers to resolve the issue. M-PESA may be substitutive to other money transfer services in Kenya, but Jack and Suri (2010), Mbiti and Weil (2011) and King (2012) give empirical evidence that M-PESA in Kenya is rather complementary than substitutive to banking products and services.

As mobile money was always assumed to be the solution to finally monitor the transactions of the "unbanked", the evidence presented above depicts that further studies may need to be done to measure the true impact of mobile money in economies.

2.3.2 Mobile money, savings and liquidity

Ky, Rugemintwari, & Sauviat, (2014), investigates whether the use of mobile money can help individuals build savings to face predictable events. They use a logistic model and hand-collected data obtained from individuals-level survey that was conducted between May and June 2014 in Burkina Faso. The results show that, although using mobile money services has no impact on overall savings or savings for predictable events, it does increase the ability of individuals to save for health emergencies. They acknowledge that the liquid savings option provided by the mobile money, accessible anywhere and anytime may have a negative impact on individual savings.

According to their study, Ky, Rugemintwari, & Sauviat, (2014) indicate that withdrawals fees are the only contingency that encourage users of mobile money to only cash out when the need arises, may help people resisting unneeded expenditures and thus encouraging savings. This assumes that mobile money transaction costs are constant over time and price sensitive. Contrary to this, Jack and Suri (2014) show that Mobile Money service providers ought to reduce the transaction costs of financial transfers, in order to increase access to liquidity so as to help households' smooth consumption in the face of shocks. This brings question on if households can actually aim to spend, through mobile money, only when the need arises despite the high liquidity option. Relaxing the assumption of constant transaction costs may question their thesis as economic theory posits that costs may reduce over time due to competition, economies of scale among other factors. Further, technology has proved to become cheaper over time, this is seen in the case of the message transfer, where the once unaffordable telegraph has now revolutionized to the efficient and cheap social media. Mobile money is a new field and as the technology improves becoming more efficient, we can't be assured that the transaction cost will be constantly high over time.

To this concept, Kulikov, Paabut, & Staehr, (2007) ascertains the determinants of household saving in Estonia based on a micro econometric analysis of household budget surveys from 2002 to 2005. They named the variable "LIQUID" to gauge the availability of cash for immediate use by the household, including the possibility of consumer credit. The work reveals that households with a relatively easy access to liquidity save less than other households. They concluded that that easy access to liquidity reduces the saving rate, while scarce liquidity encourages saving.

Additionally, Shefrin & Thaler (1988), indicate that self-control problems including temptation, as a part of a broader set of time-inconsistent preferences, play a key role when studying saving behavior. Banerjee & Mullainathan, (2010) term self-control as the trade-offs between short term gratification and long term benefits entails a conflict that manifests through temptations. Their concept indicate that individuals usually face "Temptation goods" which give utility in the present but not in the future making it difficult for them to postpone an important part of their consumption.

Cobla, Osei-Assibey, & Asante, 2015 add to this by conducting a study to find out how the use of the mobile money technology among students affects their spending behaviour. A total of 506 students from the University of Ghana were sampled for the study. Ordinary least squares (OLS) regression was used to estimate the results. Among findings from the study, active use of the

mobile money service (technology) has significant influence on students spending behaviour. On a monthly basis, students who use mobile money spend nearly 19 Ghana Cedis more than their colleagues who do not use mobile money. Students who use both mobile money and ATMs jointly spend nearly 14 Ghana Cedis more than those colleagues of theirs who use only one of the two technologies. Behavioral factors such as health condition of students, their cognitive capabilities and social status were also found to be key influences on their spending behavior. They state that the extent that the mobile money technology facilitates access to funds at any point in time, it has the potency of influencing the spending behaviour of its users through such. At Macroeconomic level, they state that electronic (money) credit generated by the mobile money technology should not be overlooked by policy makers when making monetary policies as it also influences individual user's consumption spending. They recommend that policy makers ought to strategize on how to manage economic shocks that could emanate from the use of the technology.

Kimenyi and Ndung'u (2009) ascertain this thesis by assessing the expansion of the Kenyan financial services and investigate the lessons that can be learned from mobile phone banking in Kenya. The work reveals that mobile money transfers facilitate payment for services of which labor is no exception. Per the study, prompt payment of weekly labor in remote parts of Kenya has led to a transformation of lives in Kenya, particularly in rural regions. This transformation is said to be in the right direction and suggests that the people of rural areas can now readily afford to pay for their needs on time and can increase their spending on goods and services. Thus adding to Mudau & Douglas, (2016) findings that the uptake of mobile money has increased the velocity of money and spending in the economy.

2.4 Overview of literature

From earlier studies on the theory of Savings, it is evident that many factors have an effect on savings. However, it can be noted from the literature reviewed that there appears that the earlier theories may have not conclusively studied developing countries due to the low financial inclusion in the timings of the papers. Hence, with the recent high rate of financial innovations of in developing countries, recent saving behaviors may have not been covered extensively. Hence a gap in literature can be identified concerning savings behaviors and current financial innovations.

2.5 Conceptual Framework

Figure 1: Conceptual framework

Based on the statement of the research problem, the mobile money technology leads to an increase of access to financial services and liquidity. From the above literature we find that increased liquidity may affect spending and savings in economies. From this and available data, the independent variable in this study are Mobile money transactions, the intervening variable as access of financial services and liquidity, and the dependent variables are Private savings.

3. METHODOLOGY

3.1 Research Design

The research design used in the study is an exploratory study based on time series analysis. A quantitative analysis measuring the long run effect of mobile money on private savings holding is considered.

3.2 Data collection

The study uses monthly mobile money transactions data collected from the Central Bank of Kenya website and monthly Private savings from the leading economic indicators from the KNBS Economic Survey. In order to calculate private savings ratio, Private savings was made a ratio of the GDP of Kenya by simple division. The relative figure gives a better view of the impact in the economy over time. It also gives better econometric figures and takes into account the growth of the economy over time.

3.3 Estimation and Testing

3.3.1 Unit root Test

When studying econometric relationships using time series data, there is concern about spurious regressions when data series used are non-stationary. Any time series data can be thought of as being generated by a stochastic or random process; and a concrete set of data can be regarded as a particular sample of the underlying stochastic process. Time series data can be stationary or non-stationary, but usually exhibit non-stationary characteristics. In the classical linear regression, the use of non-stationary variables is likely to give misleading results and that the asymptotic properties do not apply. Therefore it was important to determine the stationarity conditions of the variables in the model. A series is considered stationary when it has no trend i.e. when its mean and variance are constant overtime (Enders, 1995).

Testing for stationarity first involves testing for the order of integration of each variable using the Augmented Dickey-Fuller (ADF) unit root tests (Gujarati, 1995). This involves the test of a null hypothesis of non-stationarity against alternative of stationarity on models depicting random walk, random walk with a drift or random walk with a drift and a trend, (if prior preceding models fail to have a unit root). If the null is rejected, a series has a unit root and is said to be integrated of order zero, I (0); if not, the series was not stationary at levels but could be made stationary after differencing d times, I (d).

The ADF, unlike the DF unit root test considers autocorrelation of the error term. Assuming no autocorrelations of the error term biases the tests and hence its control ensures that the error term is a white noise. This made it necessary to make inference on the order of integration.

The ADF unit root test uses the autoregressive equations given as:

(i) ADF with both trend and intercept

$$\Delta Y_t = \alpha + \beta T + PY_{t-1} + \sum \delta_i \Delta Y_{t-1} + u_t$$

(ii) ADF with an intercept but no trend

$$\Delta Y_t = \alpha + PY_{t-1} + \sum \delta_i \Delta Y_{t-1} + \mu_t$$

The above equations are used to test a null hypothesis that p =1(existence of a unit root) against the alternative hypothesis that p < O. Upon estimation, if computed t statistic is greater than the critical statistic the null p =1 is rejected, indicating that the series is stationary. If the null hypothesis is not rejected, this indicates that Y_t is non-stationary.

3.3.2 Cointegration Test

Generally most of the economic variables to be non-stationary – I (1). Hence, any equilibrium theories that involve these variables require the existence of a combination of the variables to be stationary. Cointegration is an econometric method for testing the correlation between non-stationary time series variables. If two or more series are themselves non-stationary, but a linear combination of them is stationary, then the series are said to be cointegrated. Cointegration implies long run relationship of economic variables that is the economic variables may drift apart from each other in the short run but remain converged to each other in the long-run (Banerjee A. , 1993). In testing for co integration in this study, the Engle and Granger two-step estimation procedure is first used and the results are compared with Johansen Cointergration test. It is important to note that the superior test for cointegration is Johansen's test as it permits more than one cointegrating relationship.

Hypothesis

The null hypothesis in the study is:

The Mobile money transactions do not affect private savings ratio in Kenya.

4. DATA ANALYSIS

The model contains two variables: Private savings ratio and Value of mobile money. Monthly data is collected from the introduction of mobile money in March 2007 to December 2016 making a total of 118 observations.

4.1 Descriptive Statistics

Descriptive statistics are used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures. Together with simple graphics analysis, they form the basis of virtually every quantitative analysis of data.

*VALUE__KSH_BILLIONS_*		*PRIVATE_SAVINGS_RATIO*	
Mean	123.283964	Mean	1.34E-05
Standard Error	8.393198678	Standard Error	1.64E-07
Median	117.0255	Median	1.37E-05
Mode	#N/A	Mode	#N/A
Standard Deviation	91.17347486	Standard Deviation	1.78E-06
Sample Variance	8312.602519	Sample Variance	3.17E-12
Kurtosis	1.103907732	Kurtosis	-0.46506
Skewness	0.312546116	Skewness	-0.14082
Range	316.7086095	Range	6.73E-06
Minimum	0.0643905	Minimum	1.01E-05
Maximum	316.773	Maximum	1.68E-05
Sum	14547.50776	Sum	0.001578
Count	118	Count	118

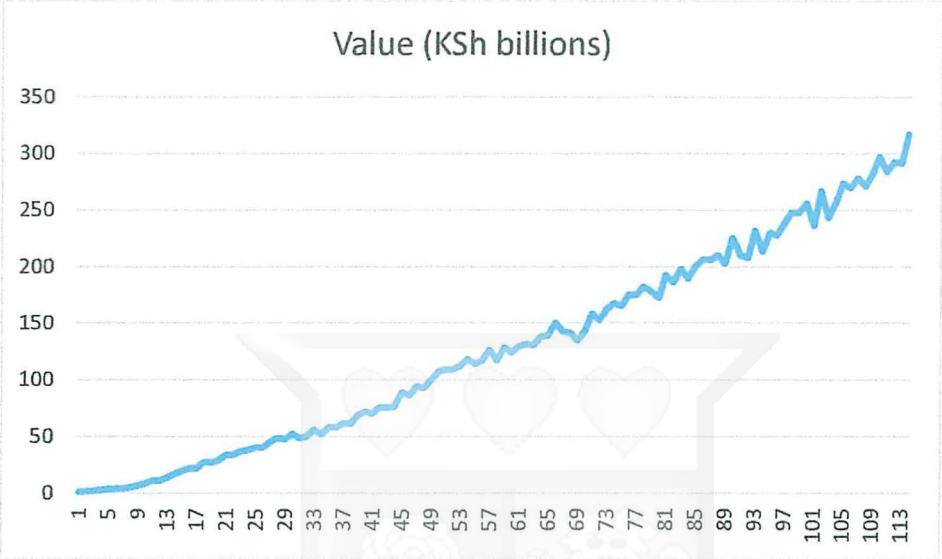
Table 1: Descriptive statistics

4.2 Graphical Analysis

Graphical analysis gives a visual of the data and gives what to expect from the data analysis.

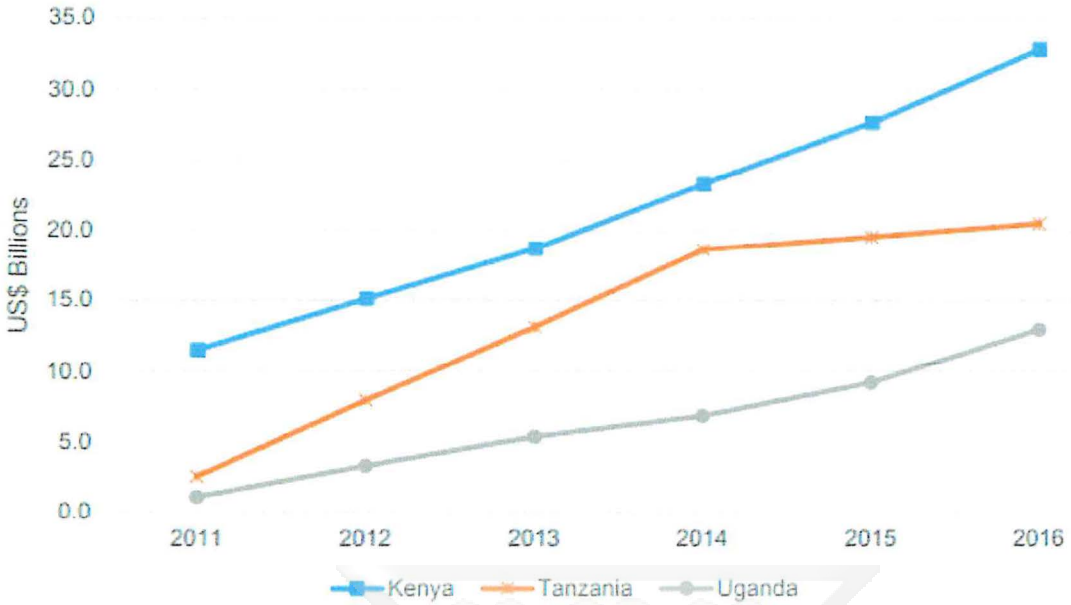
4.2.1 Value of money

The value of mobile money is given in ksh billions.



Graph 5: value of money graphical analysis

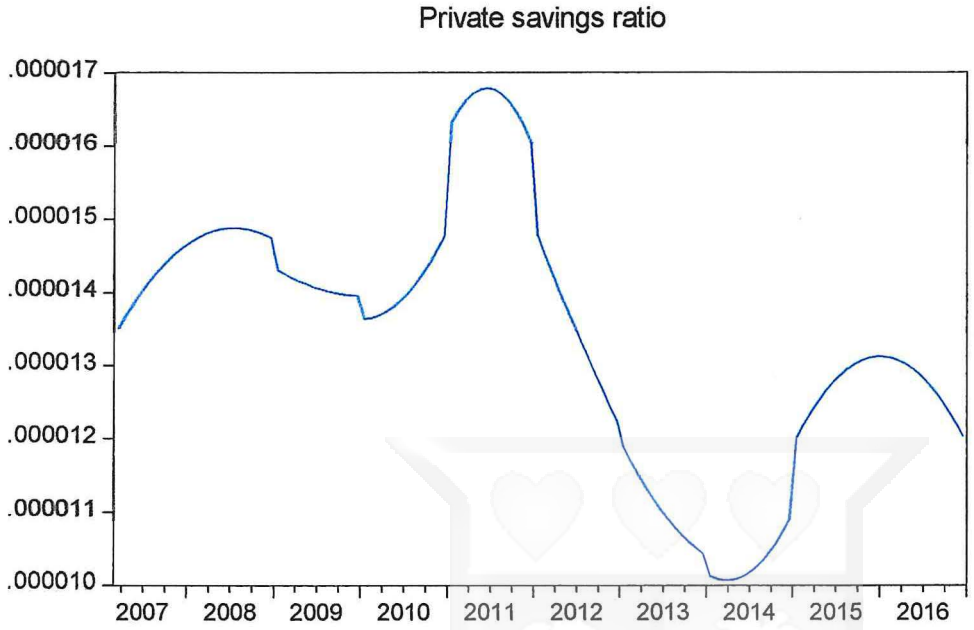
The data can be seen to be constantly increasing over time. The data also shows absence of stationarity but presence of a strong trend. In line with this findings, the 3rd Annual Competition and Economic Regulation (ACER) Conference of July 2017 carried out a comparison and found the following comparative graph in relation to the same, with available data from the three east African economies: Tanzania, Kenya and Uganda. Evidently, Kenya leads in the sector followed by Tanzania and finally Uganda.



Source: Central Banks of Kenya, Tanzania and Uganda

Graph 6: Comparison, East African mobile money transaction (2011 to 2016)

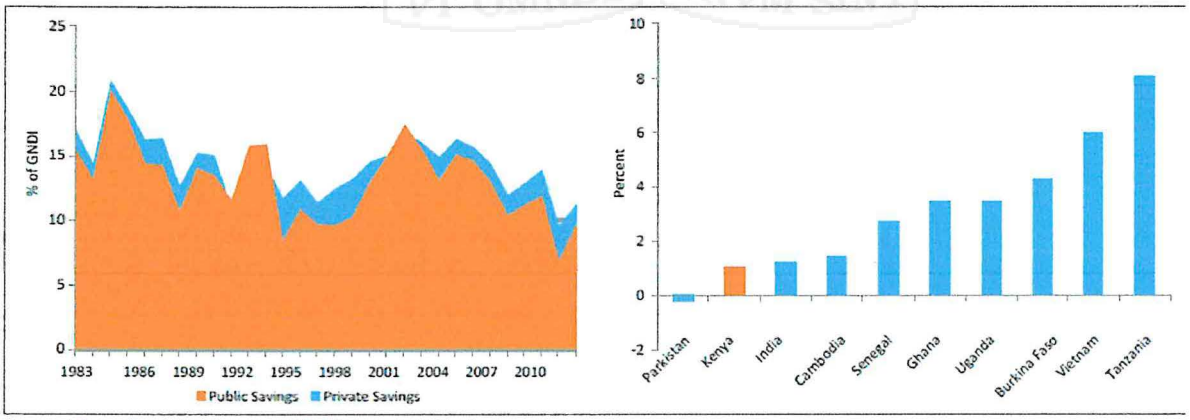
4.2.2 Private Savings Ratio



Graph 7: private savings ratio graphical analysis

The data seems to have a downwards slope with occasional variation. The data also shows absence of stationarity due to lack of a constant mean or variance, but presence of a trend.

Further on the same, the International monetary Fund World Economic Outlook carries out a study on International private saving and does a comparison with other developing economies. They expressed that Kenyan savings in constantly low and declining. The graph is presented below.

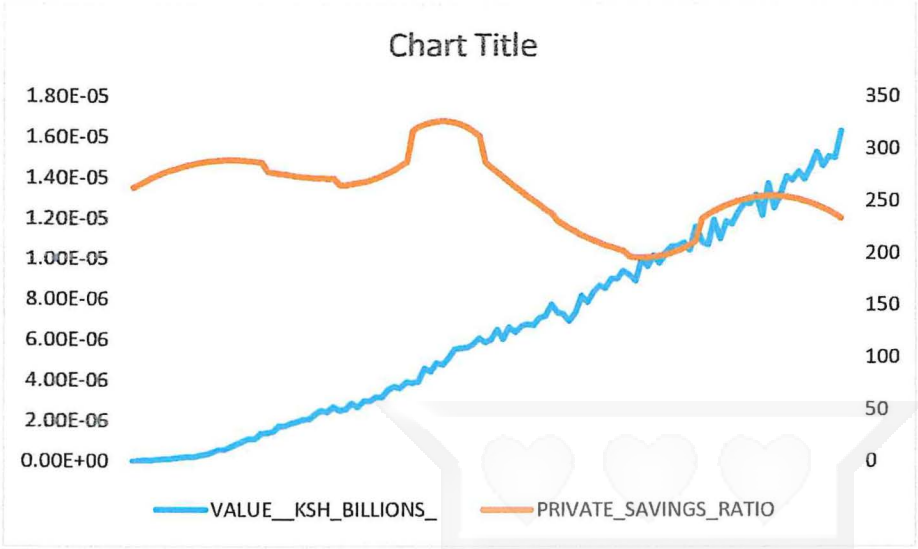


Source: International Monetary Fund World Economic Outlook.
Note: In panel b, national savings as a percentage of GNDI is the average for the 2000s. GNDI = gross national disposable income.

Figure 2: IMF developing countries private savings comparison

4.2.3 Combination

The graph below gives a graphical outlook of the relationship between the two variables.



Graph 8: Combined Graphs

From the graph above we can see that the two variables have an inverse relationship.

4.3 Correlation analysis

Correlation is a statistical technique that can show whether and how strongly pairs of variables are related. However, it is important to mention that correlation does not imply causality and further empirical analysis is necessary.

	Value of mobile money	Private Savings Ratio
Value of mobile money	1	-0.577656926
Private Savings Ratio	-0.577656926	1

Table 2: Correlation matrix

From the above analysis, we can see that the two variables have an inverse relationship. Such that, when one variables increases, the other variable decreases by 0.577656926.

4.4 Unit Root test

The use of eyeball inspection to make decisions on whether a series is stationary or not may be misleading. This study employed a widely accepted test for stationarity, the Augmented Dickey-

Fuller (ADF) unit root tests to formally test for stationarity of the variables. Unit root tests are performed at different lag lengths up to 4 lags.

Ho: Variable has unit root or is not stationary

H1: Variable does not have unit root or is stationary

Decision criteria:

1. Reject null hypothesis if P value is less than 5%.
2. Reject null if the absolute value of the test statistic is greater than the critical value.

4.4.1 Private Savings Ratio Unit root test

4.4.1.1 P value approach:

	Level	1st Difference
Intercept	0.5389	0.0007
Trend and Intercept	0.5721	0.0045
None	0.4455	0.0000
Decision:	Fail to reject null hypothesis	Reject Null hypothesis

Table 3: Pvalue approach; Private savings ratio

4.4.1.2 Test statistic approach:

	Intercept	Trend and Intercept	None	Decision
Level				Fail to reject null hypothesis
Test statistic:	-1.482775	-2.041756	-0.622805	
1% level:	-3.488063	-4.039797	-2.585226	
5% level:	-2.886732	-3.449365	-1.943637	
1st difference				Reject null hypothesis

Test statistic:	-4.308536	-4.298815	-4.307291	
1% level:	-3.488063	-4.039797	-2.585226	
5% level:	-2.88063	-3.449365	-1.943637	

Table 4: Test statistic approach; Private Savings ratio

From the two approaches taken we can see that Private savings ratio is non-stationary at level and stationary first differentiation. We can therefore conclude that the Private Savings ratio follow an integration of order 1. This result agrees with Marcel & Kirori, (2016) on private savings.

4.4.2 Mobile money transactions Unit root test

4.4.2.1 P value approach:

	Level	1st Difference	2nd Difference
Intercept	0.9999	0.2062	0.0000
Trend and Intercept	0.9837	0.0840	0.0000
None	0.9108	0.7896	0.0000
Decision:	Fail to reject null hypothesis	Fail to reject null hypothesis	Reject null hypothesis

Table 5: P value approach Value of mobile money transactions

4.4.2.2 Test statistic approach:

	Intercept	Trend and Intercept	None	Decision
Level				Fail to reject null hypothesis
Test statistic:	2.237726	-0.467089	0.966619	
1% level:	-3.493747	-4.047795	-2.587172	
5% level:	-2.51596	-3.453179	-1.943912	
1st difference				Fail to reject null hypothesis
Test statistic:	-2.203952	-3.231576	0.370224	

1% level:	-3.493747	-4.047795	-2.587172	
5% level:	2.581596	-3.152153	-1.943912	
2nd difference				Reject null hypothesis
Test statistic:	-7.753908	-7.722445	-7.672313	
1% level:	-3.493747	-4.047795	-2.587172	
5% level:	-2.889200	-3.453175	-1.614713	

Table 6: test statistic approach Value of mobile money transactions

From the two approaches taken we can see that the value of mobile money transactions is non-stationary at level and first differentiation but stationary under second differentiation. We can therefore conclude that the value of mobile money transactions from 2007 to 2016 follow an integration of order 2. These findings disagree with findings in studies by Nyasimi, (2016) who finds an integration of order 1 on the value of mobile money transactions.

In order to carry out a cointegration test, variables must follow a similar integration of order 1. Hence, we take the first difference of the mobile money transactions. We also take the first lag of private savings ratio in order to reduce the variability of the variable as well as giving better econometric properties. The following tests approve the validity of the two adjusted variables.

4.4.3 First difference of Mobile money transactions Unit root test

4.4.3.1 P value approach:

	Level	1st Difference
Intercept	0.2062	0.0000
Trend and Intercept	0.0840	0.0000
None	0.7896	0.0000
Decision:	Fail to reject null hypothesis	Reject null hypothesis

Table 7: P value approach; first difference of the value mobile money transactions

4.4.3.2 Test statistic approach:

	Intercept	Trend and Intercept	None	Decision
Level				Fail to reject null hypothesis
Test statistic:	-2.203952	-3.231576	0.370224	
1% level:	-3.493747	-4.047795	-2.587172	
5% level:	2.581596	-3.152153	-1.943912	
1st difference				Reject null hypothesis
Test statistic:	-7.753908	-7.722445	-7.672313	
1% level:	-3.493747	-4.047795	-2.587172	
5% level:	-2.889200	-3.453175	-1.614713	

Table 8: Test statistic approach; first difference of the value mobile money transactions

From the two approaches taken we can see that the first difference of the value of mobile money transactions is non-stationary at level and stationary first differentiation. We can therefore conclude that the first difference of the value of mobile money transactions follow an integration of order 1.

4.4.4 Log of private Savings ratio Unit root test

4.4.4.1 P value approach:

	Level	1st Difference
Intercept	0.5408	0.0012
Trend and Intercept	0.3846	0.0076
None	0.8067	0.0001
Decision:	Fail to reject null hypothesis	Reject null hypothesis

Table 9: P value approach; log of Private Savings Ratio

4.4.4.2 Test statistic approach:

	Intercept	Trend and Intercept	None	Decision
Level				Fail to reject null hypothesis
Test statistic:	-1.478899	-2.386411	0.436969	
1% level:	-3.488063	-4.040532	-2.585226	
5% level:	-2.886732	-3.449716	-1.943637	
1st difference				Reject null hypothesis
Test statistic:	-4.143240	-4.131711	-4.138920	
1% level:	-3.488063	-4.039797	-2.585226	
5% level:	-2.886732	-3.449365	-1.943637	

Table 10: Test statistics approach; log of Private Savings Ratio

From the two approaches taken we can see that log of private savings ratio is non-stationary at level and stationary first differentiation. We can therefore conclude that the log of private savings ratio follow an integration of order 1.

With the above adjustments, we can proceed to carry out the cointegration tests on the two i (1) variables. The next section outlines the cointegration test and results.

4.5 Cointegration tests

As stated in the methodology, two tests are conducted. The first being the Engle-Granger cointegration test and finally the Johansen cointegration test.

4.5.1 Engle Granger Cointegration test

The Engle Granger approach relies on establishing the presence or otherwise of cointegration between variables in a regression. It does so by a close examination of the properties of the residuals from a regression.

Engle & Granger, (1987) recommend a two-step procedure for cointegration analysis.

(i) Estimate the long-run (equilibrium) equation:

$$y_t = \delta_0 + \delta_1 x_t + u_t$$

The OLS residuals from above are a measure of disequilibrium:

$$u_t = y_t - \hat{\delta}_0 - \hat{\delta}_1 x_t$$

A test of cointegration is a test of whether u_t is stationary. This is determined by ADF tests on the residuals, with the Davidson & MacKinnon, (1993) critical values adjusted for the number of variables (which MacKinnon denotes as n). If cointegration holds, the OLS estimator is said to be super-consistent. Implications: as T $\rightarrow \infty$ there is no need to include I (0) variables in the cointegrating equation.

(ii) Second step: estimate the Error Correction Model

Estimation of $\Delta y_t = \phi_0 + \sum_{j=1} \phi_j \Delta y_{t-j} + \sum_{h=0} \theta_h \Delta x_{t-h} + \alpha \hat{u}_{t-1} + \varepsilon_t$ by OLS as this equation has only I (0) variables, standard hypothesis testing using t-ratios and diagnostic testing of the error term is appropriate. The adjustment coefficient α must be negative for the model to be significant.

4.5.1.1 Long-run equilibrium equation

The model being estimated is as follows:

$$lpsr = \delta_0 + \delta_1 dvkb + u_t$$

Where:

Lpsr	Log of private savings ratio
dvkb	First difference of value of mobile money in ksh billions

Hence:

$$u_t = lpsr - \hat{\delta}_0 - \hat{\delta}_1 dvkb$$

Following is an Engle Granger Unit root test on the residual with the following null hypothesis.

H_0	u_t has unit root
H_a	u_t does not have unit root
Decision Criteria:	Reject null hypothesis if t-statistic is less than the Davidson & MacKinnon, (1993) critical values

Davidson & MacKinnon, (1993) critical values for 2 variables are as follows:

1%	-3.90
5%	-3.34
10%	-3.04

Table 11: Davidson & MacKinnon critical values

The t-statistic for the residual is estimated as -1.832769 which is less that the critical values at all levels. We therefore reject the null hypothesis and conclude that according to the Engle-Granger approach, the variables have a long run relationship and are cointegrated. Therefore the model is a long-run model and the coefficient $\hat{\delta}_1$=-0.000837 is a long run coefficient. As this value is a negative value, it implies an inverse cointegration relationship between the two variables.

4.5.1.2 Step 2: Error correction model

As the variables dvkb and lpsr are cointegrated, we can run the error correction model. The main advantage of the model to simple short term dynamics is that it incorporates both short run dynamics and long run characteristics of the model simultaneously. This is since the model incorporates long run equilibrium as we will observe below. For the error correction model, the variables must be stationary, hence the first difference of the I (1) variables are used as seen in the model below:

$$d(lpsr) = \delta_2 + \delta_3 d(dvkb) + \delta_4 u_{t-1} + v$$

Where:

d(lpsr) and d(dvkb) are the first difference of the variables

δ_2 is the intercept/constant

$\delta_3$is the short run elasticity of d(lpsr) with respect to d(dvkb)

δ_4 the speed of adjustment of *d(lpsr)* to last period's to last period's error

V is the white noise error term

$u_{t-1}$is the first lag of the residual of the model$lpsr = \delta_0 + \delta_1 dvkb + u_t$. It is the error correction term as it corrects for disequilibrium and reflects the current error in achieving long-run equilibrium. As stated above, we expect that δ_4 would be less than zero.

Results:

Explanatory Variable	Coefficient	Std.Error	t-statistic	P-value
δ_2	-0.001085	0.001730	-0.626967	0.5319
δ_3	-0.0000935	0.000118	-0.809437	0.4200
δ_4	-0.007140	0.012651	-0.564403	0.5736
R-Squared	0.008176	Akaike Info. Criterion		-5.1022923
S.E. of regression	0.018633	F-statistic		0.465757
Durbin-Watson stat	1.070408	Probability (F-statistic)		0.628860

Table 12: Regression of ECM

From the above results we can see that the R-squared is less than the Durbin-Watson statistic and hence rejecting the null hypothesis that the model is spurious. The coefficient of δ_4 is less than zero hence proving the validity of the model. However the Pvalue of the variables is greater than the significance level of 5% hence we fail to reject the null hypothesis that the variables are not significant. However, due to the limitations of the Engle-Granger model and the weakness of the model due to minimal variables, this is justified and the observations are still considered. We move forward to other tests establishing whether this model best fits the data; diagnostic tests are performed and the eventual results are reported below:

Test		
Jacque-Bera Normality Test	t-statistic	0.000
Breusch-Godfrey serial correlation LM Test	t-statistic	0.000

Table 13: Diagnostic tests on ECM

From table, the Jarque-Bera test for normality, which tests the null hypothesis that the residuals of the estimated model are normal against an alternative that the residuals are not normal, depicts a t-statistic of 0.000. As the value is below the significance level of 0.05, it is an indication that the null hypothesis is rejected and that the residuals are not normal. Further, the Breusch-Godfrey serial correlation LM test tests the null that the variables in model are not serially correlated against an alternative hypothesis that they are serially correlated. The results show a t-statistic of 0.000. As the value is below the significance level of 0.05, it is an indication that the null hypothesis is rejected, giving evidence that the variables in the model are serially correlated. This model does not pass both tests and hence biased and not consistent. However, due to the limitations of the

Engle-Granger model and the weakness of the model due to minimal variables, this is justified. In order to increase the efficiency of the results, we proceed to the Johansen cointegration test.

4.5.2 Johansen Cointegration test

The Johansen Cointegration test follows as a complement to the Engle-Granger approach. The Engle-Granger procedure works well for a single equation, but it does not extend well to a multivariate VAR model. The Johansen test and estimation strategy, maximum likelihood, makes it possible to estimate all cointegrating vectors when there are more than two variables (Dwyer, 2015) treats all variables as endogenous variables making it more desirable (Wassell. & Saunders). Johansen (1988, 1991) proposed two tests: The trace test and the maximal eigenvalue test. The trace statistic checks whether the smallest eigenvalues are statistically different from zero while the Maximum Eigen statistic gives a bottom-to-top statistic.

The Johansen test can be seen as a multivariate generalization of the augmented Dickey Fuller test. The generalization is the examination of linear combinations of variables for unit roots. The Johansen technique has become the standard means of estimation in time series contexts. They are based on Granger's (1981) ECM representation. The tests done has 4 lags and 2 variables. In both test statistics, the below applies.

None	
H_0	There is no cointegration among the two variables
H_a	There is cointegration among the two variables
At most 1	
H_0	There is at least one cointegrated equation
H_a	There is no cointegration equation

4.5.3 Cointegration Test 1: Trace statistics

It is called the trace test because the test statistic's asymptotic distribution is the trace of a matrix based on functions of Brownian motion or standard Wiener processes (Johansen Econometrica 1995, p. 1555).

Decision Criteria: Reject null hypothesis is Pvalue is greater than 5%

Pvalue			
None:	0.0011	Reject null hypothesis	Presence of cointegration
At most 1:	0.2938	Cannot reject null hypothesis	There is at most 1 cointegrated equation

Table 14: Trace Statistics results

We can therefore conclude from the trace statistics that the two variables have long run association and move together in the long run.

4.5.4 Cointegration test 2: Max-Eigen statistics

The maximum eigenvalue test examines whether the largest eigenvalue is zero relative to the alternative that the next largest eigenvalue is zero. (Dwyer, 2015)

Decision Criteria: Reject null hypothesis is Pvalue is greater than 5%

Pvalue			
None:	0.0010	Reject null hypothesis	Presence of cointegration
At most 1:	0.2938	Cannot reject null hypothesis	There is at most 1 cointegrated equation

Table 15: Max-Eigen statistic results

The results from the max Eigen statistics imply that the two variables have long run association and move together in the long run.

The tables above show that there is a rank of 1 in both trace test and the maximum eigenvalues test implying that there is need to reject the null hypothesis of no cointegration in favor of the alternative hypothesis of the existence of cointegration. Therefore, there is one cointegrating equation at 5 percent level of significance, based on both tests and hence the existence of the long-run relationship among log of private savings ratio and first difference of value of mobile money technology.

4.6 Discussion of the results

The estimation results provide enough evidence of a long run relationship amongst the two variables. From the correlation and Engle Granger analysis, the relation is implied as inverse. Such

that, an increase in one may lead to a decrease in the other. However, the Johansen test disapproves by giving a positive coefficient of the relationship. Given the proved validity of the Johansen test, a significant weight is given to this result. However, we cannot disregard the former. Thus we can conclude that there is a definite relationship between the two variables but the nature of the relationship is inconclusive.

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of findings and Conclusions

This study aimed at establishing the impact of the value of mobile money transactions and private savings ratio. The study used monthly secondary data from the introduction of mobile money in March 2007 to December 2016.The study has explored in a macroeconomic aspect the long-run relationship between the value of mobile money and private savings as a ratio of GDP.

The analysis used was effective in establishing the objectives of the study. The descriptive, graphical and correlation statistics showed an inverse relationship of the two variables. However, these do not give evidence of causal relationships in the model. The unit root tests showed the trends of the two variables with the value of mobile money having a constantly increasing positive trend while the private savings ratio having a slower decreasing trend. The cointegration analysis gave evidence of a long run relationship but gave inconclusive results on the nature of the relationship. The second step of the Engle-granger test had various inconsistencies such as significance of the variables and residual statistics that were not supporting the model. However, the Johansen tests had relatively positive outputs that complimented the cointegration relationship of the two variables. However, the results of the Johansen test contradicted with the results of the Engle-Granger test making the nature of the relationship inconclusive.

This however presents the need for further studies on the topic. It also implies that despite previous empirical studies showing mobile money having a positive impact on savings, this may not be entirely true. From the empirical literature, the positive relationship may be from the increase of financial inclusion in the economy. The negative relationship may be from the increased velocity and spending caused by increase of access to financial services in the economy.

5.2 Policy Recommendations

From the empirical findings of this study, policy implications can be drawn. Based on the Harrod-Domar model, savings are a key factor of economic growth. As financial innovation continues to become an important aspect in developing economies, it is important to establish the true post effects of such in economies. In a bid to increase private savings in the economy and boost investment levels, further studies should be conducted on how mobile money can positively affect private savings in the economy. Furthermore the government can facilitate such research through funding and encouragement.

Evidence from this study also suggest that the increased financial inclusion has a positive relationship towards private savings in the economy, thus should be implemented to have more reach. Evidence from this study also implies that the value of mobile money transaction is constantly increasing and thus more individuals are using it more often while other people continue to use it with more transactions.

The study also shows that there is increased spending in the economy due to the increase of access to financial services. In as much as the theoretical evidence presented in this study show saving as necessary for economic growth, spending may also be beneficial. Economic theory stipulates that increased circulation of money may lead to economic growth. However, for a developing economy like Kenya, saving is a priority. Anything that may have a significant negative impact on such should be addressed. Hence the possibility of mobile money doing so ought to be studied carefully and solutions as well as innovations aiding the relationship to make it positive is necessary.

5.3 Limitation of the study

The major limitation encountered in carrying out this study was the lack of asymptotic data. Mobile money was introduced in the economy in 2007, giving the study a 10 year interval to the date of this study. Fortunately, the data on mobile money is available on a monthly interval giving the study 118 observations. However, private savings is given in annual intervals while GDP is given in quarterly intervals. This lead to extrapolation of Private savings ratio. As a requirement of time series analysis, data must be asymptotically large. However, extrapolation the data may not bring about the true results that the efficiency of the analysis requires. Hence the results of this study may suffer from short sample bias.

5.4 Suggestions for further Research

The study can be executed at a later date when more time series data is available for further analysis. Panel data can also be considered with other economies that have implemented the technology so as to have a broader view of the study. A microeconomic outlook could also be implemented while using primary data due to the minimal available secondary data on the new technology. This could give a qualitative approach to the topic. Further aggressive studies to determine the true nature on the relationship of the two variables ought to be carried out. Lastly, in line with this topic an analysis on the impact of mobile money transactions on spending in the economy could also be beneficial as this will give a counter argument to the study. With this, we

can establish how to achieve wholesome economic growth through both outlooks in the sector of study.

References

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

AfDB. (2011). Inflation dynamics in selected East Afican Countries: Eithopia, Kenya, Tanzania and Uganda.

Aker, J. C., & Mbiti, I. M. (2010). Mobile Phones and Economic Development in Africa.

Aron, J. (2015). 'Leapfrogging': a Survey of the Nature and Economic Implications of Mobile Money.

Aron, J., & Muellbauer, J. (2015). DOES MOBILE MONEY CAUSE INFLATION? EVIDENCE FROM INFLATION MODELS FOR UGANDA.

Banerjee, A. (1993). Time Series Data Unit roots and Cointegration: An Overview. *Oxford Bulletin of Economic and Statistics, special issue, November 61*.

Banerjee, A. V., & Mullainathan, S. (2010). The Shape of Temptation: Implications for the Economic Lives of the Poor.

Banerjee, A. V., & Mullainathan, S. (2010). The Shape of Temptation: Implications for the Economic Lives of the Poor.

Banerjee, A., & Mullainathan, S. (2010). The Shape of Temptation: Implications for the Economic Lives of the Poor. *National Bureau of Economic Research Working Paper Series 1–49*.

Cobla, G. M., Osei-Assibey, E., & Asante, Y. (2015). MOBILE MONEY TECHNOLOGY AND SPENDING BEHAVIOUR OF STUDENTS OF THE UNIVERSITY OF GHANA.

Communications Authority of Kenya. (2017). Third Quarter Sector Statitics report fr the financial year 2016/2017.

Davidson, R., & MacKinnon, J. (1993). Estimation and Inference in Econometrics. *Oxford University Press, New York, NY*.

Demirguc-Kunt, A., & Klapper, L. (2012). Measuring Financial Inclusion: The Global Findex Database. *World Bank Policy Research Working Paper*.

Demombynes, G., & Thegeya, A. (2012). Kenya's Mobile Revolution and the Promise of Mobile Savings.

Domar, E. (1946). Capital Expansion, Rate of Growth, and Employment. *Econometrica*.

Donner, J., & Tellez, C. A. (2008). Mobile banking and economic development: linking adoption, impact, and use.

Duesenberry, J. (1949). Income, Saving and the Theory of Consumer Behaviour. *Cambridge: Harvard University Press*.

Dwyer, G. P. (2015). The Johansen Tests for Cointegration.

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

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: Representation, estimation and testing. *Econometrica*.

Ernst & Young. (2009). Mobile money An overview for global telecommunications operators.

Friedman, M. (1957). Theory of the Consumption function,. *Princeton University Press*.

FSD Kenya. (2016). Annual Reprt .

Gedela, S. (2012). Determinants of saving behaviour in rural and tribal households: an empirical analysis of Visakhapatnam district.

GSMA. (2016). State of the Industry Report on Mobile Money.

Gujarati, D. (1995). Basic Econometrics (3rd Ed.). *McGraw-Hill International Editions.New York*.

Harrod, R. F. (1939). An Essay in Dynamic Theory. *The Economic Journal*.

Hayhoe, C. R., Leach, L., & Turner, P. R. (1999). Discriminating the number of credit card held by college students using credit and money attitudes.

Hirschman, E. C. (1979). The Relationship of Credit Card Acceptance to Retail Purchasing.

Ibrahim, B. A. (2015). An Analysis of Adopting Mobile Banking in Kenya.

Jack, W., & Suri, T. (2011). Mobile Money: The Economics of M-Pesa.

Juselius, K. (2006). *The Cointegrated VAR Model: Methodology and Application.* Oxford: Oxford University Press.

Kendall, J., Maurer, B., Machoka, P., & Veniard, C. (n.d.). *An Emerging Platform: From Money Transfer System to Mobile Money Ecosystem.*

Keynes, J. (1936). The general theory of employment interest rate and money,.

King, M. (2012). Is Mobile Banking Breaking the Tyranny of Distance to Bank Infrastructure? Evidence from Kenya. *Trinity College Dublin*.

Kivindu, M. M. (2015). Factrs Determining Gross Domestic savings in Kenya.

Kulikov, D., Paabut, A., & Staehr, K. (2007). A Microeconometric Analysis of Household Saving in Estonia Income, Wealth and Financial Exposure.

Ky, S., & Rugemintwari, C. (2014). Does the adoption of Mobile Money affect Savings? Evidence from Burkina Faso.

Ky, S., Rugemintwari, C., & Sauviat, A. (2016). Does Mobile Money Affect Saving Behavior? Evidence from a develping country. *Université de Limoges, LAPE, 5 rue Félix Eboué, 87031 Limoges Cedex, France*.

Makau, P. M. (1995). Financial Mobilization and Macroeconomic Stability in Kenya'. *Centre for economic research Africa*.

Marcel, I. O., & Kirori, G. N. (2016). ANALYZING THE DETERMINANTS OF PRIVATE SAVINGS IN KENYA OVER THE PERIOD 1993-2013. *The Catholic University of Eastern Africa*.

Maurer, B. (2012). Mobile Money: Communication, Consumption and Change in the. *Journal of Development Studies*.

Mbiti, I., & Weil, D. N. (2011). The Home Economics of E-Money: Velocity, Cash Management, and Discount Rates of M-Pesa Users.

Mbiti, W. (2016). African Successes, Volume III: Modernization and Development. University of Chicago Press.

Modigliani, F., & Ando, A. (1963). The life cycle hypthesis of saving; aggregate implications and tests.

Modigliani, F., & Brumberg, R. E. (1954). Utility analysis and the consumption function: An interpretation of cross-section data inPost-Keynesian Economics.

Mudau, M., & Douglas, S. (2016). Mobile Financial Services Part II: Banking the Informal Market.

Ndirangu, E. P. (2013). Determinants of Gross domestic Savings in Kenya (1970-2013). *Internaion Journal of Economics, Commerce and Management*.

Nyasimi, E. W. (2016). EFFECTS OF MOBILE MONEY TRANSFER SERVICES ON ECONOMIC GROWTH IN KENYA.

Shefrin, H. M., & Thaler., R. H. (1988). The Behavioral Life-Cycle Hypothesis.

Thulani, D., Kosmas, N., Collins, M., & Lloyd, C. (2011). Adoption and use of SMS/mobile banking services in Zimbabwe: an exploratory study. Journal of Internet Banking and Commerce.

Tiriongo, K. S. (2005). DETERMINANTS OF AGGREGATE DOMESTIC PRIVATE SAVINGS IN KENYA, 1980-2003.

Wassell., C. S., & Saunders, P. J. (n.d.). TIME SERIES EVIDENCE ON SOCIAL SECURITY AND PRIVATE SAVING: THE ISSUE REVISITED.

World Bank. (1993). The East Asian Miracle. *Oxford University Press*.

World Bank. (2016). Kenya Economic Memorandum.