THE EFFECT OF MOBILE MONEY ON SAVINGS BEHAVIORS OF THE FINANCIALLY EXCLUDED

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ABSTRACT

This study investigates whether the use of mobile money affects the savings patterns of individuals that are vulnerable to financial exclusion, that is, the low-income earners, low-educated, women and rural habitants. Studying the case of Kenya, this study uses data from the 2016 FinAccess Household Survey (N=8,665) that was designed to track and measure the drivers, growth and impact of mobile money use in Kenya. Logistic model and the 2SLS IV regression are used as the empirical estimation method for testing the statistical significance of the correlation between mobile money usage and the savings behaviors of the individuals. The results show that users of mobile money are 1.96 more likely to have a savings product than those that do not use mobile money, and that the propensity for users of mobile money to save for emergencies and for future events is 1.44 and 1.27 times higher, respectively, as compared to the non-users. These findings suggest that individuals that use mobile money perceive it as a trustworthy, efficient and reliable store of value especially making savings for future use. This analysis also finds statistically significant evidence suggesting that mobile money use significantly increases the propensity to save for individuals in demographic groups that are more susceptible to the unique challenges that lower accessibility to formal financial services. Therefore, by increasing the probability of individuals in the female, low income, low education and rural groups to save, mobile money fosters financial inclusion which is essential in the realization of the Sustainable Development Goals such as reducing poverty, increasing equality and sustained economic growth among others. In general, this study has specific policy implications for using mobile money as a device for increasing financial inclusion among the 'unbanked' population.

Keywords: *mobile money, savings, financial inclusion, formal financial institutions, financially excluded*

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CHAPTER 1: INTRODUCTION

1.1 Background Overview

In developing countries where financial inclusion is very low, many individuals and households rely on informal means of saving such as saving "under a mattress", saving in jewels or livestock, saving in groups made of friends or relatives such as merry-go-rounds where individuals come together and contribute a given amount of money in a rotatory system (Steinert *et al*. 2018). However, the adoption of mobile financial services (MFS), also known as mobile money, has revolutionized and strengthened the financial infrastructure and services by providing households and individuals the opportunity to save, spend and transfer money through short messaging service (SMS) without formal bank accounts (Hove & Dubus, 2019). The growth of M-PESA, Kenya's largest mobile money service, has been a remarkable success story that has attracted research interest from various fields of study (Jack, Ray & Suri, 2013). M-PESA is a text message-based payments system that allows its users to receive, send, deposit, withdraw and save money as well as pay for services and goods using SMS text messages that are PIN-secured.[1] A decade of empirical research evidence on the impacts of mobile financial services suggest that this technology has enhanced financial inclusion, increased household savings, decreased the cost of receiving and sending money across large distances, reduced household risk sharing strategies and increased access to informal credit (Jack & Suri, 2014; Plyler, Haas & Nagarajan, 2010). On a macro-economic level, mobile financial services have created employment, reduced poverty, stimulated investment and created economic growth (Dubus & Van Hove, 2017; Jack *et al*. 2013; Suri & Jack, 2016).

1.2 Problem Statement

As a result of the limited access to formal financial institutions, many individuals in developing countries use informal savings methods that are at times risky, unconventional and unreliable (Adan, 2016; Batista & Vicente, 2017). For instance, individuals that save by buying jewel or

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[1] A detailed background information on the history and growth of M-PESA as well as how it works is provided in the literature review chapter.

livestock not only risk losing their savings in case of loss, theft or death of the animal, but are also unable to access their savings in the event of emergencies because they have to sell these assets off in order to get liquid cash. Also, other savings mechanisms such as saving "under a mattress" poses a risk of losing the money through theft or fire and one can be tempted to use the money for other purposes such as buying "temptation goods" (Ky *et al.* 2017). Further studies show that financial inclusion is very low in developing countries; and that majority of the individuals that have a limited access to formal financial services are mainly c (Demirgüç-Kunt & Klapper, 2013; Mas & Mayer, 2011). However, the rapid penetration, adoption, access and use of mobile money is changing the manner at which individuals use financial services. For instance, the "KCB M-PESA" and the "Mshwari" menu in the M-PESA toolkit allow users to save and borrow loans based on their savings at an interest rate (Cook & McKay, 2015). This is mainly because saving on the mobile money app offers a secure, convenient and efficient way of saving because users have instant access to these funds through their mobile money, and at the same time, reduces some of the risks of using the unreliable and risky informal savings method (Prina, 2015). There is strong empirical evidence showing that access to mobile money helps households to increase savings, increase consumption, increase use of a bank account and change occupational choices (Cook & FSD Kenya, 2015; Suri, 2017; Suri & Jack, 2016). While there is a growing evidence showing that mobile money use increases savings, it remains unclear how mobile money affects the savings behaviors of individuals that are more likely to be financially excluded, that is, low-income, low-educated, female and rural residents.

1.3 Research Purpose and Research Questions

This study investigates the effect of using mobile money on the savings patterns of individuals. The specific aims are to:

- Investigate whether mobile money use increases the individual's propensity to save
- Investigate the effect of using mobile financial services on the savings patterns of individuals that are vulnerable to financial exclusion, that is, the low-income earners, low-educated, women and rural habitants.

The research questions and the null hypotheses explored are:

- *Q1: Does mobile money use increase an individual's propensity to save?*

H_0: Mobile money use does not significantly increase the propensity of an individual to save

- *Q2: How does mobile money use affect the savings behaviors of individuals that are vulnerable to financial exclusion, that is, low-income earners, low-educated, women and rural habitants?*

H_0: Mobile money use does not increase the likelihood of individuals vulnerable to financial exclusion to save for emergency events and future activities

1.4 Significance of the Study

There are many factors that motivated the choice of exploring the effect of using mobile money on the savings patterns. First, savings is one of the main components that determines the financial satisfaction of individuals. Studies show that high savings and low loans are major determinants of financial satisfaction (Ali, Rahman & Bakar, 2015). Secondly, savings play a defining role in helping people to make investments, accumulate wealth and deal with financial vulnerabilities that may arise as a result of an adverse shock (Sherraden, 2017). In developing countries with poor formal institutions such as unreliable pension plans and dysfunctional healthcare and social system, individuals have to save for old age as well as against unpredictable events such as death in the family, sickness, loss of job, etc. Therefore, it is imperative to comprehend the linkage between mobile money use and saving patterns of individuals, because this study's outcomes can be used to create the appropriate technology and policy that encourages a saving culture among the 'unbanked' population. Also, many individuals living in the developing countries are casually employed and have irregular income sources, and this limits their savings options because they tend to be discriminated against by the formal financial institutions (Labie *et al*. 2015). Moreover, a big proportion of the population that are financially excluded are the women, the low-income earners and the less educated groups (World Bank, 2014). However, with the option to save using mobile money, financial inclusion for these vulnerable groups can be improved (Demirgüç-Kunt & Klapper, 2013). Lastly, empirical evidence from various countries show that savings are positively

correlated with economic growth and development at a macroeconomic level (Khandelwal & Joshy, 2017; Kim & Nguyen, 2017; Rosado & Sánchez, 2017). This implies that savings not only improves the welfare of the individual but also has the potential to influence the economic growth of a country. This analysis is relevant to policy makers, both at governmental and international level, that are considering improving the welfare of individuals through financial inclusion.

1.5 Theoretical Basis of the Study

The theories of money are used as the theoretical basis of this study mainly because mobile money fulfils money's function as a store of value and medium of exchange functions of money. The classical and neoclassical theories of money predominantly regard money primarily as a "means of exchange" (White, 1984). In Kenya, mobile money is widely accepted and used as a medium of exchange for making purchases of goods and services between businesses and individuals. On the other hand, the real economy perspective held by the classical and neo-classical school of thought place much emphasis on money's function as a store of value, or rather, money accumulation (White, 1984). Mobile money allows users to store value in their mobile money account, which offers more safety and convenience than informal savings methods because the money saved in the mobile account can be withdrawn at any time it is needed at a mobile money agent (Cook & McKay, 2015); and this increases the reliability and efficiency of mobile money as a store of value and a medium of exchange. The ability for users to save money in their mobile money account fulfils the 'store of value' function of money, which is of the greater relevance in this study.

1.6 Current Scientific Situation

A study undertaken in Burkina Faso show that mobile money use increases the propensity to save among individuals in groups that are classified as economically marginalized (Ky, Rugemintwari & Sauviat, 2017). However, this study was carried out in Burkina Faso where the adoption of mobile money is quite low as compared to Kenya (Ky *et al.* 2017). A different study exploring the effects of mobile money use on the savings patterns of female-headed households identifies a deficiency of studies that that examine the effect of using mobile money on other vulnerable groups such as low-income earners, low educated and rural residents in Kenya (Suri & Jack, 2016). Therefore, building on the existing empirical findings

on the connection between the use of mobile money and savings behaviors of individuals, this study investigates how mobile money affects the propensity of individuals to save for emergency and future events.

1.7 Research Design

This analysis relies on data gathered from a national survey named "2016 FinAccess Household Survey" that was designed to track and measure the drivers, growth and impact of mobile money use in Kenya (FSD Kenya, 2016). The survey includes questions about the use of mobile money and savings behaviors of the individuals. The sample size of the survey is 8,665 and this sample was randomly selected is statistically valid and nationally representative at the national, province and urban/rural level. The analysis uses the logistic model as the empirical estimation method for testing the correlation between mobile money use and the savings behaviors of the individuals. To test and solve for endogeneity, this analysis carries out an instrumental variable (IV) linear probability model (LPM) that uses Two-Stage Least Squares (2SLS) Regression Analysis.

1.8 General Outline of the Dissertation

This dissertation has six main chapters. The introduction chapter offers an introductory overview of the entire dissertation followed by the chapter on the theoretical framework of the study and covers an overview of M-PESA and then presents the theoretical basis of the study. The second chapter explores existing literature that links mobile financial services and the savings patterns of the users/non-users. In the fourth chapter, the data and model specification, the dataset, variables, the estimation method, the model specification and procedures used in the regression analysis are described. In the subsequent results and discussion chapter, the main results of the study and the inferences drawn from the results in relation to the existing theoretical models are presented. The conclusion chapter presents a summary of the study, identifies the study's contribution and areas for further research based on the findings and the gaps identified.

CHAPTER 2: THEORETICAL FRAMEWORK

2.1 Introduction

In order to have a better overview of the theoretical basis of this study, it is crucial to understand how the history of M-PESA and how it works as well as its impacts. This chapter is an overview of M-PESA and then presents the theoretical basis of the study.

2.2 An Overview of M-PESA

Initially established in 2007 by Safaricom as a microfinancing system, M-PESA has evolved into a mobile money system (Cook & Financial Sector Deepening, 2015). M-PESA works through inserting a Safaricom-provided SIM card into the card slot of a mobile device, which has a toolkit that allows the users to access different functions of the service. The users do not need to download any app because it works directly over the phone; and the registration is fast and effortless as it takes a few minutes. The Kenyan government oversees the management of M-PESA funds to ensures that users do not lose their money if Safaricom ever goes out of business.

Once registered, the user can access the phone's SIM menu where they choose between various options such as "send money", "withdraw cash", "buy airtime", "Mshwari", "Lipa na M-Pesa" and "My Account". Users can deposit e-money balances into their phone wallet and also convert the received/deposited e-balances into cash at the M-PESA agents who act as the mobile network operator's 'bank agents'. Deposits are cost-free but withdrawals and sending money comes with a transaction fee (Cook & FSD Kenya, 2015). The agents run other businesses that are not only related to the telecommunication industry (such as sales of airtime, mobile phone, computers and electronics), but also include gas stations, grocery stores, bank branches, tailors, etc. (Jack *et al*. 2013). The M-PESA system has been highly optimized and users can deposit e-money balances directly from their bank accounts as well as send their e-money balances into their bank accounts. Depositing e-balances is cost-free for users and users can convert their virtual balances into cash at the M-PESA agents by using the toolkit "withdraw cash", just like people withdraw money from an ATM.

In 2019, Safaricom introduced Fuliza M-PESA, which is not a loan product, but rather, a continuous overdraft service that cover the shortfall for users who want to send money or pay with M-PESA but have insufficient funds in their e-money wallet (Safaricom, 2019). The overdrawn funds are automatically deducted as soon as a user deposits funds or receives money in their M-PESA account and users have 30 days to pay back (Safaricom, 2019).

Money stored in the e-wallet can be sent to anyone with a mobile number regardless of whether they are users or non-users (Safaricom, 2019). The option "buy airtime" is cost-free and users can also buy airtime for other users. The term "Lipa na M-PESA" on the M-PESA toolkit means "pay with M-PESA" and with this option, mobile money users could purchase goods and services and also pay bills (). Safaricom has introduced a new service called "M-PESA 1Tap" that has further simplified the process of paying bills and buying products using M-PESA where the users use the to tap-and-go service in a simple, secure and reliable manner.

The "Mshwari" menu in the M-PESA toolkit is a bank account that allows users to save and borrow loans against their savings at an interest rate (Cook & McKay, 2015). Mshwari product is operated by Safaricom and the Commercial Bank of Africa, and it is subject to Kenya's full banking regulations (Cook & McKay, 2015). The more the user saves, the higher the interest rate (2% for KES 1-10,000 and 5% for amounts above 50,000). Mshwari also offers users the opportunity to lock in their savings at 1% additional interest rate. The minimum savings balance is KES 1 and maximum savings balance is 500,000 with a physical submission of an ID and unlimited for those who submit a physical tax ID (Cook & McKay, 2015). The loan term is 30 days where the minimum loan for the users is KES 100 and the maximum loan is KES 100,000. The loan can be renewed once at an additional loan facilitation fee of 7.5% of the outstanding balance. The M-PESA transaction fees and Mshwari interest rates are provided in Figure 1 in the appendix.

Since its adoption, M-PESA has transformed into the most extensively adopted and highly accessible mobile phone-based financial service in the world (Suri, 2015). Statistics from the Communications Authority of Kenya sector show that Safaricom controlled 69% of percentage point of subscriber market share in the financial year 2016/2017 followed by Airtel Networks Kenya whose market share was 17.5%. In its half-year results for the period ended September 2018, Safaricom made net profits of KES 31.5 billion (€277 million) whereby M-PESA

contributed to 64% of the service revenue growth attained during this period (Safaricom, 2018). In the six-month's period, Safaricom customer base reached 29.94 million and the number of 30-day active M-PESA users reached 21 million (Safaricom, 2018). In the 2017/2018 financial year, M-PESA registered earnings increased by 18.2% to KES 35.52 billion (€ 312 million) from the previous year's Ksh30.05 billion (€264 million). Out of the 198,234 mobile money agents that are registered in Kenya as of December 2017, Safaricom had 152,077 agents while its major rivals, that is, Airtel Kenya, Mobile Pay and Mobikash had 23,515; 5,893 and 16,749 agents respectively (Communications Authority of Kenya, 2018).

There is a remarkable body of evidence documenting how mobile money has reshaped conventional financial systems in developing countries as well as the unique uses of mobile money. For instance, Jack *et al*. (2013) found that 96% use the service to make remittances between person-to-person, 42% use it for savings purposes and 75% use it to purchase airtime, and 25% use it to pay for services, bills, and/or wages. In their study, Mbiti and Weil (2013) report that some users of mobile money keep money in their e-wallet account rather than to send and receive money because it is safer and more reliable way of saving money as compared to the informal savings mechanisms.

2.3 Theory

In his book "*Money and the Mechanism of Exchange*" Jevon (1875) defines the four main functions of money, that is, common measure of value, medium of exchange, standard of value, and store of value. Following the popularity of mobile money services, various studies have explored mobile money from the perspective of the theories of money (Fung *et al*. 2014; Dahlberg, 2015; Arvidsson, 2014). For payment instrument to be desirable, it should embody the characteristics of universality, convenience, information, security, certainty and economy (Dahlberg, 2015; Jacob *et al*. 2008). Mobile financial services comprise of all these characteristics. In modern economics where money that is stored in e-wallets, mobile money is regarded as store of value as long as the mobile money provider is seen as trustworthy, and it is also used as a medium of exchange for buying and selling goods and services between businesses and individuals that accept it as a medium of exchange (McLeay, Radia & Thomas, 2014). Mobile money is considered a desirable instrument of payment because it embodies

the characteristics of universality, convenience, information, security, certainty and economy as described by Dahlberg (2015).

The neoclassical and classical theories of money primarily consider money as a means of exchange, and these theories are historically based on barter trade (White, 1984). The various payment instruments in the economy are assumed to compete to be the most preferred methods of payments by the participants in the transactions (White, 1984). With relevance to e-money, this implies that mobile money payments must offer some incentives to the users, such as decrease in transaction costs, increase productivity and better security in order to be competitive (Dahlberg, 2015). These incentives are relevant to this study because saving money in a mobile money account offers more security and offers convenience to the users.

The state theory of money, which is commonly referred to as the neo-chartalist, regards money as state money where the central banks have the authority to control the monetary system (Wray, 2000). The government of Kenya oversees the management of mobile money funds to ensures that users do not lose their money if the providers become bankrupt. This makes users gain a feeling of safety when using mobile money as a driver of savings; and as a result, the state theory of money builds on the function of mobile money as a store of value.

The neoclassical and classical theories of money vary from the state theory of money in that the neo-chartalist school of thought looks at money from the perspective of monetary economy while the classical and the neo-classical economists looks at money from the real economy perspective (Wray, 2000). The real economy perspective place much emphasis on the money's fundamental function as a storing value, or rather, money accumulation. Therefore, the real economy perspective is very important in this analysis as it can explain the association between mobile money and saving.

The differences in the interactions between the neo-chartalist and classical and neo-classical school of thought can be seen in the functions of mobile money. The Central Bank of Kenya has the power to intervene and relax liquidity constraints even though the mobile money provider is more actively engaged in the managing e-liquidity by issuing e-money against unbacked money with an approval of the central bank. From a neo-chartalist perspective, the Central Bank of Kenya would intervene if there were liquidity issue, which creates confidence amongst users to save their money on mobile money. From the classical and the neo-classical

perspective, it is in the best interest for the provider to maintain e-liquidity for their mobile money in order to keep the service competitive. The interaction between these the role of the state and market forces are what makes mobile money efficient.

The social theory of money is closely relevant to the other theories of money but takes a sociological stance that builds on the work of Max Weber and Georg Simmel where money is regarded as a social construct that is recurrently re-negotiated and founded on the social relations between the monetary agencies and other society's economic agencies (Fine & Lapavitsas; Hunt, 2003). People use mobile money as a social network where people receive and send money within their social groups, hence strengthening their social relations.

In addition, the social theory of money is crucial in identifying the key stakeholders engaged in mobile financial services. These include m-money agents, mobile-network operators (MNOs), banks, retailers, employers, donors, civil society organizations, the media, microfinance institutions, and the end-users of the services (Jenkins, 2008). The social theory of money helps us to comprehend the structure of mobile money and also to explore the role of agents in the success of mobile money payments. Studies show that mobile money agents play a very vital role in increasing the access and adoption of the technology.

2.4 Conclusion

Looking at the mobile money's function as a store of value, this invention allows its users to save money at an interest through Mshwari, lock in their savings to stay away from "consumption temptations", keep their money on their mobile accounts without any interest, and even loan money at an interest. This access to microfinance options through the mobile money use increases access to informal credit and the propensity to save. In the long run, the use of the savings can improve the socioeconomic conditions of individuals by stimulating investments, increasing income and reducing poverty among other impacts. On the other hand, mobile money acts as a medium of exchange. The competitive advantage of mobile money as compared to paper money is its convenience, safety and affordability to send and receive among household. Thus, mobile money reduces the cost of sending money across large distances, increases consumption, enhances financial inclusion and reduces household risk sharing strategies among households.

CHAPTER 3: LITERATURE REVIEW

3.1 Introduction

This chapter presents what other researchers have already written with regard to how the use of mobile money influences the savings patterns of individuals, with an aim of locating this research within the existing literature context with the intention of understanding the research problem and identifying the existing research gaps.

3.2 Financial Inclusion and Mobile Money

In developing countries, the availability of efficient and reliable financial systems is central to financial inclusion, poverty reduction economic growth (Suri & Jack, 2016). However, the high transaction costs pose a major challenge to the efficiency of financial markets in these countries (Tavneet Suri, 2015). Statistics show that more than two billion individuals have very limited access to formal financial services and that majority of these individuals live in regions such as developing nations where financial inclusion is very low (World Bank, 2014). In this context, formal financial institutions are defined as institutions like microfinance and banks that are licensed and regulated by the state to deal with monetary and financial transactions such as deposits, investments, savings, currency exchange and loans. Empirical evidence suggests that financial inclusion as a major driver of economic growth has the potential of increasing the Growth Domestic Product (GDP) of emerging economies by 6% by 2025 (Manyika *et al*. 2016). In Kenya, more than 93 percent of households have access to M-PESA and 48.76% (KES 3.6 trillion = $26 billion) of Kenya's share of GDP is processed over M-PESA (Central Bank of Kenya, 2019). Further, increasing financial inclusion is considered central towards the realization of the Sustainable Development Goals such as poverty reduction and increasing equality (United Nations, 2015).

Further studies also show that mobile money has tremendously increased financial access and financial inclusion for vulnerable sociodemographic groups such as the poor and rural residents who have previously had low financial inclusion (Ouma *et al*. 2017). This is mainly because formal financial institutions do not have many products that suit the poor people, and these formal institutions are normally located in urban areas (World Bank, 2014). Majority of the individuals without an account in the formal financial institution cited barriers such as

high travelling costs, long distances to the financial institutions and not having enough deposit to open an account or maintain the costs an account as some of the barriers they faced (World Bank, 2014). The majority of the "unbanked" population mainly constitute of women, youth, low-educated, low-income earners and rural residents (Hove & Dubus, 2019).

The adoption, use, and access of mobile money has significantly improved financial inclusion of more than 1.6 billion people, where majority of them are women (Manyika *et al*. 2016). A report released by the African Development Bank describes mobile financial services as a "game changer in Africa", mainly because it allows users to "send and receive considerable volumes of small-value transactions without visiting a physical financial institution" (Trik & Faye, 2013, p. 2). Further, the high numbers of agents spread across the country makes it easier for users to transact and save using their mobile money accounts regardless of their location or socioeconomic status (Jack & Suri, 2011). Registration of mobile money is very simple as compared to the complicated the procedure of opening a bank account in Kenya. The accessibility, convenience, safety and reliability of mobile money has been essential in increasing financial access and financial inclusion in Africa.

3.3 Factors Contributing to M-PESA Adoption, Accessibility, Use and Growth

Several dynamics have played a central role in the rapid growth of M-PESA in Kenya. First, is the high mobile phone penetration in the country. In 2017, the penetration of mobile subscriptions was 91% (46.94 million users), which was higher than the 80% mobile penetration in Africa (Communications Authority of Kenya, 2018). By December 2018, the mobile penetration was estimated to be 100.1%. Statistics from the Kenya Bureau of Statistics attributed the upsurge in mobile penetration to the fact that around 30% of Kenyan mobile users possess at least two SIM cards from the either same or different service providers.

The second factor accelerating the uptake of M-PESA is the availability of agents who collect money which is then transferred to Safaricom who in turn deposits it in M-PESA trust accounts that are held in different commercial banks. One of the requirements to be a mobile money agent is to have a bank account where Safaricom can electronically make the deposits. The trust accounts are treated as regular current accounts and there are no restrictions on how Safaricom can access to funds. In 2017, the number of bank's ATMs decreased from 3,000 to

2,000 while the number of M-PESA agents increased from 161,583 in 2017 to 198,234 in 2018 (Communications Authority of Kenya, 2018).

The third factor is the convenience, security and ease of using mobile money. Using a technology acceptance model, Mbogo (2010) examined the role of mobile payments on micro-business and found that ease of accessibility, low cost, high security and the convenience of the of M-PESA encouraged micro businesses owners to use M-PESA and develop start-up ideas that enhanced their success and growth. Before the adaption of mobile money in Kenya, most households relied on informal methods of sending remittances such as hand-to-hand deliveries or informally through bus services/drivers, friends or post office, which was expensive (cost about €4 bus ride), created delays and had high risks of non-delivery or theft among others. However, M-PESA transaction costs are low and have high levels of certainty and safety in the shortest time possible (Suri, 2015).

3.4 Mobile Money and Savings

Individuals with low access to formal financial institutions, also known as the unbanked, often rely on informal savings methods that are unsafe, inconvenient and unreliable (Adan, 2016; Batista & Vicente, 2017). While some of these informal savings mechanisms such as saving in form of jewel or livestock or saving in rotating groups are convenient if one is to save for an activity in the future, individuals cannot rely on them in the event of an emergency and also, they are often characterized with risks (Gugerty, 2007). Informal saving method that have liquid cash such as saving under a mattress are also risky because the money might be stolen. Given the uncertainties that arise from using informal savings methods, it is safer, convenient and more reliable to save in a mobile money account.

Saving in a mobile money account is also more convenient and efficient than saving in a formal financial institution such as a bank. The number of mobile money agents have tremendously increased across the country over the last decade, both in rural and urban areas (Communications Authority of Kenya, 2018). In just between July 2016 and July 2017, 1.7 billion transactions were processed over M-PESA. These statistics demonstrate that mobile money services are growing faster than banking sector in the country. The availability of the mobile money agents in both rural and urban areas offers a more convenient alternative for users of both informal and formal savings mechanisms to use mobile money as their saving

alternative because mobile money users do not need to travel long distances to get to the nearest bank.

The evidence on the affiliation between mobile money and savings behaviors is mixed evidence. For instance, a randomized experimental study conducted in Mozambique found that farmers that used mobile money increased their savings and investments in farm produce as compared to mobile money non/users (Batista & Vicente, 2017). An earlier survey study examining the use of mobile money among smallholder farmers in Kenya also found that mobile money used increased farmers' incentives to save for future purchases of farm inputs, and as a result, farmers who used mobile money sold larger quantities of their produce and made higher profits than non-users (Kikulwe, Fischer & Qaim, 2014). These studies imply that mobile money use increases the capacity of the rural poor to save.

Suri & Jack (2016) found that mobile money increased the savings behaviors and financial resilience behaviors of female-headed households where majority of the women reported using their savings to change their occupational choice from agriculture into business. These findings indicate that mobile money can positively affect the saving behaviors of women. Survey results from Burkina Faso also showed that mobile money use increased the propensity to save for emergency purposes among low-educated, rural residents, low-income earners, female and irregular income earners (Ky, Rugemintwari & Sauviat, 2017). However, the study found no statistically significant correlation between using mobile money and the likelihood to save for future predictable events.

3.5 Conclusion

The two distinctive features that arise from the review of the existing literature are that: people within the vulnerable groups are capable of saving mainly through informal savings mechanisms due to the low financial inclusion in the developing countries; and adoption and the use of mobile money may or may not have an effect the savings patterns of individuals. This shows that there is a divide in the evidence on the nature of the correlation between savings and mobile money use. In the next chapter, the dataset, variables and the estimation method used to explore the interrelation between mobile money and individual's savings patterns are discussed.

CHAPTER 4: DATA AND MODEL SPECIFICATION

4.1 Introduction

This study investigates how the use of mobile financial services affects the individual's capacity or behavior to save, particularly for emergency and future events. This chapter provides a detailed description and explanation of the data, including the survey details and the demographic information of the sample. The chapter also describes the variables used, their indicators and a description of how they are measured. Further, the estimation method, the model specification and the endogeneity issues are discussed. The procedures followed in carrying out the 2SLS and logistic regression procedures are also discussed. It is important for researchers to highlight the distinct features of the study because different study designs, datasets, variables of interest and analysis techniques affect the validity, reliability, falsifiability, generalization and replicability of the study result (Machlup, 2004).

4.2 Survey details

This analysis relies on data collected from the 2016 FinAccess household survey that was collected in October 2015 as part of the baseline surveys that were collected earlier in 2006, 2009 and 2013 as a joint initiative between the Kenya National Bureau of Statistics, FSD Kenya, and Central Bank of Kenya. The survey was designed to track and measure the drivers, growth and impact of mobile money use in Kenya. The survey was part of a longitudinal study that was carried out in four rounds starting in 2006, with follow up in 2009, 2013, 2015 where the same households were tracked over the four rounds. The target sample was 10,008 but 8,665 face-to-face interviews (administered electronically) were successfully completed giving the survey an 87% success rate. The survey is statistically valid and nationally representative at the national, province and urban/rural level. The sample of the survey were individuals aged 18 years and above and they were randomly selected. The survey covered questions on savings and the use of financial services as well as general knowledge on mobile money. The surveys were administered to heads of households or their spouses in case they were absent after three visits.

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4.3 Demographic Data of the Sample

The sample size used in this study is 8,665. Descriptive statistics in Table 1 show that 56% (4,852) live in rural areas while 44% (3,813) live in urban areas. 60.9% of the respondents are female and 39.1% (3,384) are male.

Table 1: Descriptive demographic data of the sample

Variable		Frequency	Percent	Valid Percent	Cumulative Percent
Cluster type					
Valid	Rural	4852	56.0	56.0	56.0
	Urban	3813	44.0	44.0	100.0
	Total	8665	100.0	100.0	
Gender of respondent					
Valid	Male	3384	39.1	39.1	39.1
	Female	5281	60.9	60.9	100.0
	Total	8665	100.0	100.0	
Household head					
Valid	Male	6340	73.2	73.2	73.2
	Female	2325	26.8	26.8	100.0
	Total	8665	100.0	100.0	
Marital status					
	Single	2057	23.7	23.8	23.8
	Married	5234	60.4	60.6	84.4
Valid	Divorced/Separated	454	5.2	5.3	89.6
	Widowed	897	10.4	10.4	100.0
	Total	8642	99.7	100.0	
Age Group					
	16-17yrs	457	5.3	5.3	5.3
	18-25yrs	1971	22.7	22.7	28.0
	26-35yrs	2529	29.2	29.2	57.2
Valid	36-45yrs	1522	17.6	17.6	74.8
	46-55yrs	876	10.1	10.1	84.9
	>55yrs	1310	15.1	15.1	100.0
	Total	8665	100.0	100.0	
Education level of Respondent					
	None	1561	18.0	18.0	18.0
	Primary	3865	44.6	44.6	62.6
Valid	Secondary	2416	27.9	27.9	90.5
	Tertiary	823	9.5	9.5	100.0
	Total	8665	100.0	100.0	
Education level of Female Head/Spouse					
	None	2548	29.4	33.5	33.5
	Primary	3110	35.9	40.8	74.3
Valid	Secondary	1461	16.9	19.2	93.5
	Tertiary	498	5.7	6.5	100.0
	Total	7617	87.9	100.0	
Income group					
	KSh0-100	63	.7	.7	.7
	KSh101-1500	1256	14.5	14.7	15.5
	KSh1501-3000	1338	15.4	15.7	31.2
	KSh3001-7500	2110	24.4	24.7	55.9
	KSh7501-15000	1834	21.2	21.5	77.4
Valid	KSh15001-30000	1175	13.6	13.8	91.2
	KSh30001-50000	381	4.4	4.5	95.6
	KSh 50001 - 100000	277	3.2	3.2	98.9
	KSh 100001 - 200000	59	.7	.7	99.6
	Over KSh 200000	36	.4	.4	100.0
	Total	8529	98.4	100.0	
Number of income earners in hh					
	None	1094	12.6	12.6	12.6
	One	4717	54.4	54.4	67.1
Valid	Two	2513	29.0	29.0	96.1
	Three	263	3.0	3.0	99.1
	More than three	78	.9	.9	100.0
	Total	8665	100.0	100.0	

Data on the education level of the respondents show that 18% have no education, 44.6% have primary level education, 27.9% have high school/secondary level education and the remaining 9.5% have tertiary/post-secondary school education. For further analysis, those with primary

school level and no education were considered as low educated while those with secondary and tertiary level of education were considered as highly educated.

On Income, 55.9% of the respondents earn a monthly income of below Ksh. 7,500 (which is an equivalent of $75 at the current exchange rate of $1 = Ksh.100). Further, the cumulative percentage show that 77.4% of the respondents earn a monthly income of less than 15,000 ($150) per month. Further analysis show that the median monthly income for the sample is Ksh. 6,400 ($64). Thus, using this data to calculate the monthly per capita income, individuals earning below Ksh. 6,400 ($64) are considered as low-income earners while those that earn above 6,400 are considered as medium/high income earners in the analysis. Majority (54.4%) of the individuals report to have only one income earner and 12.6% reported not having any income earner in the household while 29% of the households had two income earners. Only 0.9% of the respondents reported coming from households with more than three income earners.

Mobile money usage in Table 2 show 66% are currently using mobile money while 34% are non-users. The most popular purpose as to why the they use mobile money is to receive payments (32.3%) and to save or keep money (15.9%). Majority of the respondents (80.5%) also reported having a mobile money agent at a walking distance from their houses, which shows that mobile money access was high among the respondents, including non-users.

Table 2: Descriptive data on respondents' mobile money use

Variable		Frequency	Percent	Valid Percent	Cumulative Percent
Mobile Money Users					
Valid	MM users	5715	66.0	66.0	66.0
	MM non-users	2950	34.0	34.0	100.0
	Total	8665	100.0	100.0	
MM agent Access					
Valid	Walking distance	6971	80.5	80.5	80.5
	Non-walking distance	1694	19.5	19.5	100.0
	Total	8665	100.0	100.0	
MM Main Use					
Valid	Saving/Keeping money	1376	15.9	22.2	22.2
	Receive money	2802	32.3	45.2	67.4
	Send money	1059	12.2	17.1	84.5
	Make/receive payments	513	5.9	8.3	92.8
	Buy airtime	447	5.2	7.2	100.0
	Total	6197	71.5	100.0	
Missing	System	2468	28.5		
Total		8665	100.0		

Table 3 presents descriptive data on the saving behaviors of mobile money users and non-users. The data show that 80% of mobile money users have a savings product while only 49% of non-users reported as having a savings product. Save for emergency events and save for a future activity is also high among the mobile money users (61.7% and 61.4%) as compared to non-users (39% and 37.7%) respectively. However, the descriptive data on the respondent's frequency of saving seems to be similar amongst both users and non-users hence not considered in the selection of the variables.

Table 3: Descriptive data on the saving behaviors of mobile money users and non-users

Savings behaviours of MM Users and non-users			Frequency	Percent	Valid Percent	Cumulative Percent
Saving						
MM users	Valid	Have saving product	4601	80.5	80.5	80.5
		No saving product	1114	19.5	19.5	100.0
		Total	5715	100.0	100.0	
MM non-users	Valid	Have saving product	1451	49.2	49.2	49.2
		No saving product	1499	50.8	50.8	100.0
		Total	2950	100.0	100.0	
Saving for Emergency						
MM Users	Valid	Save for emergency	3528	61.7	61.7	61.7
		No emergency savings	2187	38.3	38.3	100.0
		Total	5715	100.0	100.0	
MM Non-users	Valid	Save for emergency	1150	39.0	39.0	39.0
		No emergency savings	1800	61.0	61.0	100.0
		Total	2950	100.0	100.0	
Saving for future						
MM Users	Valid	Save for future	3507	61.4	61.4	61.4
		No future savings	2208	38.6	38.6	100.0
		Total	5715	100.0	100.0	
MM Non-users	Valid	Save for future	1113	37.7	37.7	37.7
		No future savings	1837	62.3	62.3	100.0
		Total	2950	100.0	100.0	
Savings frequency						
MM Users	Valid	Daily	242	4.2	5.1	5.1
		Weekly	1004	17.6	21.2	26.3
		Monthly	2866	50.1	60.5	86.8
		Once every 3 months	312	5.5	6.6	93.4
		Once every 6 months	95	1.7	2.0	95.4
		Almost never	136	2.4	2.9	98.3
		Never	82	1.4	1.7	100.0
		Total	4737	82.9	100.0	
	Missing	System	978	17.1		
	Total		5715	100.0		
MM Non-users	Valid	Daily	70	2.4	4.8	4.8
		Weekly	321	10.9	21.9	26.7
		Monthly	709	24.0	48.5	75.2
		Once every 3 months	144	4.9	9.8	85.0
		Once every 6 months	48	1.6	3.3	88.3
		Almost never	104	3.5	7.1	95.4
		Never	67	2.3	4.6	100.0
		Total	1463	49.6	100.0	
	Missing	System	1487	50.4		
	Total		2950	100.0		

4.4 Variables, indicators and their measurements

To measure how mobile money affects the saving behaviors of individuals, savings is treated as the dependent variable that characterizes the savings behavior of the individual while mobile use is used as the independent variable.

The ***dependent variable*** for this analysis is savings, which is a binary variable that corresponds to the group that currently have a savings product (Have savings product = 1) and those that reported as not having a savings account (No savings product =0). The savings product include instrument such as savings account in a SACCO, microfinance, or bank, saving with a group, family or friends, hiding money in secret place and saving through Mshwari and KCB M-Pesa. Further, saving is also measured using the purpose for saving that includes save for a particular purpose in future (denoted as *saving_future*) and save for emergencies or unexpected expenses (denoted as *saving_emergency*) that are binary variables whose definition is yes=1 and no=0 as shown in Table 4.

The ***independent variable*** in this analysis is *MM_use*, which is a dummy variable that equal to 1 if an individual report as currently using mobile money otherwise it is zero if an individual report as not currently using mobile money. A review of existing literature show that the access to mobile money is a key factor that influences individual's adoption and use of mobile money because many people prefer to use mobile money if they have an agent close to them to make transactions (Jack *et al*. 2013); and mobile money agents play a very vital role in ensuring that its users can make withdrawals and deposits from their e- wallets as discussed earlier in the literature review (Jack, Ray & Suri, 2013; Suri, 2017; Dubus & Van Hove, 2017; Mbiti & Weil, 2015).

This study uses the variable mobile money access (denoted as *MM_access*) as an ***instrumental variable*** in the model specification and endogeneity test. The main assumption in this study is that mobile money access induces changes in the mobile money use (the explanatory variable) but has no independent effect on savings (the dependent variable). In this study, mobile money access is measured using based on how near or far the agents are from the consumer. The options are condensed to either walk or use other means. Those that report that the nearest mobile money agent is at a walking distance are treated as having close proximity to mobile money agent, hence high access, and those that have to use other means

such as own motor vehicle, motorcycle, bicycle, public transport, etc. are treated as not having mobile money access. Mobile money agent access is also a binary variable where Non-walking distance = 0 Walking distance = 1.

The **control variables** used in this analysis are *gender of the respondent*, *cluster type*, *Income group, education level of Respondent*, marital status and age. For the age, this analysis adds a new variable age squared in order to model the effect of the differing ages, instead of drawing the assumption that the effect is linear for all ages. As earlier explained, individuals with primary school level and no education were considered as low educated while those with secondary and tertiary level of education were considered as highly educated. Also, individuals earning below Ksh. 6,400 are considered as low-income earners while those that earn above 6,400 are considered as medium/high income earners. The variables and their indicators are explained in Table 4.

Table 4: Variable description and their definitions

Variable	Indicator Coding	Observations	Marginal Percentage
Saving [savings]	No saving product = 0 Have saving product = 1	2613 6052	30.2% 69.8%
Future saving [saving_future]	No future savings = 0 Save for future = 1	4045 4620	46.7% 53.3%
Emergency saving [saving_emergency]	No emergency savings = 0 Save for emergency = 1	3987 4678	46.0% 54.0%
Mobile Money Use [MM_usage]	MM non-users = 0 MM users = 1	2950 5715	34.0% 66.0%
MM agent Access [MM_access]	Non-walking distance = 0 Walking distance = 1	1694 6971	19.5% 80.5%
Gender [gender]	Male = 1 Female = 2	3384 5281	39.1% 60.9%
Cluster type [cluster_type]	Rural = 1 Urban = 2	4852 3813	56.0% 44.0%
Income level [income_level]	Medium/high income group = 2 Low income group = 1	4139 4526	47.8% 52.2%
Household head [gender_of_hh_head]	Male = 1 Female = 2	6340 2325	73.2% 26.8%
Education level of Respondent [education]	None = 1 Primary = 2 Secondary = 3 Tertiary = 4	1561 3865 2416 823	18.0% 44.6% 27.9% 9.5%
Valid		8665	100.0%

4.5 Model Specification

The empirical estimation model used to explore the correlation between mobile money use and the savings behaviors of the individuals is based on logistic model with the following specification:

$$\text{Logit (p)} = \log\left(\frac{p}{(1-p)}\right) = PROB\{y_i = 1\} = \phi\left[\alpha + \beta_1 MM_{usage_i} + \beta_2 X_i + \varepsilon_i\right]$$

This equation is translated as below in terms of probabilities

$$PROB\{y_i = 1\} = \phi\left[\alpha + \beta_1 MM_{usage_i} + \beta_2 X_i + \varepsilon_i\right]$$

Where:

y_i is the dependent variable denoting individual i saving behavior;

ϕ is the logistic distribution's cumulative distribution function;

MM_usage_i is the independent variable denoting the use of mobile money;

X_i are additional control variables, namely, cluster type, age group, education, gender, income and marital status; and

ε_{ij} is the standard error for individual i.

In this analysis, the hypothesis tested is:

H_0: Mobile money use does not significantly increase the propensity of individuals to save

H_1: Mobile money use significantly increases the propensity of individuals to save

If the co-efficient β_1 is not significantly different from zero, the null hypothesis H_0 cannot be rejected on the basis that there is no statistical significance. Otherwise, reject the null hypothesis.

The second assumption made in this study is that the increasing the use of mobile money could have a different impact on the savings behavior of individuals of certain socio-demographic group. Therefore, this model is tested for invariance over vulnerable and non-disadvantaged social groups. The vulnerable group consisting of low-income earners, rural residents, low-educated and female-headed households. The second group is the non-vulnerable group consisting of medium/high income earners, male-headed households, high educated and urban residents. Accordingly, those belonging to the disadvantaged group take the value of 1 while those in non-disadvantaged groups take the value 0. To identify the influence of mobile money usage on the saving behaviors of the vulnerable v. non-vulnerable

groups, this analysis modifies the estimation model to include interaction terms as shown below:

$$PROB \{y_i = 1\}$$
$$= \phi \left[\alpha + \beta_1 MM_{usage_i} + \beta_2 MG_i + (\beta_3 MM_{usage_i} * MG_i) + (\beta_4 MG_i * X_i) + \beta_5 X_i + \varepsilon_i \right]$$

Where:

MG_i is the dummy variable denoting the characteristics of individual i who belong to vulnerable group for low income, female, low education or rural cluster;

Coefficients $\beta_1 + \beta_3$ yield the total effect denoting difference in saving behavior among mobile money users and non-users with varying individual characteristics

$\left(\beta_3 MM_{usage_i} * MG_i \right)$ and $(\beta_4 MG_i * X_i)$ are the interaction terms

X_i is the control variables excluding the demographic characteristics that are considered in the vulnerable group.

When taking the individual characteristics into consideration, the assumption made in this analysis is that:

H_0: Mobile money use does not significantly increase the propensity to save among of individuals vulnerable to financial exclusion

H_1: Mobile money use significantly increases the propensity to save among of individuals vulnerable to financial exclusion

If the total effect given by coefficients $\beta_1 + \beta_3$ is statistically significant, the implication is to reject the null hypothesis then we make the inference that the total effect of mobile money on the saving behavior of the vulnerable individuals is significant.

4.6 Endogeneity

Many economics models involve multiple dependent variables theorized to be simultaneously and causally interrelated (Nakamura & Nakamura, 1998) and failure to address endogeneity issues could lead to inconsistency with standard estimation methods that maintain independence between the included variables the model's error (Petrin & Train, 2010). In this

analysis, it is important to make the assumption that the variable MM_usage (mobile money usage) is exogenous and uncorrelated with the error term ε_i. A review of existing literature shows that M-PESA has four main uses, that is, buy airtime, to send or receive person-to-person remittances, pay bills and services and to save and borrow loans through Mshwari (Jack *et al*. 2013; Cook & McKay, 2015). Individuals use mobile money for saving purposes because of its convenience, safety and ease of access (Suri, 2017). The endogeneity issue in this analysis arises from the causal and simultaneous interrelation between mobile money use and the savings patterns of individuals.

Given that the possibility of having endogeneity is not negligible, mobile money access MM_access is used as the instrumental variable (IV) that is uncorrelated to the error term of the model and savings (the dependent variable) but correlated with the endogenous regressor (mobile money use), is identified. Previous studies examining the impact of mobile money in Kenya have previously used mobile money agent's access as an instrumental variable in their analysis (Jack, Ray & Suri, 2013; Suri & Jack, 2016); which makes it the most preferred IV for this study. However, this analysis acknowledges that IV has weak instrument issues whereby the IV used is weakly correlated with the dependent variable (Stock & Watson, 2015); and this could affect the validity and accuracy of the findings as it could yield biased estimators, wrong standard errors and unreliable hypotheses tests (Stock, Wright & Yogo, 2002). To detect and solve the endogeneity as well as the weak instruments problem, this analysis carries out an instrumental variable (IV) linear probability model (LPM) using the Two-Stage Least Squares (2SLS) Regression Analysis as recommended in various econometric literature (Stock & Watson, 2015; Dougherty, 2011).

The main assumption made here is that the proximity to mobile money agent, which measures mobile money access, plays a major role in ensuring the effective functioning of mobile money. However, the access to mobile money agent may not have any effect on the saving behaviors of individuals. In this analysis, the coefficient of mobile money access is expected to have a negative sign because the further the mobile money agent, the harder it becomes for users to access some of the mobile money services, and consequently, this may reduce the use and adoption of mobile money.

4.7 Two-stage LS regression and Logistic regression procedure

In the first stage of 2SLS, mobile money use is regressed on mobile money access including the control variables and the t statistic of mobile money access is was 20.02 and statistically significant. This fulfills the assumption that mobile money use is correlated to mobile money access. In the second stage, mobile money use is replaced with the predicted values from the first stage then savings is regressed on the predicted values from the first stage regression and the control variables. Comparing the model with predicted values with that of the original OLS regression show that the coefficient of mobile money use dramatically changes from 0.208 in the original OLS model to 0.673 in the second stage regression as shown in Table 10. This implies that the effect of mobile money use is underestimated in the original regression equation. The standard errors in the predicted model are not correct because Stata does not recognize predicted values. Thus, IV regression is used to get the correct standard errors.

To test for endogeneity, the same steps for running the first stage regression are followed but instead of predicting the values of the mobile money use, the residuals are predicted using command predict e, residual. In the second stage regression, the original OLS regression were run by including the predicted e residuals into the regression equation. The t-statistics was -5.71 with a p value of 0.00 (statistically significant). This means that there is 100% confidence that there is endogeneity in the model as shown in Table 11. For the correct standard errors, 2SLS IV regression and logistic regressions are carried; and these results are as shown in Table 5.

CHAPTER 5: RESULTS AND DISCUSSION

5.1 Introduction

This chapter reports the findings of study. The first section presents the procedures and empirical data obtained from the empirical results based on whether they are statistically significant or not; and the second section presents a discussion of the results and their implications based on the identified theoretical framework and the existing literature.

5.1 Results

5.1.1 Mobile money and savings

Table 5 show the effect of using mobile money on the likelihood to have a savings product, to save for emergency purposes and save for future purposes. Columns 1-3 are 2SLS IV regression results and columns 4-6 are logit regression results.

Table 5: 2SLS IV Regression and logit regression results

	Two-stage least-squares IV regression			Logit regression with exponential coefficients		
	Have a savings product	emergency purposes	Save for future purposes	Have a savings product	Save for emergency	Save for future purposes
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile money use	0.6732108***	0.3680386***	0.2487767***	1.960522***	1.444898***	1.282456***
	(.083718)	(.094118)	(.092399)	(.164131)	(.1359909)	(.1184977)
Cluster type (rural/urban)	0.0500158***	-0.0037608	-0.0143937	0.9512144***	1.003768	1.014498
	(.0113109)	(.0127161)	(.0055146)	(.012764)	(.012764)	(-0,989973)
Age	0.0032166	0.0301572***	0.0273386***	0.9967886	0.970293***	0.9730317***
	(.0049965)	(.0056172)	(.0124838)	(.0049804)	(.0054503)	(.9625699)
Education	-0.0378912**	-0.0110587	-0.0436952**	1.038618**	1.01112	1.044664**
	(.0157007)	(.0176511)	(.0173288)	(.016307)	(.0178474)	(.0181027)
Gender	-0.0577384***	0.0208152*	0.0386337***	1.059438***	0.9794*	0.962103
	(.0101757)	(.0114398)	(.0112308)	(.0107805)	(.0112041)	(0.0108052)
Income	0.0087892	-0.0194816***	-0.0420818***	0.9912493	1.019673***	1.04298***
	(.006262)	(.0070399)	(.0069114)	(.0062072)	(.0071784)	(.0077498)
Marital status	-0.0165401**	-0.0084965	-0.0023934	1.016678**	1.008533	1.002396
	(.0070049)	(.0078751)	(.0077313)	(.0071217)	(.0079423)	(.0072084)
constant	0.4894244***	0.9583914	1.281457	1.178396***	1.357346***	1.247311***
	(.0373968)	(.0420425)	(.0412746)	(.0440682)	(.0570662)	(.0514823)
Root Mean Square Error	0.4294974	0.4828529	0.4740340	0.4295	0.48285	0.47403
R-squares	0.1197	0.0614	0.0972	0.1197	0.0614	0.0972
F-statistic	165.03***	79.38***	130.78***	165.03***	79.38***	130.78***

The coefficients of 2SLS IV regressions are the log odds while the coefficients of the logit regressions are the odds ratio (exponential of log odds). The robust standard errors are in brackets. *** Significant at the 1% level; ** Significant at the 5% level; and * Significant at the 10% level.

The P-value of the F-statistic for the 2SLS and the logit regression models are zero for all the three dependent variables, which implies that the model is statistically significant at all the levels. Further, the R-square values are 0.1197 for savings, 0.0614 for save for emergency and 0.097 for save for future purposes. This means that 11%, 6% and 9.7% of variance in having a

savings product, save for emergency and save for future respectively, can be explained by mobile money use.

In columns 1-6, the variable of interest, mobile money use, is positive and statistically significant at $P<0.05$; hence reject the null hypothesis of exogeneity that is related to mobile money use across all the estimations. This means that mobile money use has a significant effect on savings, save for emergency and save for future event.

Using the exponential coefficients in the logistic model, the results show that mobile money users are 1.96 times more likely to have a savings product than non-users. Further, mobile money users are 1.44 and 1.28 more times to save for emergency and save for future respectively than mobile money non-users.

A look into the control variables, that is, cluster type, age group, education, gender, income and marital status, show that there is no single control variable that is statistically significant across all the three dependent variables. However, each of the control variables is statistically significant at least at one of the dependent variables.

Across the group that has a savings product, cluster type, education, gender and marital status are statistically significant while income group and age does not matter. Cluster type is positive and statistically significant meaning the likelihood to have a savings product increases for the urban cluster than the rural cluster, holding all other factors constant. Education, gender and marital status are also statistically significant meaning that the likelihood to have a savings product increases for the higher educated, female and the married.

For the dependent variable save for emergency purposes, only age and income are statistically significant. This means that the propensity to save for emergency purposes increases for older individuals and those in high-income earning group. For the dependent variable save for future purposes, the results show that age, education, gender and income are statistically significant. This implies that the propensity to save for future purposes increases among older individuals, female, high educated and high-income earners. Cluster type and marital status are statistically insignificant in both save for emergency and save for future while education and gender are statistically insignificant for save for emergency. The implications for these findings are further discussed in the discussion sector.

5.1.2 Effect modification and interaction terms

To investigate how the use of mobile money services influences the savings patterns of individuals that are more likely to be financially excluded, our variables interaction terms are created. These interaction terms are: mobile money use*rural cluster; mobile money use*low income earners; mobile money use*female; and mobile money use*low educated.[2]

Table 6: Mobile money and saving behaviors of rural cluster

	Two-stage least-squares IV regression		
	Have a savings product	Save for emergency	Save for future purposes
	(1)	(2)	(3)
Mobile money use	-.5888381	.7708366**	1.375199***
	(.3932637)	(.3498878)	(.4165198)
Rural residents	-1.514089***	.1656546	.6895466
	(.4594242)	(.4087509)	(.4865927)
Mobile money use*rural	2.007116***	-.9855856*	-1.848224***
	(.6569603)	(.5844993)	(.6958103)
constant	1.283713***	.2602415	-.1584903
	(.3084106)	(.2743938)	(.3266488)
Total effect	0.6948749***	-0.214749*	-0.473025**
	(.085)	(0.23461)	(0.2792905)
Control variables included	YES	YES	YES
Rural* controls included	YES	YES	YES
Root Mean Square Error	.6499094	.5782262	.6883425
R-squares	-1.0167	-0.3467	-0.9044
F-statistic	151.66***	118.98***	133.52***

The coefficients of 2SLS IV regressions are the log odds. The odds ratio are calculated using exponential of log odds. The robust standard errors are in brackets. *** Significant at the 1% level; ** Significant at the 5% level; and * Significant at the 10% level.

Table 6 show that mobile money use increases the rural cluster's propensity to have a savings product, to save for emergency and to save for future. The total effect is statistically significant at $p < 0.01$ for having a savings product; $p < 0.1$ for saving for emergency; and $p < 0.05$ for saving for future use hence reject the null hypothesis[3] at 1%, 10% and 5% confidence level respectively.

In Table 7, β_1 coefficients related to the propensity to save for emergency and future purposes are positive and statistically significant at $p < 0.05$ but the total effect for both dependent variables are not statistically significant hence we cannot reject the null hypothesis. However,

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[2] In the analysis, β_1 stands for the effect of mobile money use on savings for the control group=0. β_3 stands for coefficient of interaction term and $\beta_1 + \beta_3$ is the total effect of using mobile money on savings for the treatment group=1.

[3] H_0: Mobile money use does not significantly increase the propensity to save of vulnerable group (null hypothesis)

the total effect of mobile money on the likelihood of women having a savings product is 2.85 higher than that of men (statistically significant at 5% level).

Table 7: Mobile money and saving behaviors of females

	Two-stage least-squares IV regression		
	Have a savings product	Save for emergency	Save for future purposes
	(1)	(2)	(3)
Mobile money use	.2633618	.5892869**	.8885531***
	(.1864783)	(.2032448)	(.1892235)
Female	-.3631622	.2365781	.6895466
	(.2032448)	(.2062369)	(.4865927)
Mobile money use*female	.7843811**	-.4378786	-1.848224
	(.3098807)	(.5844993)	(.6958103)
constant	.4469236***	.1385444	-.1584903
	(.1311191)	(.2743938)	(.3266488)
Total effect	1.0477429**	0.4755473	0.4506745
	(0.4967)	(.4799484)	(.2326658)
Control variables included	YES	YES	YES
Female* controls included	YES	YES	YES
Root Mean Square Error	.5187785	.5070805	.5264157
R-squares	-0.2850	-0.0357	-0.1138
F-statistic	228.67***	139.00***	208.34***

The coefficients of 2SLS IV regressions are the log odds. The odds ratio are calculated using exponential of log odds. The robust standard errors are in brackets. *** Significant at the 1% level; ** Significant at the 5% level; and * Significant at the 10% level.

In Table 8, the total effect of mobile money use on increasing the propensity to save for emergency and for future among the low-income earners is statistically significant hence: reject the null hypothesis with 99% confidence level.

Table 8: Mobile money and saving behaviors of low-income earners

	Two-stage least-squares IV regression		
	Have a savings product	Save for emergency	Save for future purposes
	(1)	(2)	(3)
Mobile money use	2.303736***	2.669326***	3.234943***
	(.6696678)	(.8344034)	(.9815248)
Low-income	2.082276***	2.866425***	3.463751***
	(.870548)	(1.084699)	(1.275953)
Mobile money use*low income	-1.814323	-3.770175***	-4.734169***
	(1.061595)	(1.322743)	(1.555968)
constant	-1.41785**	.1385444**	-.1584903**
	(.6131652)	(.7640013)	(.8987095)
Total effect	0.885886	-1.100849***	-1.499226***
	(.2664612)	(1.177526)	(1.684386)
Control variables included	YES	YES	YES
Low income* controls included	YES	YES	YES
Root Mean Square Error	.76299	.9506825	1.118306
R-squares	-1.7621	-2.6370	-4.0229
F-statistic	102.43***	30.68***	34.65***

The coefficients of 2SLS IV regressions are the log odds. The odds ratio are calculated using exponential of log odds. The robust standard errors are in brackets. *** Significant at the 1% level; ** Significant at the 5% level; and * Significant at the 10% level.

In Table 9, the effect of mobile financial services use on the tendency to save for emergency and for future for the low-educated is statistically significant at all the three dependent variables levels; hence reject the null hypothesis with 99% confidence level for having a savings account and with 90% confidence level for saving for emergency and for future purposes.

Table 9: Mobile money and saving behaviors of low-educated

	Two-stage least-squares IV regression		
	Have a savings product	Save for emergency	Save for future purposes
	(1)	(2)	(3)
Mobile money use	2.725258***	1.627082**	1.539588**
	(.6696678)	(.7228701)	(.6395004)
Low education	2.64063**	1.321986	1.011617
	(1.172621)	(.8747916)	(.7739005)
Mobile money use*low education	-4.612125**	-2.819119*	-2.373348*
	(2.079778)	(1.551544)	(1.372602)
constant	-1.145421*	-.3775879	-.287662*
	(.6545036)	(.4882689)	(.431956)
Total effect	-1.886867**	-1.192037*	-0.83376*
	(.1374437)	(.5794469)	(.3170296)
Control variables included	YES	YES	YES
Low education* controls included	YES	YES	YES
Root Mean Square Error	1.13457	.8464052	.748788
R-squares	-5.1459	-1.8855	-1.2536
F-statistic	22.40***	43.74***	93.27***

The coefficients of 2SLS IV regressions are the log odds. The odds ratio are calculated using exponential of log odds. The robust standard errors are in brackets. *** Significant at the 1% level; ** Significant at the 5% level; and * Significant at the 10% level.

5.2 Discussion

5.2.1 Mobile money and savings behaviors

The estimation results demonstrate that mobile money use has a positive and statistically significant effect on the likelihood to have a savings product, to save for an emergency and to save for a future event. This is in line with existing empirical evidence that show that mobile money increases the propensity to save (Plyler, Haas & Ngarajan, 2010; Kikulwe, Fischer, & Qaim, 2014; Batista & Vicente, 2017). Unlike Ky *et al*. (2017) who found that mobile money does not have any effect on save for future events, this study finds that mobile money has a statistically significant effect on individual's propensity to save for future events.

The probability of a mobile money user to have a saving product is 1.96 more than that of a non-user. Also, mobile money are 1.44 and 1.27 times more likely to save for emergency and to save for future respectively, than non-users. Assuming that mobile money users save because they perceive mobile money as a store of value, then these findings are in line with theoretical framework discussing the link between mobile money, savings and neo-classical theories of money. Studies suggest that majority of mobile money users keep money in their e-wallet account because it is safer and more reliable way of keeping money when travelling, to buy airtime in the future or to send to their families and friends in case of an emergency but when it comes to save for long term purposes, mobile money users are likely to combine saving in mobile money with other saving products (Morawczynski & Pickens, 2009; Mbiti and Weil, 2013; Mbarathi & Diga, 2014). This could be because mobile money saving toolkits such as Mshwari offers low interest rates as compared to those offered by banks and some assets (Cook & McKay, 2015).

Also, looking at these results from the 'temptation goods' perspective, the high accessibility of mobile money agents and the other uses of mobile money could also explain why mobile money users are more likely to keep money in their mobile money accounts for shorter periods than longer periods. This is probably because mobile money users are likely to be tempted to withdraw the money saved and use it for consumption, or they may use the money to pay bills or send it to someone who has an emergency. However, if mobile money was hard to translate to cash or not usable to pay for bills or buy products, many users would not get into the 'consumption temptation'. Thus, many people may prefer to save for future events in illiquid forms such as investing on assets rather than keeping the money on mobile money because they do not want to be tempted to divert the money for other uses.

These results imply that the neoclassical-based function of mobile money as a 'medium of exchange' creates the 'temptation goods' dilemma because mobile money is as liquid as cash money since it can easily be withdrawn or be used to pay for a good directly. This shows the competing functions of money and their effect on how people see and use mobile money. On one hand, mobile money is preferred because of its liquidity as a 'medium of exchange' but on the other hand, it is used as a 'store of value' when people prefer to use the mobile money service for savings purpose. This means that as people use mobile money as a store of value, its function as a medium of exchange decreases, and vice-versa.

5.2.2 Saving patterns across various sociodemographic groups

The data on the control variables provides a good outlook into how some demographic features affect individuals' saving behaviors. The findings show that cluster type is positively and statistically correlated with savings but has no statistical significance with relation to save for emergency and save for future, meaning that the probability to have a savings account is greater among those living in urban areas as compared to rural residents. This phenomenon can be explained by the fact that urban residents have more opportunities to save because of the high availability of formal financial institutions than in rural areas (World Bank, 2016).

Age is positive and statistically significant for having a savings product and save for future but insignificant for save for emergency. This means that the likelihood to hold a savings account and save for a future event increases over age. This is inconsistent with the life-cycle hypothesis that argues that people save more when they are younger and consumes more when they are older (Modigliani, 1996). The high levels of youth unemployment for persons aged between 18-30 years in Kenya could explain for these results because majority of the young people in Kenya are unemployed (Haji, 2007), and as a result, lack money to put into savings.

Gender is negative and statistically significant for having a savings product but positive and statistically significant for save for the future but irrelevant for save for emergency. This indicates that the likelihood to have a savings product is high among males than women while the likelihood to save for future is higher among females than in males. One explanation for these results can be understood by looking at the sociocultural settings in Kenya where men are the main financial decision makers and most of the savings accounts in the households are mostly held in the man's name, and the woman should always seek the permission of their husband before making financial decisions (Johnson, 2004). The second explanation is that males in Kenya have higher financial access than women, and as a result, they can access formal financial services (World Bank, 2017). These reasons explain why men have higher likelihood to hold savings product than women.

The results showing that women are more likely to save for future activities than men are consistent with the findings by Suri & Jack (2016) who found that women save with the aim of changing their occupational choice from agriculture into business rather than for short-

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term purposes. The results can also be explained by the social framework of saving in Kenya whereby majority of individuals that engage in savings groups and merry-go-rounds are women and the aim of these savings are normally for specific purposes rather than short-term reasons (Adan, 2016).

Education is negative and statistically correlated with having a savings product and save for future which means the likelihood to have a savings product and to save for future decreases as education level increases. An explanation for this phenomenon is that those who are more educated have high financial literacy about other available financial services such as loans to finance their long-term rather than save for it (Perez-Arce,2017).

5.2.3 Effect of mobile money on the savings patterns of vulnerable individuals

The findings show that mobile money use significantly increases the propensity of female, low-education and rural cluster to have a savings product. The exponential coefficients are 2.003 for rural, 2.851 for female and 0.1515 for low-educated. These results imply that mobile money users in the rural, females and low-educated groups are 2.003, 2.851 and 0.1515 more likely to have a savings product than urban, males and high-educated groups.

The results also show that mobile money use significantly increases the likelihood of individuals in the rural, low-income and low-education groups to save for emergency with exponential coefficients of 0.807, 0.333 and 0.304 respectively. This means that mobile money users in the rural, low-income and the low-education groups are 0.807, 0.333 and 0.304 more likely to save for emergency than users in the urban, high-income and high-education groups respectively.

Lastly, mobile money use significantly increases the propensity to save for future purposes among individuals in the rural, low income and low education groups with exponential coefficients of 0.623, 0.223 and 0.434. This means that money users in the rural, low-income and the low-education groups are 80.7%, 33.3% and 30.4% more likely to save for future purposes than users in the urban, high-income and high-education groups respectively.

These results are in line with the existing mobile money - financial inclusion nexus where mobile money is empirically tested as increasing financial access to women, low-educated, low-income earners and rural residents. In developing countries, it is a challenge to open a

bank account with the formal financial institutions because of the institutional requirements and strict regulations (World Bank, 2017). However, this process is harder for women as compared to men because of the existing educational, policy, technological, cultural and legal barriers (World Bank, 2017). Therefore, it would be easier for women to register for a mobile money account than a bank account because the only requirement is a phone and a national ID (Suri & Jack, 2016).

Rural residents have less access to formal financial services because the institutions are mostly located in urban centers which are difficult to access (World Bank, 2016). Thus, most rural residents prefer mobile money services because they are more accessible due to the high numbers of mobile money agents that are located even in the most remote areas (Mbiti & Weil, 2015). Descriptive statistics results show that 80.5% of all respondents reported having a mobile money agent at a walking distance from their houses. On the other hand, formal financial institutions such as banks and SACCOs have very low penetration to the rural areas (World Bank, 2014). This analysis assumes that the high accessibility of mobile money and the lack of financial alternatives makes rural residents to use mobile money as a saving tool for the future.

The findings also found a statistically significant total effect of mobile money use for both save for emergency and save for future for individuals in the low-income and the low-education groups, which means that mobile money use increases the propensity of low-income earners and the low-educated to save for both emergencies and future events. Previous studies have shown that mobile money boosts the propensity of the low-income earners and the poor to frequently save volumes of small amounts due its convenience (Ouma, Odongo & Were, 2017). Further, majority of low-income earners are casually employed or have informal business, which is a major barrier to formal financial services because most of the poor and low-income individuals do not meet the minimum deposit, guarantee and proof of income requirements that majority of formal financial institutions require from their customers (Prina, 2015). Thus, this group may find mobile money more tailored to their needs as they can make smaller value deposits and savings since the minimum deposit amount for Mshwari is Ksh.1 ($0.01) compared to many banks in Kenya that ask for a minimum deposit of up to $500 (Wamuyu, 2016).

The findings suggest that low-income, the low-educated and the rural clusters are using mobile money to save for future. One of the reasons as to why people use saving products for long-term purposes is because they are risky takers expecting to yield higher returns from the 'asset' or they are risk averse expecting security of their savings or investments. Given that saving in mobile money does not yield high returns, the only other probable explanation as to why users may prefer to save for future in their mobile money is because they trust the service and are not worried about losing their savings. Thus, mobile money meets this 'need for secure store of value' for rural and low-income earners that have low access to other formal financial services. Mobile money as a 'safe store of value' for rural and the poor is in line with assumptions made under the state theory of money where the role of the government intervention also influences people's perception and trust in mobile money hence the reason it is a preferred medium of storing value.

Individuals in the low education group also have high propensity to have a savings product as well as save for emergency and for future purposes. A probable explanation for this phenomenon is that individuals that are low-educated tend to have causal jobs with irregular income, and as a result, find mobile money more accommodating to their needs. The other reason could be that the low educated find mobile money convenient and easy to use due to their literacy levels as compared to other formal financial services. This can be further explained from the assumption made by the theories of money that for payment instrument to be desirable, it should embody the characteristics of universality, convenience, information, security, certainty and economy (Jacob *et al*. 2008). The convenience, reliability, acceptability, universality and the ease to use of mobile money is thus, one of the main reasons why it is highly preferred by individuals that are vulnerable to financial exclusion.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary of the Findings

The goal of this study was to investigate how mobile money use influences individuals' propensity to save and the effect of mobile financial services on the savings patterns of individuals that are vulnerable to financial exclusion, that is, low-income earners, low-educated, women and rural habitants. The main research questions explored were:

- Q1: Does mobile money use influence an individual's likelihood to save?
- Q2: How does mobile financial services affect the savings behaviors of individuals that are vulnerable to financial exclusion, that is, the low-income earners, low-educated, women and rural habitants?

The results show that the probability of a mobile money user to have a saving product is 1.96 more than that of a non-user. Also, mobile money users are 1.44 and 1.27 times more likely to save for emergency and to save for future respectively, than non-users. With regard to the individuals that are vulnerable to financial exclusion, this study established that the use of mobile financial services increases the likelihood to have a savings product for women. For rural cluster, mobile money use has a significant effect on the propensity of the users to have a saving product and to save for a future activity. The results also suggest that the use of mobile money significantly increases the propensity of low-income earners to save for both emergencies and future events. Amongst the low educated group, the use of mobile financial services significantly increases the likelihood of individuals that are low-educated to have a savings product, save for emergency and also save for the future.

A summary of the findings show that the mobile financial services increases the propensity to save for individuals vulnerable to financial exclusion (female, rural, low-educated and low-income). Individuals belonging to these sociodemographic groups, that is, female, rural and low-income earners face unique challenges that lower their ability to access formal financial services. Thus, by increasing the probability of the female, rural, low-educated and low-income groups to save, mobile money fosters financial inclusion which is vital to the accomplishment of the Sustainable Development Goals such as poverty reduction, increasing equality and sustained economic growth among others.

6.2 Contributions and Implications of the Study

This analysis is at the intersection of the diverse strands of existing literature exploring the mobile money usage and access and the savings behaviors of individuals. Thus, this study contributes to an expanding literature that shows how mobile money use affects the savings patterns of individuals of certain sociodemographic characteristics. More specifically, this study tests the conjectures that mobile money use affects the savings patterns of vulnerable groups differently than that of non-vulnerable groups.

Further, given that the effect of using mobile money on the savings patterns of individuals from different sociodemographic groups have not been extensively explored, this study helps fill in this research gap and builds on the existing literature on the specific impacts of mobile financial services on savings because the sustainability of mobile money services depend on its achieved impact on the society.

This study makes theoretical contributions on the theories of money by reviewing and applying the various theoretical assumptions on the classical, neo-classical, state theory of money and social theory of money in the context of mobile money. From a neoclassical perspective and classical, this study argues that the competing functions of money as a 'store of value' and 'medium of exchange' have a substantial effect on the manner at which people use mobile money, that is, to save or for consumption. Mobile money as a store of value encourages users to save for future use while looking at mobile money as a medium of exchange would encourage users save money for short-term purposes such as emergencies.

This study has key theoretical and policy implications. It is relevant to policy makers, both at governmental and international level, that are considering improving the welfare of individuals through financial inclusion. The use of mobile money as a store of value gives users a safer and more reliable savings mechanism as opposed to the informal savings methods that are used in areas where financial inclusion is still low. In addition, the use of mobile money offers poor individuals with less alternatives an access to mobile banking services because they can deposit small amounts into the mobile money account that they can easily access in the event of an emergency. More specifically, undertaking this study offers significant theoretical and policy implications that shifts the debate on financial inclusion countries from

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the traditional credit and savings services, towards the need for mobile financial services in developing countries.

6.3 Study Limitations and Areas for Further Research

The scope of this study is limited to the analysis of the effect of mobile money usage on the saving behaviors of individuals in a developing country. Thus, the findings of this study can be generalized within this context. However, for further research, this study can be replicated in a context of developed, emerging or developing economy. The survey data used was collected in 2016, and in the past 3 years, a lot has changed regarding mobile money in Kenya. For future studies, this study recommends replicating the study using more recent data in order to capture the current status and developments on mobile money. The study can also be replicated using different sample or sampling frame. This is because the less-educated individuals in developing countries face many financial literacy and income challenges that make them vulnerable to financial exclusion.

6.4 Conclusion

Mobile money services have greatly transformed the financial inclusion landscapes in developing countries where majority have high inaccessibility to formal financial services. This study has demonstrated that mobile money users are twice as much likely to save than those that do not use mobile financial services, which calls for the need to promote saving through mobile money as this can mobilize and promote savings for female, rural and low-income groups who are highly vulnerable to financial inclusion.

These results have significant macroeconomic implications that can be adopted at policy level. In the past, policies aimed at increasing financial access among those that are vulnerable to financial exclusion have focused more on savings and credit services offered by microfinances and SACCOs. However, this study has demonstrated that mobile money can be used as an instrument of increasing financial inclusion policy for women, low-educated, low-income and rural residents. Thus, enacting laws and policies that increase the use and access of mobile money as a savings mechanism in developing countries could have a positive impact on the economic wellbeing of these marginalized groups, and the region at large.

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IV regression stata output

Table 10: Comparison of original OLS regression and 2SLS regression

```
. reg savings MM_usage gender cluster_type agegroup education incomegp maritalgp
```

Source	SS	df	MS		Number of obs	=	8,506
					F(7, 8498)	=	213.15
Model	265.961411	7	37.9944872		Prob > F	=	0.0000
Residual	1514.7562	8,498	.178248553		R-squared	=	0.1494
					Adj R-squared	=	0.1487
Total	1780.71761	8,505	.209373029		Root MSE	=	.42219

savings	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
MM_usage	.2083394	.0109282	19.06	0.000	.1869175	.2297613
gender	-.0645152	.0099317	-6.50	0.000	-.0839839	-.0450466
cluster_type	.0195201	.0097465	2.00	0.045	.0004146	.0386255
agegroup	-.013934	.0038817	-3.59	0.000	-.0215431	-.0063249
education	-.1180027	.0063735	-18.51	0.000	-.1304964	-.105509
incomegp	-.0214272	.0031277	-6.85	0.000	-.0275583	-.0152962
maritalgp	-.0140272	.0068717	-2.04	0.041	-.0274974	-.000557
_cons	1.535423	.0391466	39.22	0.000	1.458686	1.61216

```
. reg savings MM_usagehat gender cluster_type agegroup education incomegp maritalgp
```

Source	SS	df	MS		Number of obs	=	8,506
					F(7, 8498)	=	165.03
Model	213.105451	7	30.4436358		Prob > F	=	0.0000
Residual	1567.61216	8,498	.184468364		R-squared	=	0.1197
					Adj R-squared	=	0.1189
Total	1780.71761	8,505	.209373029		Root MSE	=	.4295

savings	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
MM_usagehat	.6732108	.083718	8.04	0.000	.5091032	.8373185
gender	-.0577384	.0101757	-5.67	0.000	-.0776852	-.0377916
cluster_type	.0500158	.0113109	4.42	0.000	.0278436	.072188
agegroup	.0032166	.0049965	0.64	0.520	-.0065778	.0130109
education	-.0378912	.0157007	-2.41	0.016	-.0686684	-.0071141
incomegp	.0087892	.006262	1.40	0.160	-.0034859	.0210643
maritalgp	-.0165401	.0070049	-2.36	0.018	-.0302715	-.0028088
_cons	.4894244	.1909039	2.56	0.010	.1152063	.8636425

```
. reg savings MM_usage gender cluster_type agegroup education incomegp maritalgp e
```

Source	SS	df	MS		
				Number of obs	= 8,506
				F(8, 8497)	= 191.28
Model	271.751386	8	33.9689232	Prob > F	= 0.0000
Residual	1508.96623	8,497	.177588116	R-squared	= 0.1526
				Adj R-squared	= 0.1518
Total	1780.71761	8,505	.209373029	Root MSE	= .42141

savings	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
MM_usage	.6732108	.0821419	8.20	0.000	.5121927	.834229
gender	-.0577384	.0099841	-5.78	0.000	-.0773097	-.0381671
cluster_type	.0500158	.011098	4.51	0.000	.028261	.0717705
agegroup	.0032166	.0049024	0.66	0.512	-.0063934	.0128265
education	-.0378912	.0154051	-2.46	0.014	-.068089	-.0076935
incomegp	.0087892	.0061441	1.43	0.153	-.0032548	.0208332
maritalgp	-.0165401	.006873	-2.41	0.016	-.0300129	-.0030673
e	-.4732162	.0828759	-5.71	0.000	-.6356731	-.3107593
_cons	.4894244	.18731	2.61	0.009	.1222513	.8565975

```
Two-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	F-Stat	P
savings	8,506	7	.4294978	0.1197	165.03	0.0000
saving_eme~y	8,506	7	.4828529	0.0614	79.38	0.0000
saving_fut~e	8,506	7	.474034	0.0972	130.78	0.0000

	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
savings						
MM_usagehat	.6732108	.083718	8.04	0.000	.5091188	.8373029
cluster_type	.0500158	.0113109	4.42	0.000	.0278457	.0721859
agegroup	.0032166	.0049965	0.64	0.520	-.0065768	.01301
education	-.0378912	.0157007	-2.41	0.016	-.0686655	-.007117
gender	-.0577384	.0101757	-5.67	0.000	-.0776833	-.0377935
incomegp	.0087892	.006262	1.40	0.160	-.0034847	.0210631
maritalgp	-.0165401	.0070049	-2.36	0.018	-.0302701	-.0028101
_cons	.4894244	.1909039	2.56	0.010	.1152418	.863607
saving_emergency						
MM_usagehat	.3680386	.094118	3.91	0.000	.1835619	.5525152
cluster_type	-.0037608	.0127161	-0.30	0.767	-.028685	.0211634
agegroup	.0301572	.0056172	5.37	0.000	.0191472	.0411672
education	-.0110587	.0176511	-0.63	0.531	-.0456559	.0235385
gender	.0208152	.0114398	1.82	0.069	-.0016074	.0432378
incomegp	-.0194816	.0070399	-2.77	0.006	-.0332803	-.0056829
maritalgp	-.0084965	.0078751	-1.08	0.281	-.0239322	.0069392
_cons	.9583914	.2146193	4.47	0.000	.5377253	1.379057
saving_future						
MM_usagehat	.2487767	.092399	2.69	0.007	.0676694	.4298841
cluster_type	-.0143937	.0124838	-1.15	0.249	-.0388627	.0100753
agegroup	.0273386	.0055146	4.96	0.000	.0165297	.0381476
education	-.0436952	.0173288	-2.52	0.012	-.0776605	-.0097299
gender	.0386337	.0112308	3.44	0.001	.0166207	.0606468
incomegp	-.0420818	.0069114	-6.09	0.000	-.0556284	-.0285351
maritalgp	-.0023934	.0077313	-0.31	0.757	-.0175471	.0127604
_cons	1.281457	.2106995	6.08	0.000	.8684736	1.69444

Figure 1: Mshwari savings and loans rates

Minimum savings balance	KES 1
Maximum savings balance	KES 100,000 (with just M-PESA KYC) KES 250,000 (with verification of National ID) KES 500,000 (with physical submission of ID) Unlimited (with submission of tax ID)
Savings interest rate	2%: KES 1–10,000 3%: KES 10,001–20,000 4%: KES 20,001–50,0000 5%: Above KES 50,000
M-Shwari Lock Savings interest rate	Earns an additional 1% over the rates above
Minimum loan amount	KES 100
Maximum loan amount	KES 100,000
Loan pricing	7.5% loan facilitation fee (no other interest or fees)
Loan term	30 days (renewable one time, with an additional 7.5% loan facilitation fee applied to the outstanding balance)
Cost to move money between M-PESA and M-Shwari	Free
Cost to move cash in and out of M-PESA	Free to deposit, standard cash-out fees apply

Source: CBA (2014).