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Essays in Household Financial Capability among Kenyan Households focused on Financial Inclusion and Financial Literacy

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Summary

This thesis provides empirical evidence on the importance of financial access as well as financial literacy for households use of formal financial products and services to enhance their financial capability. Using nationally representative household survey data for the years 2009, 2013 and 2016, this thesis endeavours to show how being able to access formal financial services and products boosts a household's financial well-being. In addition to access, I find that households also need a basic level of financial knowledge so as to be able to demand the products and services suitable for their needs. Where the needs of the customer, especially those that are un-or under-banked are understood, the supply side will come up with innovative financial products and services to meet these needs.

In Kenya the concept of mobile money through the M-PESA platform has changed the way in which households interact with money as well as financial services. Introduced as a method of money transfer to enable people send and receive money, it has over time evolved to provide traditional banking services. Individuals with a mobile phone and subscribed to M-PESA can not only make transfers, they can also make payments for goods and services, save what is not immediately needed to be withdrawn or sent and more recently access credit. With this provision individuals who previously had no safe place to save money, i.e. used informal mechanisms such as under the mattress now have an easy to use, safe and cheap place to store money for later use, for example in case of emergencies.

In addition to making simple financial services available to the poor, the mobile phone has also provided a channel for bite-sized information on financial matters to be discharged to the population. Where individuals are unable to attend financial literacy classes, basic financial information can easily be made available through mobile technology. Furthermore, the concept of mobile money has also increased the impact of social networks as individuals often tend to get financial information from their mobile money agent. The essays in this thesis empirically show the positive effects that

financial inclusion through mobile money as well as financial literacy have had on individuals' financial behaviour. The findings in these essays also open up the space for discussion on financial literacy matters in developing countries. Kenya is an interesting example of a developing economy where mobile technology on payments transfers is leading but it has a below-average literate population. In this regard, the essays here set out a platform to further find out what in what ways can the financial literacy be enhanced keeping in mind that individuals may not have the time to attend financial literacy courses.

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List of Abbreviations and Acronyms

ASCA   Accumulating Savings and Credit Association

ATM   Automated Teller Machine

CBA   Commercial Bank of Africa

CBK   Central Bank of Kenya

Chama   ROSCA in Swahili

CMA   Capital Markets Authority

DFID   Department for International Development

DTM   Deposit Taking Microfinance Institutions

DTS   Deposit Taking Saccos

FSD (K)   Financial Sector Deepening (Kenya)

GoK   Government of Kenya

IRA   Insurance Regulatory Authority

KCB   Kenya Commercial Bank

KNBS   Kenya National Bureau of Statistics

M-PESA   Mobile based money transfer service. "M" – Mobile "PESA" – Money in Swahili

MFSP   Mobile Financial Service Provider

MFI   Microfinance Institutions

NASSEP   National Sample Survey and Evaluation Programme

NHIF   National Health Insurance Fund

NSE   Nairobi Securities Exchange

NSSF   National Social Security Fund

OECD   Organisation for Economic Co-operation Development

RBA   Retirement Benefits Authority

ROSCA   Rotating Savings and Credit Association

SACCO   Savings and Credit Co-operative

SASRA   Saccos Society Regulatory Authority

SSA   Sub-Sahara Africa

USA   United States of America

UK   United Kingdom

UN   United Nations

CHAPTER 1

1. INTRODUCTION

1.1 The Concept of Household Finance

Household finance has occupied economic researchers and policy makers alike. However, unlike the traditional areas of finance; asset pricing and corporate finance, household finance has been a little more difficult to determine (Campbell, 2006). By definition, asset pricing refers to how capital markets determine the assets prices and the average returns the assets have on the risk undertaken. While corporate finance deals with how enterprises or companies use financial instruments or resources to further their interests (profit) and to counter the agency problem. If we further use this analogy, household finance can then be considered as the arm of economics that seeks to establish how households use financial instruments available to them to attain their financial well-being. Households in contrast to enterprises are plagued with a number of issues ranging from access to financial products and services or lack thereof to knowledge of use and opportunity for use of financial instruments (Campbell 2006). Financial inclusion has been found to be the first step in a series of interventions required to improve household financial capability and thus financial well-being (Allen et al. 2012; Demirguc-Kunt et al. 2015).

Inclusive financial systems, which means systems that allow broad access to financial services with minimal price or non-price barriers to their use, have been put forth as a major key to enabling poor and /or marginalized segments of the population interact with financial services and products (Demirgüç-Kunt and Klapper 2012a). To minimize the effect of lack of access to financial products and services, especially among vulnerable households the concept of microfinance through the Grameen Bank model was introduced in a number of developing countries in Asia. Bangladesh recorded one of the highest successes in the enhancement of financial inclusion among the rural households and women (Hulme 2009).

Whereas this expansion of microfinance has worked in a number of Asian countries, financial inclusion in developing countries, especially in sub-Saharan Africa (SSA), has not been as rapid. Allen et al. (2014) find that the financial development gaps experienced in sub-Saharan Africa (SSA) countries are heavily influenced by low levels of financial inclusion. They proposed the replication of mobile money use as a means for financial inclusion among other SSA countries following the success experienced in Kenya following the launch of M-PESA. Their findings on the financial development gaps showed that the sparsity of the population especially in rural areas makes it financially unviable to provide financial services through traditional brick and mortar financial institutions (Allen, Carletti, Cull, Qian, et al. 2014).

In a study on prices and knowledge in Indonesia and India, Cole, Sampson, & Zia (2011) find that households were averse to holding accounts in financial institutions to a large extent because of cost barriers. With regard to poor households the need for financial services and products range that is broad enough to accommodate their needs. This inherently includes services that are relatively easy and cheap to maintain. In an examination of adoption and use of digital financial services specifically mobile money in Kenya, Morawczynski (2010); Morawczynski & Pickens (2009) find that M-PESA has enabled economically vulnerable households and individuals interact with financial products that were previously inaccessible to them. The appeal of the M-PESA account relates to the reduced or nearly eliminated barriers to holding an "account". With no minimum balance or numerous documentations required to open the M-PESA account, the use of mobile money among households in Kenya grew exponentially over the first years. Figure 1 shows the trend of adoption of M-PESA among households.

Figure 1.1: Adoption of M-PESA among households in Kenya
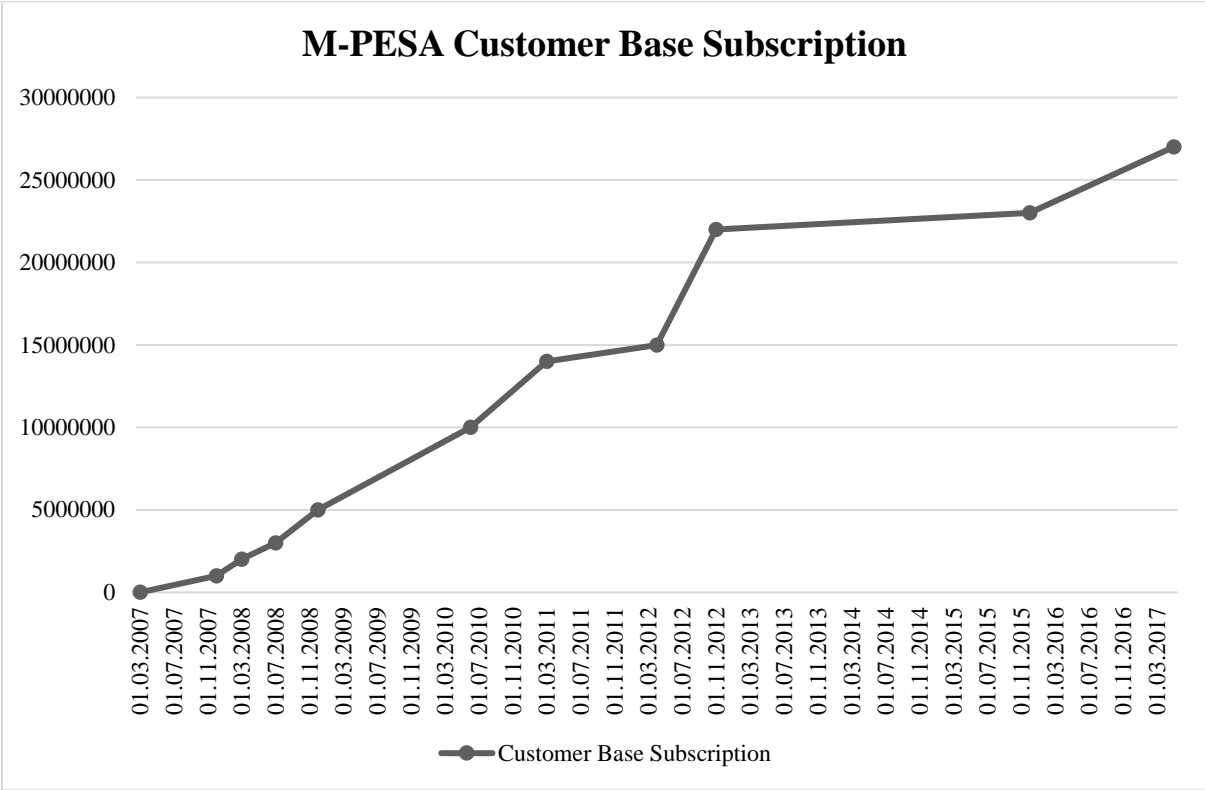
Source: Safaricom annual report (Safaricom 2017)

Sayinzoga, Bulte, & Lensink, (2016) find that previously excluded households in developing countries are better off with improved access to financial services and products. This is despite the fact that evidence on the influence of financial access on reducing poverty is somewhat mixed. They state that in addition to access to financial services and products, for household finance to make sense there needs to be an investment in human capital. Cole et al. (2011) find that in addition to prices, awareness of and knowledge about financial services and products available to households had a significant predictive ability on the demand for financial products. Following classic economic theory of rational individuals, the use of financial instruments and engagement in financial markets by individuals depends as much on availability as on their knowledge and understanding of these products. For consumers to make sound financial decisions that are beneficial to them and their households as well as safe-guard their future, they need to be well-informed (Hilgert, Hogarth, and Sondra 2003). The definition of financial literacy by the Organization for Economic Co-operation

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and Development (OECD) inherently encompasses gaining financial information as a mode of enhancing human capital. It defines financial literacy as:

"…the combination of consumers'/investors' understanding of financial products and concepts and their ability and confidence to appreciate financial risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well-being" (OECD 2005).

1.2   Overview of Kenya
1.2.1   Demographics
The Kenyan population is largely rural based with approximately 60% of the population living in rural areas. In this regard majority rely on farming, self-employment, casual labour or support from family and friends as their primary source of income. This in turn means that individuals' incomes are associated with high levels of uncertainty and volatility. According to the Kenya National Bureau of Statistics (KNBS) women provide 80% of Kenya's farm labour and manage 40% of the country's smallholder farms. However, their ownership is limited to only 1% of the land resources and 10% of available credit. This gender disparity in labour and income plays a big role in determining the vulnerability of women and especially women headed households in Kenya.

Education levels are on average low to moderate with majority of the population having attained a secondary education as the highest level and several citing lack of funds to further attain tertiary education. The average age of the Kenyan population falls between 18 and 35 which means the country has a relatively young population and thus a high work force. With reference to gender, the proportion of men to women has been roughly the same throughout the years since the first census (1969) however, women have been marginally higher than men in the population. In general, though, the population of Kenya has risen steadily in recent decades.

1.2.2   Financial Inclusion Landscape in Kenya
The financial inclusion landscape among Kenyan households has undergone tremendous changes and improvement since the baseline household survey on financial access and inclusion was

conducted in 2006. The financial inclusion landscape measured in these surveys measures the access, usage, quality and impact of financial products and services in Kenya. The surveys used a sampling method based on the Kenya National Bureau of Statistics (KNBS) national household master sample frame known as the National Sample Survey and Evaluation Programme (NASSEP)[1]. The surveys then group the respondents into 5 categories with reference to their level of financial inclusion referred to as access strands: Formal prudential, formal non-prudential, formal registered, informal and excluded Table 1.1 below shows a description of these segments (FSD Kenya 2013). The excluded category refers to individuals who use neither of the undermentioned forms of financial services providers.

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[1] Access to the full reports with a full explanation on the sampling and survey methodology for the FSD household surveys can be found here.

Table 1.1: Classification of Access Strands in Kenya

Access Strand	Description	Institution Type
Formal Prudential	Financial services providers prudentially regulated and supervised by independent statutory regulatory agencies (CMA, CBK, IRA, RBA and SASRA)	Commercial banks (includes mobile bank accounts e.g. KCB M-PESA, MCo-op Cash, M-Shwari, Deposit Taking MFIs, Forex bureau, Capital markets, Insurance providers, Deposit Taking SACCOs
Formal non-prudential	Financial services providers subject to non-prudential oversight by regulatory agencies or government departments/ministries with focused legislation	Mobile financial services providers (MFSP), Postbank, NSSF, NHIF
Formal registered	Financial services providers that are registered under a law or government direct interventions	Credit only MFIs, credit only SACCOs, Hire purchase companies, Development Financial institutions (DFIs)
Informal	Financial services provided through unregulated forms of structured supervision	Informal groups e.g. ROSCAs, *Chamas* and ASCAs. shopkeepers/merchants, employers, shylocks/moneylenders
Excluded	Financial services used are through family, friends, neighbours or money kept in secret places	Social networks and individual arrangements (e.g. secret hiding place).

Source: FSD Kenya National Survey 2009, 2013, 2016

Over the ten-year period between the baseline survey in 2006 and the most recent survey in 2016, levels of exclusion and usage of informal mechanisms have reduced while usage of formal financial services has increased. Figure 1.2 shows the overall changes in financial inclusion over the years.

Overall, 75.3% of Kenyans are now formally included. This shows a 50% increase over the last ten years. In turn financial exclusion has also more than halved over these ten years from 41.3% to 17.4%. Similarly use of informal services has also significantly reduced over time. With reference

to vulnerable demographics, rural based, female, low income and less educated individuals were found to make up the majority of users of informal financial mechanisms or excluded altogether.

Figure 1.2: Changes in Financial Access Strands in Kenya
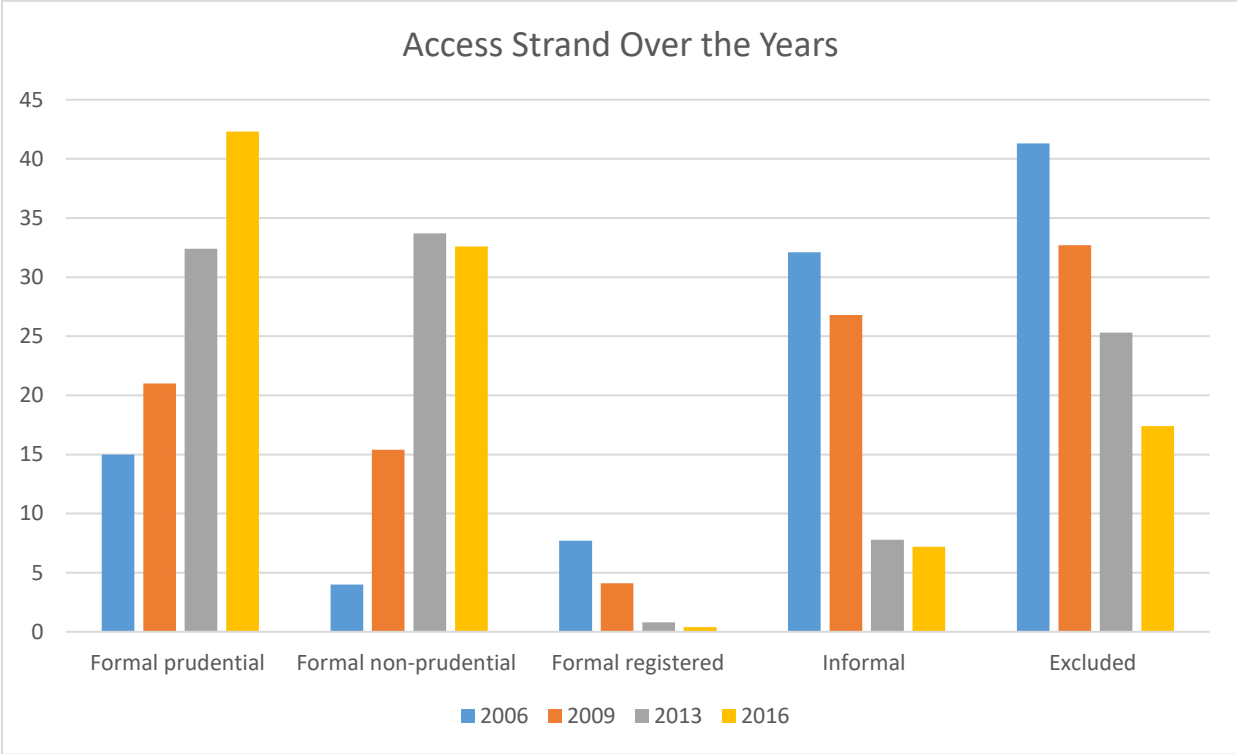
Source: FSD annual report 2016

Evidence from studies using household surveys in some emerging markets have found that limited demand for formal financial services, e.g. bank accounts is mainly driven by their high transaction and maintenance costs as well as documentation required to access (Allen et al. 2012). In addition to cost, there is emerging evidence that the low levels of financial literacy among population in emerging markets, poses a barrier to demand for service. Cole, Sampson, and Zia (2011) find that in addition to price, where individuals are unfamiliar or lack understanding about a financial service or product, they will not seek it out to use it. In SSA two complementary studies find that financial literacy has an effect on household financial behaviour (Murendo and Mutsonziwa 2017; Sayinzoga, Bulte, and Lensink 2016).

Therefore, on the one hand there is a need to improve access to formal financial services among low income households and on the other, there is also a need to improve their levels of knowledge and

understanding of financial concepts, products and service. This is necessary so as to ensure two things: the supply side provides financial products and services that serve the wide ranging and varying needs of the previously un-/under-served population and the users to know what services to demand for their specific needs. One way that has been "piloted" with success in Kenya is the use of mobile money. This is different from traditional mobile banking, where customers of a bank access their banking services through the mobile phone. The concept of mobile money refers to the ability to perform financial transactions on one's mobile phone without the need of having a bank account.

With the collaboration between banks and the mobile service provider to provide banking services to users of mobile money, the evolution of mobile money has almost come full circle. These facilities are provided through two (most prominent) services: KCB M-PESA and M-Shwari. The former is bank based where users of mobile money open a bank account at the collaborating bank and have two-way transaction ability, i.e. through the mobile phone and through the bank. The latter is mobile based where the requirement for the beneficiary is that they are a user of M-PESA. The user in this case has access to savings and credit facilities through the mobile phone and not through the bank, however their money is credited to an account in their name linked to their M-PESA account. From this perspective mobile technology has made a positive and significant mark in the improvement of the financial ability among households in Kenya.

1.2.3 Mobile Money and its role in the financial landscape of Kenyan households

Mobile money was commercially introduced in Kenya in 2008 through the mobile service provider Safaricom as M-PESA[2]. It enjoyed rapid adoption and growth among the population starting with the urban, relatively wealthy and educated class and moved on to the rural, poorer and less educated folk. Its success has been hinged on its ease of use, cheap access and safety with reference to money transfers. What started out solely as a money transfer mechanism with the slogan *"Send money*

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[2] "M" stands for mobile and "PESA" is the Swahili word for money.

home" has now become a tool and platform for formal financial services. Morawczynski (2010) established that the adoption and usage of M-PESA would evolve over time to provide a platform where users not only transfer money between each other, but it would also become a tool for making payments, buying goods and services, and eventually a savings wallet. With the recent collaborations between banks and the mobile service provider, the scope of M-PESA has expanded to providing traditional banking services of savings and credit that were previously inaccessible except through a traditional bank. In this way, the mobile service provider has contributed, almost by mistake, to enhancing financial inclusion in Kenya (Safaricom 2017).

Financial inclusion as a concept encompasses more than just individuals' access to formal financial services. In my opinion and from the empirical evidence from my research, inclusion requires individuals to also have an understanding of the financial services being served at the table to which they now have access to. These two elements: financial access and financial knowledge together make up inclusion and lead an individual towards financial capability which includes skills, attitude and behaviour. In developing economies, access to formal financial services and products as well as knowledge and understanding of their use is limited. This is especially so in SSA where it has led to the prolonged financial development gap described in a 2014 World Bank working paper by Allen, Carletti, Cull, Qian, et al. (2014). However, the widespread adoption and use of mobile technology provides a step in the right direction toward closing the financial inclusion gaps and driving financial development. To enhance financial development, the household needs to be able to manage its limited financial resources in such a way that they are able to mitigate shocks to their finances.

1.3   Motivation

In considering household finances among individuals in developing countries, income flows are found to be small and erratic both in the short term and across an individual's life cycle. With the growing concern of governments as well as the United Nations for self-sustainability and poverty

reduction there is a need to maximize short term income and enable individuals to cushion themselves in case of financial shocks. On a broader perspective, this refers to ensuring that households or individuals are financially capable. A financially capable individual is one who is able to understand and process financial information and make informed financial decisions regarding use of financial products and services to benefit their present and future life situation. To be financially capable one needs to: know their financial needs; have access to financial services and products that could meet these needs; have the knowledge and skill required to use or demand for the services and products they need; and make rational financial decisions.

For this to happen, low income households need access to financial services and products through mechanisms that are cheap, easy to use and reliable. In addition to this they also need a channel to enhance their knowledge of (or lack thereof) the use of particular financial services and products. With the realization that financial education programs are not viable for low income households due to the opportunity cost of time, the advent of mobile technology could provide the platform required to pass on financial information. With mobile phones being ubiquitous in SSA and especially Kenya, I saw an opportunity to contribute to financial capability literature in developing countries. The rapid adoption of mobile money through M-PESA in Kenya, provides a worthy platform to study how the use of mobile money can influence other aspects of an individual's financial life.

Mobile money was introduced as an easy, cheap and safe channel for money transfer. However, with time other advantages of the technology have been found. This fact motivated me to find out how being a mobile money user could influence other areas of the individual's life and in turn their household's financial well-being. I looked at mobile money use as a tool for enhancing financial capability through: providing a possible platform for financial literacy to occur; being a direct safe place to store money as savings for emergencies, to smooth consumption in case of a shock or for future use; and finally hoping to find a significant correlation between mobile money use and

financial literacy, I looked at the impact being financially literate would have on one's saving behaviour.

With FinAccess household survey data being made publicly available to researchers, I saw the opportunity for using the first nationally representative household data on financial access and financial inclusion to pursue the questions stated below:

1. Can mobile technology provide a convenient way of passing on financial information among individuals in developing countries?

2. Does mobile money use affect a household saving behaviour?

3. To what extent does an individual's financial literacy levels affect their saving behaviour?

1.4 Contributions of the specific empirical analyses undertaken

1.4.1 Mobile Financial Services as a Tool for Financial Literacy

Poor individuals in developing countries do not have the luxury to attend financial education programmes, as this is in direct conflict with their livelihood source. In this regard, the first part of the dissertation deals with a proposition for using the ubiquitous mobile phone in Kenya as a tool for providing financial literacy. This idea is an enhancement of a proposal by Cole, Sampson, and Zia (2011) and Allen, Carletti, Cull, Qian, et al. (2014), to further financial literacy and in turn financial development of developing economies especially in Sub-sahara Africa using technology. The motivation for this first paper is driven by the fact that the use of mobile phones in Kenya for financial transactions can be expanded to include other uses. Mobile technology in developing countries is surprisingly relatively easily available which means that people do not have to find extra time outside of their schedule to learn about financial elements.

In Sub-Sahara Africa, Kenya has been at the forefront of mobile technology as well as mobile financial services adaptation. Using the FinAccess household survey of 2009 and 2013, this paper determines the predictive ability and correlation between the use of mobile financial services and

the level of financial literacy. To operationalize use of mobile money, I consider the household's proximity to a mobile money agent. The mobile money agent provides the access point for the use of mobile money services for deposits and withdrawals. These are also viewed as channels of social interaction where information about financial services and products can be shared and exchanged among members of the community.

The hypothesis tested in this paper was: Users of M-PESA should have a gradual increase in their levels of financial literacy as compared to non-users.

The findings were: Though hard to establish causality, high positive correlations were established between households' use of M-PESA and their level of financial literacy. Users seemed to have a higher level of financial literacy in terms of basic knowledge and understanding of financial terms and concepts. In addition to the correlations, use of mobile money had a predictive ability to enable one to increase their level of financial literacy. Given the nature of mobile money use especially in rural areas, the mobile money agent becomes an attractive place for peer and social network influence in terms of financial products knowledge.

The contributions made by this paper are two-fold: to literature, I extend works by Cole, Sampson, and Zia (2011) and Allen et al. (2014) in using the SSA context to test the plausibility of mobile technology use for financial literacy as well as closing the financial inclusion gaps. To methodology, I complement work by van Rooij, Lusardi, and Alessie, Rob (2007) in the Netherlands on the use of a financial literacy index. Here I look at the basic form of the financial literacy index.

1.4.2 Mobile Money and Household Saving Behaviour: Evidence from Kenya's M-PESA

Households in emerging economies are on average at a disadvantage when they experience income shocks or unexpected expenditures, e.g. due to illness, death of family member. With the understanding that their incomes are low and often times erratic, these individuals are left exposed and vulnerable to shocks and an inability to smooth consumption. In Kenya the lower middle to low

income households represent approximately 60% of the population (KNBS website get citation). Low income coupled with handicapped access to financial products and services magnifies the exposure problem for vulnerable households. With the low levels of banking access, mobile money quickly attained a transformational impact status. This was due to its ability to fit into the everyday lives of individuals making it possible to formalize and personalize financial services and products.

Mobile money's evolution from a simple transfer mechanism to a platform for providing formal financial services is on the verge of coming full circle. Morawczynski (2010) argued that in time the mobile wallet would be used by individuals as a "savings accounts" given its convenience, safety and price friendliness. In this paper I try to empirically show that this proposition is possible and the effect that mobile money has on households' propensity to save by virtue of them being users is quite significant. Notably, low income individuals in developing countries already had a saving habit as Collins et al. (2009) find in their "Portfolios of the Poor" survey. The challenge however, in addition to earning the money, was to store it safely and manage to have a cushion in case of a shock to income. The question whether mobile money use affects saving behaviour has been often asked and to my knowledge two academic studies have been conducted so far in SSA on the same. One by Ky, Rugemintwari, and Sauviat (2016) who look at mobile money use effect on saving behaviour in Burkina Faso and the second a study in Kenya by Jack and Suri (2014) who looked at the effect of mobile money on household consumption smoothing. This paper relied on these two papers especially with reference to the empirical framework due to the comparability of Kenya and Burkina Faso.

The hypothesis tested here was: The propensity to save and access emergency savings for users of mobile money should be higher than that of non-users. The relationships tested were:

1. The use of mobile money improves the household's saving behaviour by enhancing their likelihood to save regularly and for emergencies.

2. To the extent that mobile money is affordable and accessible disadvantaged groups such as women, low income, rural based and less educated individuals benefit from the use of mobile money to increase their savings.

3. To the extent that mobile money is accessible and affordable, users of mobile money are able to access saved funds faster than non-users in case of unexpected shocks.

The findings from this paper showed that users of mobile money were able to access funds faster in case of emergencies than non-users. This was found to be from two perspectives where the user either already had some money in their mobile wallet or they could quickly ask family or friends to send them money. With reference to savings, mobile money was set up as a platform for sending and receiving money. However, evidence shows that users of mobile money were in a better position to "save" using on their mobile money accounts. This is also viewed from two perspectives: (1) where individuals deliberately leave some money on their M-PESA account for a rainy day or simply to save and have access to it when they need the money, or (2) individuals transfer money from their secret hiding places and put it into their M-PESA account as it is safer and less susceptible to theft or inappropriate use. Either way, the mobile wallet provides a savings platform for individuals whether there is a deliberate plan to save or if it is purely because the money is not immediately needed.

This paper made two **contributions** to literature: (1) the use of a developing country context, Kenya, to contribute to the limited research in the saving behaviour of individuals, and (2) establishing the benefits of mobile money among vulnerable individuals with reference to their ability to save and access emergency funds.

1.4.3   Financial Literacy and Saving for Retirement among Kenyan Households

This paper furthers the discussion on household saving behaviour with the focus shifting to financial literacy after households have gained access to formal financial services and products. Financial literacy enables individuals to process economic information and make informed decisions about

financial planning, wealth accumulation, debt and pensions (Lusardi and Mitchell 2014a). Empirical research shows that financial literacy *inter alia* has been found to influence savings and investment decisions (Jappelli and Padula 2013; van Rooij, Lusardi, and Alessie 2011). Majority of the studies on financial literacy, however, have been concentrated in developed markets in the United States and Europe. Still less work has been done in developing countries where studies on financial literacy's effect on household financial behaviour are few and far between.

In SSA, I found two fairly recent studies that also helped guide the empirical structure of this paper. In Rwanda, Sayinzoga, Bulte, and Lensink (2016) studied the effects of financial literacy on financial decision making among rural households. The other study was in Zimbabwe by Murendo and Mutsonziwa (2017) where they measured the effects of financial literacy on saving behaviour. The scarcity in financial literacy research in developing countries has been mainly due to the lack of reliable data on individuals' habits. With the introduction of FinAccess Surveys and the global Financial Literacy Index more nationally representative and reliable data has been collected for use in these studies.

To measure financial literacy, I developed a financial literacy index somewhat more advanced than the one used in the first paper. In the first paper, a basic financial literacy index was determined which measured only knowledge and understanding of financial concepts and terms. A similar index (different survey periods) was used in the descriptive statistics stage however a more advanced index was developed for the regressions. The development of this index, in addition to knowledge of terms and concepts, took into consideration other elements of attitude and behaviour toward financial matters were included in the index following van Rooij, Lusardi, and Alessie (2011); Murendo and Mutsonziwa (2017).

The hypothesis tested here was: the test statistic for an individual's likelihood to save for retirement should be positive and statistically significant from zero if the individual has a higher level of financial literacy. The relationships tested were:

1. Financially literate individuals will have a higher tendency to save on a regular basis.

2. Financially literate individuals will have a higher likelihood to save for retirement to finance their lives in old age.

The findings of this paper were consistent with prior research where the likelihood to save for old age was higher among more financially literate individuals. This is plausible because where people have a better understanding of their economic lives and of those around them, they will tend to think about sustainable ways of financing their retirement and not purely relying on family. This necessarily means that more financially literate individuals will also be saving regularly as this goes into their retirement pool.

This paper makes two **contributions** to literature: (1) adding to the pool of financial literacy research with the aim of reducing the scarcity of work in the area in developing countries, and (2) the replication and use of the financial literacy index in a developing country context, Kenya.

1.5   Structure of the Dissertation

This dissertation concerns itself with empirically establishing the role that financial inclusion and financial literacy have in improving the financial lives of poor households in Kenya. Its chapters are dedicated to three elements in the ways in which financial inclusion and financial literacy can help households in closing the financial development gaps in SSA. The second chapter deals with how mobile technology or mobile money use can interface with providing financial literacy to its users. The third chapter looks at how the mobile money platform can provide a safe and cheap space for vulnerable members of the community to save money especially for emergencies. The fourth chapter looks at how financial literacy influences the ability of individuals to save for retirement or old age. The final chapter gives an overall conclusion to the dissertation where limitations to the study as well as suggestions for further research are given.

CHAPTER TWO

2. Mobile Technology as a Tool for Financial Literacy: Evidence from Kenya's M-PESA

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ABSTRACT

The need for inclusive financial systems in Sub-Saharan Africa has over the past decade become an important consideration for economic development. In order to achieve the financial inclusion goal while reducing irrational financial behaviour, there is a documented need to increase households' financial literacy levels. In addition, it has been found that financial literacy on households' use of financial services carries potential benefits. There is however little evidence of any significant effects of financial education programs to this end. Using household survey data from FSD Kenya I conduct an empirical analysis to determine whether and to what extent a household's use of mobile money increases its likelihood to be financially literate. I find that the interaction of individuals with basic financial services made available through mobile technology provides a channel to achieve financial literacy. With the introduction of mobile money technology financial literacy need not be solely considered from a financial education perspective. From the regression results mobile money use is a significant predictive determinant of financial literacy. This means that mobile technology when used to provide financial services opens up a channel for individuals to become more informed about financial terms and concepts. This in turn encourages their use of formal financial products and services.

2.1   INTRODUCTION

Financial development in Sub-Saharan Africa (SSA) has become an important point of discussion among policy makers and researchers alike. Several researchers[3] have documented that access to formal financial systems among households and individuals can enhance household welfare, in turn increasing asset ownership and driving economic growth. It has been observed that African financial sectors still underperform in comparison to peer developing countries despite the numerous financial sector reforms that SSA countries have undergone in the past two decades (Allen, Carletti, Cull, Qian, et al. 2014). For financial development to take root and developing countries in SSA to catch up with other peer developing economies, the glaring financial inclusion gap needs to be filled. Financial inclusion refers to the accessibility of formal financial services for the unserved or underserved groups in society (Hannig and Jansen 2010). The need for inclusive financial systems requires an understanding of the unserved or underserved group. It consists of establishing a financial system that has services catering to people with a wide range of varying needs (Demirgüç-Kunt and Klapper 2012a).

For financial inclusion or the provision of formal financial services to have the desired effects on households in developing markets there needs to be prior knowledge of the products and services and understanding of their use. In their paper on the demand for financial services among individuals in emerging markets, Cole, Sampson, and Zia (2011) find that financial education was a predictive determinant of demand for financial services among households in Indonesia. They argued that although literacy has the potential to improve financial behaviour among households, education programs have little if any significant effects. In broadening their work, this paper finds that with the introduction of mobile money technology financial literacy need not be solely considered from a financial education perspective. Financial literacy can be achieved through interaction of the

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[3] See discussion papers from the World Bank Policy Research Series by (Allen et al. 2013; Allen, Carletti, Cull, Qian, et al. 2014; Allen et al. 2012; Demirguc-Kunt, Klapper, and Singer 2013)

individual with a basic financial service made available through a ubiquitous channel such as mobile technology.

Poor individuals in developing countries do not have the luxury of time to attend financial education programs as their livelihoods are dependent on daily wages posing a direct opportunity cost conflict even when said programs are freely offered (Cole, Sampson, and Zia 2011). To deal with this they propose the use of information technology such us mobile technology to enhance literacy among the poor underserved populations in emerging markets. This is because mobile technology in developing countries is relatively easily available and people do not have to find extra time out of their schedule to attend financial education programs. Using Kenya's mobile money technology, M-PESA, this paper finds that an individual's or household's use of mobile money is a significant determinant of their level of financial literacy.

In SSA, Kenya has been at the forefront of mobile technology and mobile financial services introduction as well as its adoption. In the 2015 financial year performance for Safaricom[4] (the company responsible for the development of the M-PESA phenomenon), the cumulative value of the money transferred via M-PESA was more than US$ 43.8 billion. In comparison to other money transfer channels, a majority of M-PESA users send small but more frequent remittances (Aker and Mbiti 2010; Allen, Carletti, Cull, Qian, et al. 2014). M-PESA does not therefore propose to eliminate the use of other transfer mechanisms but rather fill a niche for low value high volume transactions. Based on these numbers, it is observable that M-PESA provides a platform that brings more persons to the table with reference to use of financial services.

FinScope surveys[5] across Africa have been conducted to establish the levels of financial inclusion over the past decade. In Kenya the Financial Sector Deepening (FSD) is responsible for these surveys.

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[4] Safaricom is the largest mobile telecommunications corporation in Kenya. It controls approximately two thirds of the Kenyan market share for mobile phone services, i.e. adult population with a current subscription rate of 23.3 million customers (Safaricom, 2015) of which 19 million are active.

[5] FinScope surveys are nationally representative consumer surveys of how individuals in developing economies source their income and manage their financial lives. The body is FinMark Trust based in South Africa and set up in 2002. The surveys in Africa are conducted in various countries in partnership with independent trusts funded by UKAid under the

Over the past 5-6 years they began an initial focus on financial literacy among households with a few questions included in the surveys. To measure financial literacy and determine its relationship with mobile technology I use the FSD Kenya household survey data of 2009 and 2013 to device an index based on knowledge and understanding of financial terms. The level of financial literacy in SSA has been found wanting in comparison to other developing countries (Allen, Carletti, Cull, Qian, et al. 2014).

To operationalize mobile technology, I use a household's accessibility to a mobile agent; i.e. how many agents are present within the household's area. To measure financial literacy I have constructed a basic financial literacy index measure following (van Rooij, Lusardi, and Alessie 2011) using the FSD survey questions on the merged datasets for 2009 and 2013. My findings show that those households located in areas with a higher number of mobile agents displayed higher levels of financial literacy after controlling for geographical dispersion. This means that mobile technology used to provide financial services opens up a channel for individuals to become more financially informed about financial concepts and provides a predictive ability for financial literacy.

This paper makes the following two contributions to literature: first, I establish that the use of mobile money technology provides a significant determinant for increased financial literacy levels; Second the use of SSA context complements (Cole, Sampson, and Zia 2011) and (Allen, Carletti, Cull, Qian, et al. 2014), extending research on financial literacy and use of financial services among households in developing countries. It also makes a methodological contribution to the analysis of financial literacy in developing economies where I develop a basic financial literacy index.

The rest of this paper is organized as follows: Section 2 presents a brief literature review on financial literacy and mobile technology; Section 3 discusses the data and sets out the empirical framework;

DFID. In Kenya the Financial Sector Deepening is in charge of conducting these surveys in collaboration with the government and the Central Bank. ('Finmark Trust | Information and Research' n.d.)

Section 4 presents the results and discussion of findings; Section 5 concludes proposing policy recommendations as well as citing the limitations encountered.

2.2 LITERATURE REVIEW

2.2.1 The Concept of Financial Literacy

The definition and measurement of financial literacy has been debated among academic researchers[6] and policy makers alike over the past decade. The multiple definitions of financial literacy proposed as well as questions used in surveys to measure it range significantly in complexity and emphasis (Robb 2012). In examining a range of financial literacy measures used in the definition, Huston (2010) finds that financial literacy, financial knowledge and financial education have in literature been interchangeably used. Although Robb (2012) finds that the concepts of financial literacy and financial knowledge are distinct (the former involves understanding and ability whereas the latter is about recalling a set of facts), he acknowledges that these concepts are still continuously interchangeably used.

Given this complexity he proposed financial literacy is best taken as a construct which incorporates a number of elements that together influence a consumer's financial decision making. This view had been similarly held by Lusardi & Mitchell (2007) who examined financial literacy in relation to individuals' financial well-being for example savings and cautious credit taking, mortgage and retirement planning. They build on the Organization for Economic Development (OECD) definition of financial literacy in their financial education project aimed at increasing financial literacy among its member countries. The OECD defines financial literacy as:

> "…the combination of consumers'/investors' understanding of financial products and concepts and their ability and confidence to appreciate financial risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well-being" (OECD 2005).

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[6] (Huston 2010; Lusardi 2011; Lusardi and Mitchell 2007a, [a] 2014; Miller et al. 2009; OECD 2005; Perotti et al. 2013; Remund 2010; Robb 2012; Schmeiser and Seligman 2013)

As seen above this definition is a combination of constructs which makes it palpable for use in different contexts. This paper will take on this definition and concentrate on consumers understanding of financial products and concepts.

2.2.2 Economic Case for Financial Literacy

The world's financial markets are becoming more accessible to the retail investor providing a wider array of financial products and services. Economic research has over the past decade focused on financial literacy in a bid to avert another financial crisis due to poor financial decision making as proposed by the President's Advisory Council on Financial Capability (PACFC 2013). To theoretically conceptualize financial literacy Lusardi & Mitchell (2014a) considered the microeconomic approach to savings and consumption of rational beings introduced by Modigliani and Brumberg in 1954. Theoretically a rational individual will consume less than his income and have a store of funds in order to support times of low earning. He will also make investment decisions based on his risk profile and returns on the investment made. In general, the microeconomic models assume that individuals are fully informed and have the capacity to formulate and execute economic spending plans on their income. However Lusardi (2011) found in the United States (US) and van Rooij et al. (2011) in the Netherlands that a majority of the individuals have limited financial knowledge and thus make irrational financial decisions.

Similar to the sub-prime mortgage crisis in the US, developing economies experience asset price bubbles and/or pyramid schemes in which consumers are duped and lose their money. Miller, Godfrey, Levesque, & Stark (2009) argued that all other factors held constant a financially literate individual would not take on credit they could not afford. In their report they argue that the financial crisis highlighted a gap in financial markets literature as well as the vulnerabilities of uninformed individuals in complex financial markets. They argue that the problem is however not confined to developed markets. The financial sector in developing economies continues to expand with products and services becoming tailor-made to serve the poor in a bid to increase financial inclusion. Bearing

this in mind and the possible contraction of international capital inflows to developing economies makes a viable case for the consideration of financial literacy among individuals in poor countries (Miller et al. 2009). Moreover further recent research has established that the SSA countries have a wider financial inclusion gap in comparison to their peer developing countries (see table 2.1) brought about by, *inter alia*, low levels of financial literacy (Allen, Carletti, Cull, Qian, et al. 2014).

In light of the above, financial literacy levels of individuals are important inasmuch as they are considered with respect to their possible impact on economic behaviour. Unfortunately, there exists relatively few household surveys dealing with financial literacy and financial decision making. Among the first researchers to combat this problem were Lusardi and Mitchell (2006) using the Health and Retirement Study in the US. They established that households lacked basic levels to financial knowledge on factors such as interest, inflation effects, and risk diversification. The illiteracy levels were more acute among females, the elderly and those with low levels of education. In the Netherlands, van Rooij et al. (2011) conducted a household survey on financial literacy and stock market participation. In addition to the numeracy or computational financial literacy questions devised by Lusardi and Mitchell (2006), they included questions on knowledge and understanding of terms at two levels. They constructed two financial literacy indices on the basic and more complex level of questions on stock market investments (van Rooij, Lusardi, and Alessie 2011). Their results were similar to the US survey where individuals with low levels of financial literacy knew less about the stock market and were less likely to participate in it. There were also similar findings among with regard to demographic disparities where females, the elderly and individuals with lower levels of education being less financially literate and hence not participating in the stock market.

Shifting the focus to developing economies Collins, (2010) documented financial lives of the poor living on less than $2 a day. They found that financial exclusion among individuals is due to a number of reasons including income level, geographical location, gender and financial literacy. In a nationally representative survey among Indonesian households, Cole et al. (2011) compared product price and

consumer knowledge to establish determinants of demand for financial products. From their observational results in addition to cost of products and lack of income they found that financial literacy is a strong and consistent determinant of demand for financial services. Moreover, they established that more financially literate households tended to make better financial decisions. To establish causality, they carried out a field experiment and found that financial literacy was a strong predictive determinant of demand for financial services. However, the price of the financial product had a much larger effect. The main reason given by the respondents was the opportunity cost associated with acquisition of financial knowledge. This was a discouraging factor where individuals were not ready to take time off to undergo a free financial education program. In this regard Cole et al. (2011) proposed further research on more cost effective ways to provide financial knowledge.

Further financial inclusion research in developing markets has been conducted in SSA by Allen et al. (2014) who compared financial inclusion among peer developing countries as classified by the world bank. They find a wider gap among SSA countries than their peer developing countries in use of financial services. Table 2.1 shows the percentage of people with an account at a formal financial institution.

Table 2.1: Percentage Adult Population with an Account at a Formal Institution

Region	Account at a formal institution (% age 15+)
East Asia and Pacific	54.9
Europe and Central Asia	44.9
Latin America and Caribbean	39.3
Middle East and North Africa	17.7
South Asia	33.0
Sub-Saharan Africa	24.0

Source: Allen, Carletti, Cull, Qian, et al. (2014)

Note: the regions are with respect to only middle- and lower-income countries according to the World Bank classification

Similar to the Indonesian survey, the Global Findex survey[7] shows that 32% of the unbanked respondents cited cost as a barrier to having a bank account (Demirgüç-Kunt & Klapper, 2012). These costs covering transaction costs and annual fees of operating a bank account make small value transactions unaffordable. In addition to cost barriers in SSA, poor infrastructure and sparse populations contribute to the low levels of financial inclusion as it would be cost inefficient to provide financial services through traditional brick and mortar branches. In this regard, there is a continuous call to the financial sector in developing economies to come up with innovative ways of reaching the financially excluded as well to provide more tailored products and services (Allen, Carletti, Cull, Qian, et al. 2014). Further exploring the need for inclusive finance in SSA, in countries such as Nigeria, Malawi and Mozambique, it has been documented that a large proportion of the population lack awareness of basic financial concepts and products hence do not use them. From the financial inclusion surveys it has also been documented that in low income countries financial literacy is positively correlated with use of bank accounts and take up of insurance services (Xu and Zia 2012).

The FinScope surveys in African countries find that where individuals have access to financial information they are more likely to make us of financial services (Xu and Zia 2012). In Kenya, for example the FSD surveys find a positive relationship between exposure to financial information and use of a financial service such as a bank account. From these surveys the source of financial information is found to be highest through media such as Radio. In Kenya, the observational data show that financial awareness among a high proportion of the population is on money transfers and on mobile financial transactions than on more complex financial products (Xu and Zia 2012). These correlations support the proposal made by Allen et al. (2014) on the use of mobile technology as an innovative way to increase financial inclusion among the population in developing countries and reduce the financial inclusion gap in SSA. This is also consistent with what Cole, Sampson, and Zia

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[7] The Global Findex stands for Global Financial Inclusion Database. It refers to the world's most comprehensive set of data on how people make payments, save money, borrow and manage risk.

(2011) suggested to consider mobile phones as a platform for the transmission of financial information in a cost-efficient and time saving manner.

2.2.3 The Mobile Phone as a Platform for Financial Services in Kenya

Development of mobile phone use in Africa has flourished over the past one and a half decades. Previously, the ownership and use of the mobile phone was privy to the elite minority or the political class of the developing world (Aker and Mbiti 2010). Data from the Global System for Mobile Communications Association (GSMA)[8] shows that only 10% of the African adult population had mobile phone coverage in 1999. This coverage was primarily concentrated in North Africa and in South Africa as an SSA country (Aker and Mbiti 2010). However, by 2008, 65% of Africa's adult population had mobile phone coverage. Despite the prevalence of poverty in SSA, the rate of adoption of mobile phones in SSA has been exceptionally high (see figure 2.1). Kenya alone accounted for over 30 million mobile phone users in 2013 as shown in figure 2.2 below shows the development of mobile phone subscribers in Kenya from the year 2001. Based on this overwhelming response and uptake of the mobile phone in SSA, Allen et al. (2014) highlighted the continued promise of success of the mobile phone as a platform for financial services in the region.

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[8] The GSM Association is an association that represents that interests of mobile operators across the globe and which unites approximately 800 operators with over 250 companies in the mobile ecosystems (http://www.gsma.com/aboutus/, 2015).

Figure 2.1: Mobile Money use Penetration in Africa
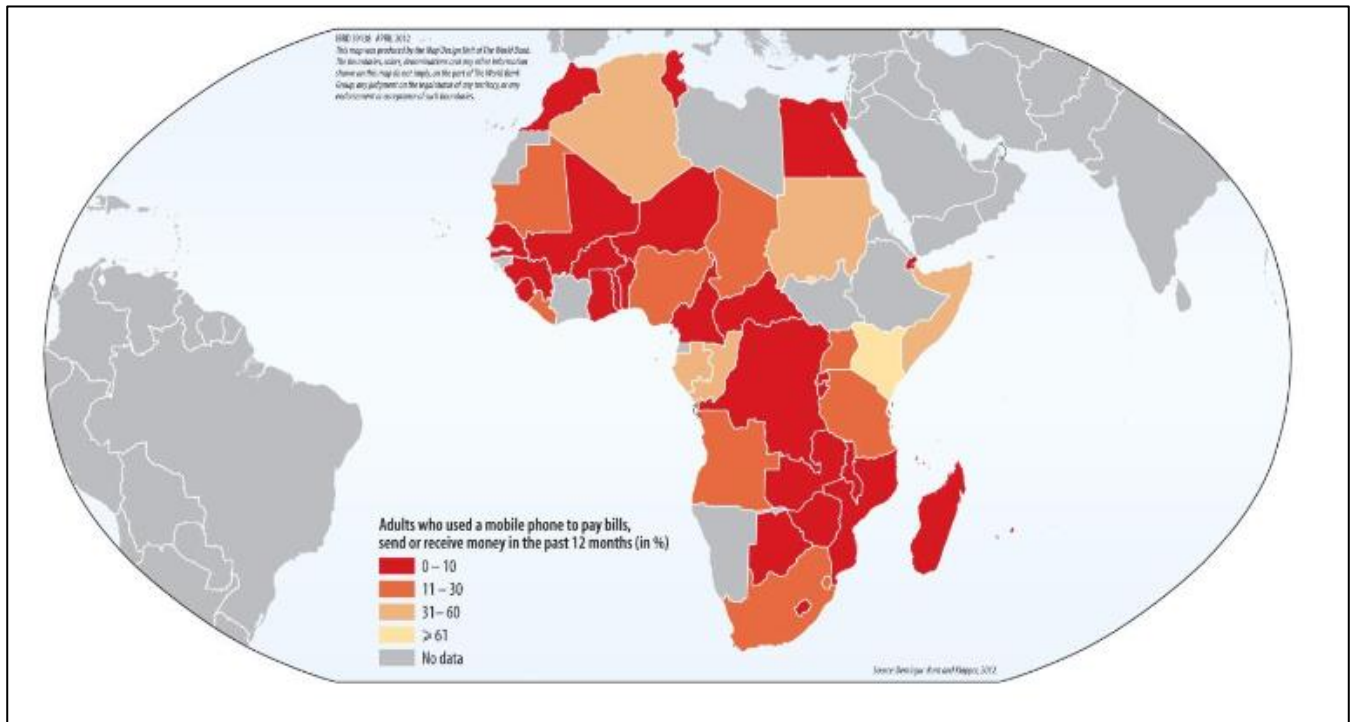
Source: (Demirgüç-Kunt & Klapper, 2012)

Figure 2.2: Development of Mobile Subscribers in Kenya
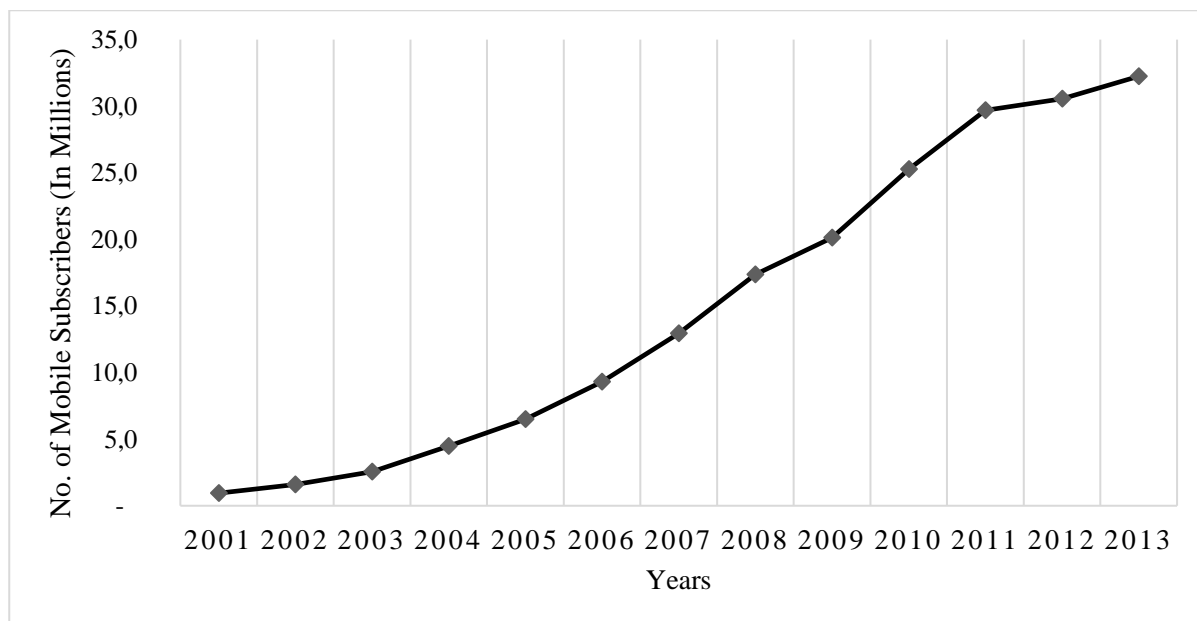
Source: Communications Authority of Kenya Annual Reports

The mobile phone as a platform for financial services was launched in Kenya in 2007 by Safaricom,

the largest telecommunications company in Kenya, following a donor-funded pilot project with the

UK based Vodacom. With this launch Safaricom introduced a payment and money transfer services

known as M-PESA (Jack and Suri 2011a). The product allows its users to send money stored on the

mobile phone using SMS technology, pay for goods and services as well as exchange e-money for cash. The introduction of mobile money transfer services was not intended to replace other payment mechanisms as previously noted but rather address a consumer niche that needed a fast, cheap and secure way of performing low value but high volume transactions (Jack and Suri 2011a). Money transfer services as well as cash withdrawal is made possible by the presence of Safaricom M-PESA agents who are currently located in most parts of Kenya including rural and sparsely populated areas of Kenya. Figure 2.3 below shows the annual growth of mobile money subscribers and agents in Kenya.

Figure 2.3: Trend Number of Mobile Money Subscribers and Agents in Kenya over time
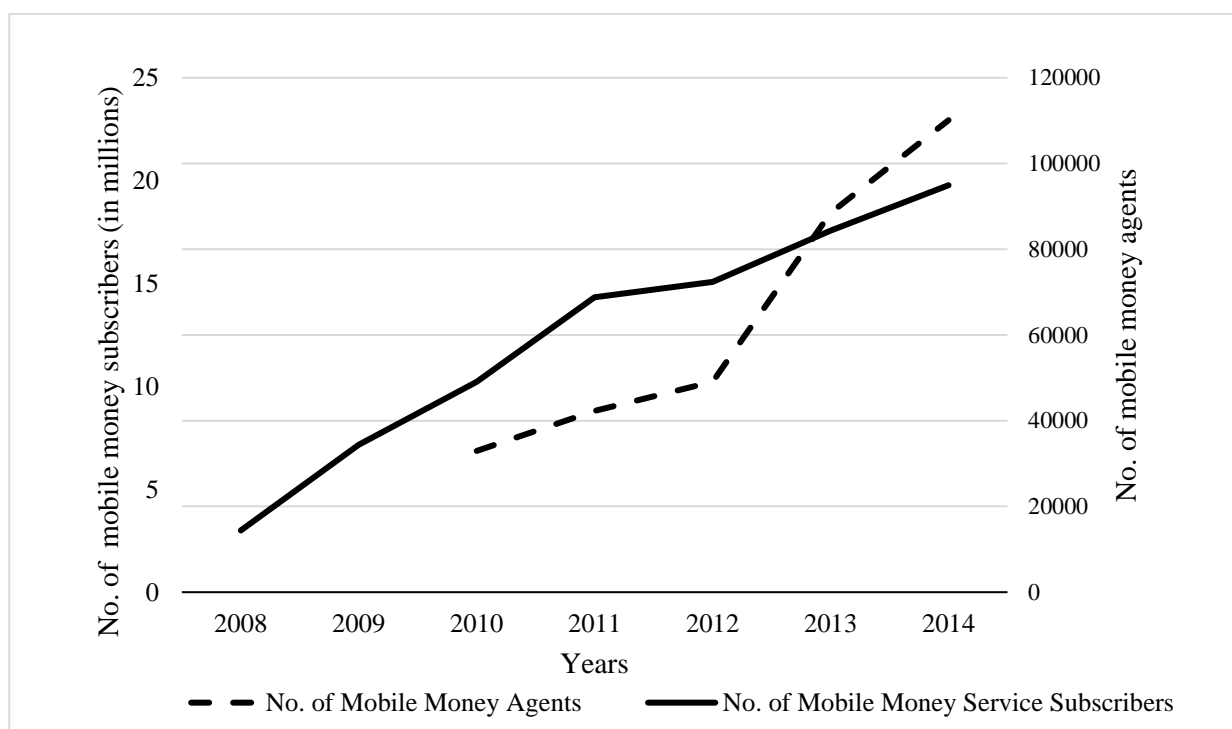
Source: Communications Authority of Kenya annual reports and Safaricom annual reports

The widespread use of mobile technology and mobile money among formally excluded groups in developing economies has had and continues to have a transformative effect on economic activity (Yenkey, Doering, and Aceves 2015). Mobile money use in Kenya, where it is most widely spread and developed can be used to perform almost any kind of transaction including making remittances, paying wages and salaries, making government related payments such as taxes, public parking fees and so forth. This makes the platform very interactive and thus it lends itself to use for other products

as individuals often have their cell phones at hand. Given this level of development in mobile money use and the continued financial sector expansion, Kenya lends itself as a perfect context to conduct an empirical study. I propose to evaluate two ideas: i) use of mobile technology for financial transactions overcoming the cost and infrastructural barriers experienced with traditional provision of financial services (Allen, Carletti, Cull, Qian, et al. 2014) and ii) the identified need for financial literacy for better use of financial services and products (Cole, Sampson, and Zia 2011; Miller et al. 2009). In this paper I examine mobile phone use as an innovation to provide financial services and whether its ubiquity provides a viable time and cost-efficient source of financial literacy.

2.3 DATA DESCRIPTION AND EMPIRICAL FRAMEWORK

2.3.1 Context and Data Description

In this paper I use FinScope survey data collected and maintained by the FSD Kenya[9], an independent trust funded by Department for International Development (DFID) in partnership with the government of Kenya and the Central Bank of Kenya. FSD Kenya in a bid to establish and improve the level of financial inclusion in Kenya have conducted nationally representative household surveys since 2006 in three phases. These surveys collect data on households' access and use of financial services based on their level of formalization. The use of FinScope national surveys which measure a few aspects of financial literacy in SSA and other countries in the lowest income World Bank rank is necessitated by the lack of national survey focused on financial literacy. These surveys to date have been the most widely spread in Africa and though mainly concerned with financial inclusion, give us a snapshot of the financial literacy situation (Xu and Zia 2012).

Using the information gathered from these household surveys, I construct a financial literacy index measure based on the questionnaires for the survey cycles of 2009 and 2013[10]. The financial literacy index concept is adapted from van Rooij et al. (2011) where they proposed both a basic and more complex financial literacy index constructed from questions on financial literacy and stock market participation. In the survey conducted in Kenya, the questionnaires look at the basic level of financial literacy. Appendix A1 provides an extract of the questionnaire with these questions. In the Netherlands van Rooij et al. (2011) wanted to find out the impact of financial literacy on stock market participation and thus incorporated a secondary level of complex questions on stock markets with which they constructed a secondary financial literacy index. Given the levels of basic literacy in SSA,

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[9] The trust's aim is to make financial markets work for the poor. Their work seeks to harness financial solutions to meet the needs of lower income households and smaller scale businesses helping them manage scarce resources and invest in the future (see: http://fsdkenya.org/about-us/).

[10] In this paper, I exclude the 2006 survey as there wasn't any part of the questionnaire dealing with financial literacy and mobile technology use for financial services had not yet been launched in Kenya. Hence this particular survey was not relevant for this paper.

I limit the scope of the measurement of financial literacy to the assessment of basic financial literacy, i.e. knowledge and understanding of financial terms among households in both rural and urban areas.

Sampling for the surveys was done by the Kenya National Bureau of Statistics based on the Census of the Kenyan Population of 1999 and 2009. To achieve a nationally representative sample, cluster stratified probability sampling technique was used based on the National Survey Sampling Evaluation Program (NASSEP) IV and V for the rounds in 2009 and 2013 respectively. There were three levels of selection: first a selection of clusters to ensure representation at the national, provincial and urbanization levels (650 clusters in 2009; 710 in 2013). The second a selection of twelve (12) households within each cluster and the third level selecting a respondent randomly in each household aged 16+ years. The surveys also sought information on the household head whom being the income earner is also often responsible for making the household's financial decisions. Three visits were made to households where the respondents were not initially present to ensure maximum target results. The final figures after completion were 6598 households in 2009 and 6449 in 2013 which represented a two-thirds completion level. (Johnson, Brown, & Fouillet, 2012).

With the given datasets I conducted a cross-sectional analysis of the impact of mobile technology on financial literacy among households. Further surveys should make it possible in the future to conduct time series trend analysis on impact. However, at this point I can only conduct a snapshot analysis using cross-sectional data. To do this I merged the two data sets from the surveys of 2009 and 2013 and selected variables based on literature that have been found to have an impact on households' financial literacy in other contexts. Household demographics such as age, gender, education level marital status, as well as socio-economic characteristics such as income source and per capita expenditure were selected and included in the empirical model. Geographical demographics were also included with the households grouped as either rural or urban and clustered by province as the village fixed effect. Included as well among the control variables is a set of financial access controls

which allowed for the distinct measurement of mobile technology contribution with reduced deflection of causality.

Table 2.2 below presents summary statistics of the household characteristics for the combined dataset. It gives an overview of how the households are constituted on average.

Table 2.2: Summary Statistics Household Characteristics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Household Characteristics					
Rural/Urban household	13,047	0.6777	0.4674	0	1
Total HH Size (no. of Persons)	13,047	4.6992	2.5854	1	24
Age of HH head (no. of years)	13,047	41.1355	17.4652	16	105
HH Per Capita Expenditure	13,039	11,356.9	25,340.55	0	812,500
Gender HH head	13,047	0.7260	0.4460	0	1
Education level attained HHhead	13,047	2.7520	1.4701	1	7
Marital Status HH head	13,047	2.7117	1.1077	1	5
HH Own Cell Phone (percent)	13,047	0.5634	0.4960	0	1
Mobile Money Used (percent)	12,615	0.5124	0.4999	0	1
Financial Access Controls					
Bank Product Current	13,047	0.2570	0.4370	0	1
SACCO Product Current	13,047	0.1016	0.3021	0	1
MFI Product Current	13,047	0.0334	0.1797	0	1
HH Income Source (Percent)					
Transfers	13,047	0.5294	0.4992	0	1
Employment	13,047	0.3524	0.4777	0	1
Agriculture	13,047	0.5044	0.4999	0	1
Own a Business	13,047	0.2397	0.4269	0	1
Rent and Investment	13,047	0.0382	0.1916	0	1

Source: Author generated using FSD Datasets 2009, 2013 surveys

Note: Per capita expenditure is given in Kenya Shillings (Kshs.) which is the local currency in Kenya. The minimum age of respondents for the survey was capped at 16 years of age. The education level and marital status were coded into 7 (none, some primary, completed primary, some secondary, completed secondary, technical training after secondary, university) and 5 (single, divorced/separated, married/living together, don't know). The rest are binary variables and interpretation depends on whether they are values or categorical variables.

On average majority of the households surveyed in both rounds are rural households at 67% of the total dataset. This is due to the fact that Kenya has a majority of people living in rural areas even with the increased rural-urban migration and development of slum dwellings. It is important to note here that slum dwellings in urban cities were not classified as rural areas but rather as urban areas. The

number of persons per household is on average 4-5 persons where the household unit takes care of a standard nuclear family in the event that the head is married. Where the head is single, they are often living with siblings or some member(s) of their extended families. The average age of the household head is 41.13 years old with a level of education of at least having completed primary school that is approximately 8 years of basic formal education.

Given that majority of households are in rural areas agriculture is found to be a relatively high source of household income at 52.9%. Subsequently with a number of people living in the rural areas, there is a tendency to have the main income earner working in a town further away from home or in the city and will send money back home. This is reflected by the 52% of households on average having transfers as their source of income. Also given the time period in which the surveys were conducted the reliance on transfers is likely to include some lingering effects of the post-election violence which left several people without farms to depend on. This was also noted by Jack & Suri (2014) where several households reported negative shocks to their livelihood and income sources. Transfers were also enabled by the fact that more households had access to a mobile phone at 56% and the widespread use of the mobile money transfer service M-PESA provided by Safaricom launched in 2007 at an average of 51.2%.

2.3.2 Empirical Framework

Kenya's co-occurrence of semi-formal financial services use through mobile money services makes it an ideal context for an empirical study on the influence of mobile money use on financial literacy. FSD Kenya's financial inclusion household surveys provide empirical raw data for the analysis of the identified unresolved relationship between mobile technology use and financial literacy. In these surveys, the respondents were required to identify any financial services that they were familiar with in terms of awareness and/or usage. The 2009 survey was the first to be conducted after the launch of the mobile money platform M-PESA for remittances. With the adoption of mobile financial services platform, it became easier, faster and cheaper to make domestic remittances. From the 2013 survey

the proportion of all domestic transfers made in Kenya was 91.5% (see Table 2.3 below). The proximity of mobile money agents has made it a more possible, easier and faster means for persons to send and receive money.

Table 2.3: Percentage Usage of Various Forms of Money Transfer in Kenya

Money Transfer Channel	2006	2009	2013
Family/Friends	57.2	35.7	32.7
Bus or matatu	26.7	4.0	5.4
Money transfer service	5.3	4.0	1.9
Cheque	3.8	1.2	1.3
Direct to bank account	9.6	3.2	4.3
Post Office	24.2	3.4	1.3
Mobile Money	0	60.0	91.5

Source: FSD Survey data

Inasmuch as there is a significant uptake and usage of mobile money for remittances, it is necessary to highlight that the initial adopters and users of mobile financial services were urban, wealthy and already banked. Therefore, it would be plausible to conclude, also already financially literate. However, this theory holds true for the money sent whereas the recipients increasingly became more rural based following the branding and thrust of M-PESA[11].

It is plausible to propose that the widespread usage of mobile money was likely to have a two-fold impact in Kenya: (i) M-PESA user households' financial knowledge would gradually increase and (ii), access to mobile money should consequently enable a household to counter financial shocks affecting economic well-being. The first empirical research was conducted on the second impact by Jack & Suri (2014) where they found that households using M-PESA were able to easily smooth consumption and share risk , for instance, getting money fast to pay for medical bills or such other

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[11] The marketing campaign for M-PESA was always "Send money home ". This is with reference to the fact that the majority of people live in rural areas whose working children and/or husbands in the urban areas. These people in the urban areas are expected to provide for their families and send the money back home for the welfare of their households. Previously this would be costly and would have a time component that negatively influenced the optimal use of the funds finally received.

shocks. In this paper I deal with the first impact and will look at subsequent effects on household financial welfare in consequent work.

2.3.3 Measuring Mobile Money Usage and Determinants of Financial Literacy

The main explanatory variable of interest for this paper is mobile money usage in a household. Mobile money usage is measured using the proximity of a household in a province (its geographical region) to a mobile money agent estimated by the number of mobile money agents present in a province.[12] As opposed to a household's use of mobile money, i.e. amount and frequency sent and received, as the measure for usage, mobile money agents present in a province was selected as a variable exogenous to the household. This was viewed necessary to circumvent the probable reverse causality problem that was foreseeable between the household use of mobile financial services and its level of financial literacy. From this point of view, it would not be explicitly possible to state whether the household uses mobile money and other financial services because they are already financially literate, or they are financially literate due to their use of mobile financial services. Therefore, to enable me to control the direction of plausible causality it was necessary to determine an exogenous variable independent of the household that allowed me to measure mobile money usage. The number of mobile agents was computed per province and the logarithm of this value was taken as the main predictor variable for the regression model.

In the surveys conducted in 2009 and 2013 there was additional emphasis on financial literacy where questions on financial literacy were introduced. The measure used to determine basic financial literacy was awareness and understanding of financial terms and financial institutions and providers, two questions to establish numeracy skills and information on sources of financial advice. To allow for use of the two surveys the questions needed to be the same from one survey to the next. In this regard, this paper focuses on the financial literacy questions on awareness and understanding and leave out the numeracy skills questions as the latter differ from one survey period to the other. The

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[12] This data was retrieved from Safaricom who have the largest network of mobile money agent distribution across the country. As a listed company its information was also publicly available.

addition of financial literacy questions in the 2009 and the 2013 surveys points to a possible explanation for the gap in financial inclusion among SSA countries in comparison to their peer developing countries as well as the need to avoid another financial crisis due to lack of financial knowledge (Allen et al., 2014). This subsequently justifies the need to discuss financial literacy as a means toward financial capability among households in SSA.

To establish awareness of financial terms the household was required to select the option that best described their experience with certain financial services terms. The options were: "Never heard of this word or phrase", "Heard of this word or phrase but don't know what it means" and "Heard of this word or phrase and know what the term means". In conducting the survey, it was necessary to establish the respondents' levels of effective literacy, i.e. ability to read and write in English or Swahili which helped reduce bias as the interviews were limited to these two languages[13]. Similarly as in van Rooij et al. (2011) households were instructed to answer without seeking further clarification of the terms. Among households, the most commonly understood financial terms in both surveys were: savings account, budgets, cheques and insurance. The least understood were collateral, mortgage and inflation. Figure 2.4 below shows in percentage the mean level of understanding of financial terms in Kenya.

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[13] English and Swahili are the national and official languages of Kenya and are used in all institutions. All official documentation as well as information in all financial institutions is given in these two languages.

Figure 2.4: Descriptive Statistic Display of Household Knowledge of Financial Terms
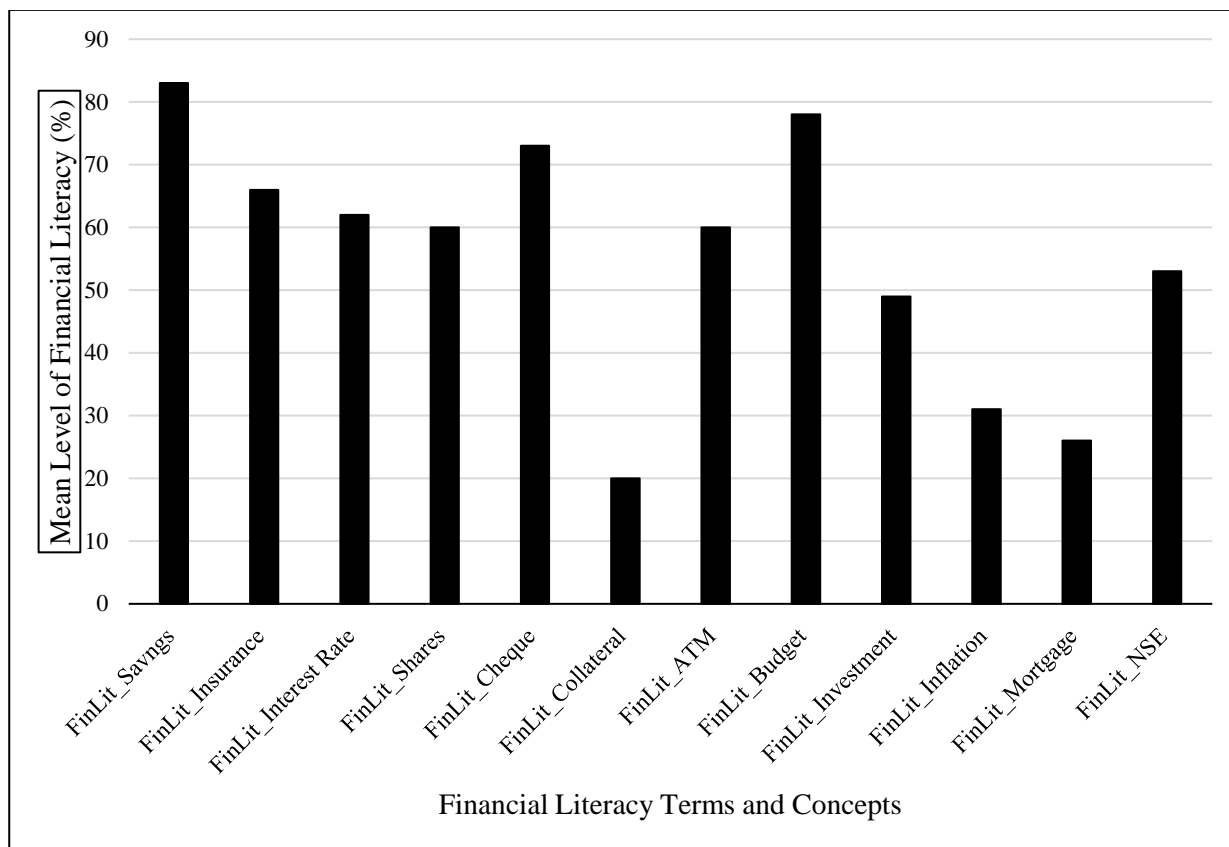
Source: Author generated from FSD Datasets

From the descriptive statistics displayed above the individuals seemed to have a fairly good knowledge of the financial terms and concepts put to them. The most unfamiliar term was collateral at an average of 20% while the most known and understood term was savings account. The next best understood term was budgets at 78% and as noted by FSD Kenya in a recent analysis on the lives of the poor majority of the respondents have to fit several needs within a minimum level of household income (Johnson et al., 2012). Savings account as expected is the most widely understood financial term or concept as it does not necessarily entail using a *"formal savings account"* in the strict sense of the term. In conducting the financial inclusion surveys, FSD Kenya found that although the number of persons operating a bank account is low, several people have various forms of informal savings, e.g. rotating savings and credit associations (FSD 2006, 2009, 2013). This would explain the high level of knowledge about savings among households. From the financial literacy descriptive statistics, there seems to be a moderately high level of financial literacy among individuals where they have

heard of the financial term and know what it means. This paper aims at empirically finding out what proportion of this level of financial literacy can be attributed to the household's use of mobile money.

2.3.4 Model Specifications

Following van Rooij et al. (2011) I construct a basic financial literacy index. To do this I take the responses on the twelve financial terms and construct a binary variable for the option "know and understand this word or phrase". I then create a count variable with the sum of the value of the response which takes on a value ranging from 1-12 depending on the total number of financial terms known and understood. With this value for the response variable I run a Poisson regression analysis on the explanatory variables taken from the household characteristics and the mobile money agents' data. These results are presented and discussed in the next section. To validate the index model, I ran an OLS regression using the financial literacy index as well as logit regressions on the binary variables for each individual financial literacy term.

$$FinLitIndex = \beta_0 + \beta_1 MobileAgents_j + \beta_n X_{ij} + \mu_{ij} + \varepsilon \qquad (1)$$

Where *FinLitIndex* is a count variable which encompasses the twelve financial literacy terms selected for this paper. *MobileAgents* is the main variable of interest which determines the usage of mobile money by household i in province j; X_{ij} is a set of household demographic and socio-economic characteristics for household i in province j and μ_{ij} is a control variable for use of other formal financial products by a household which would influence their level of financial literacy. As the financial literacy index is a count variable, I run a Poisson regression and use the averaged marginal effects to interpret the results.

For the model validation I take the individual financial literacy terms and regress each one of them on the main variable mobile money as well as the household demographics controlling for the financial access controls. I ran individual logit regressions for each of the financial terms on a similar set of explanatory variables, to establish to what extent knowledge of each individual term is influenced by mobile money use.

$$FinLitTerm = \beta_0 + \beta_1 MobileAgents_j + \beta_n X_{ij} + \mu_{ij} + \varepsilon \qquad (2)$$

Where the FinLitTerm is a binary variable representing individual financial literacy terms analysed. Given that it is a binary variable I run Logit regressions and the results are presented in table 7.2, appendix A2.

2.3.5 Multi-Collinearity of Explanatory Variables

To determine whether multicollinearity was present among the explanatory variables I conducted a variance inflation factor (VIF) analysis using the OLS regressions with the above specifications. The VIF is measured by 1/Tolerance which is based on the proportion of variance the *i*th independent variable shares with the other independent variables in the model (O'brien, 2007). The education variable needed to be orthogonalized and its seven levels combined to form a binary value index and eliminate the problem of over-specification which arose when all five were included in the model. For the purposes of this model it did not make a difference whether one had a primary, secondary or tertiary level of education. What mattered to the analysis was whether the individual had accessed formal education or not. After correcting for the over-specification in the model and retaining all other independent variables the VIF analysis returned a value of 1.38. This confirmed the stability of the model and maintained the statistical significance and signs of the other variables as expected.

2.4 RESULTS AND DISCUSSION OF FINDINGS

2.4.1 Mobile Money Usage and Financial Literacy

Microeconomic theory on financial decision making is hinged on the fact that people make rational savings and/or consumption decisions. Models of microeconomic theory make the general assumption that individuals have the capacity to make complex economic decisions to execute saving and spending plans as well as deal with financial markets. More latter day research finds that fewer individuals than would be expected actually have this kind of knowledge (Lusardi & Mitchell, 2014b). Moreover, for individuals to acquire such financial knowledge would necessitate a cost in terms of both financial and time. The use of financial education programs was found to have modest effects on financial behaviour among households in Indonesia (Cole et al., 2011). They found that Indonesian households, even where financial education programs were offered for free, found it difficult to take time off from their farms or jobs to attend the programs. What the Indonesian study however found was a strong and consistent correlation between financial literacy and use of financial services.

The Indonesian study tested whether financial literacy affects financial behaviour among households and found a strong correlation. Cole et al. (2011) further conducted a field experiment to establish causality and reported that the most common answer among households for not using a bank account was the lack of sufficient money and the second most common answer was not knowing how a bank operates. They therefore established that in addition to price they found that financial literacy was a predictive determinant of demand for financial services

Comparing the financial development and financial inclusion gap in Africa with peer countries, initial research shows that any substantial gains in Africa would require a new array of services as well as delivery channels (Allen et al., 2014). With the established economic importance of mobile money by Jack & Suri, (2014), this paper using Kenya as a sample country contributes to a literature gap providing a missing piece to the financial literacy puzzle. I propose that individuals who have access

to mobile technology, i.e. are using mobile money will be more likely to be financially literate on a basic level.

My empirical specification uses mobile money agents per province as the measure for availability and access to mobile technology for the household. Among the independent variables, I control for a household owning a mobile phone to filter plausible causal deflection. The dependent variable as mentioned earlier is a basic financial literacy index. This index was constructed using basic financial terms where individuals were asked to state whether they knew and understood particular financial terms. There are two specifications of the regression given below. One specification includes the total number of persons in the household whereas the other does not. From a socio-economic perspective, the number of persons in a household has an effect on the savings and consumption decisions made based on the income of the household. The coefficient value differential between the two models is negligible. In this regard I control for the household per capita expenditure in both models which makes for a better measure of household socio-economic ability.

Table 2.4 and 2.5 present the regression results as well as the averaged marginal effects with robust standard errors. From the results tables, the empirical findings establish a strong positive relationship between mobile money usage and financial literacy among individuals. This means that households located in areas where there is higher access to mobile money agents have a higher likelihood of being financially literate. This was after controlling for the location factor and accounted for demographic as well as socio-economic factors influencing households in the Poisson regression. The results show that on average access to mobile technology use improves a household's financial literacy likelihood by 0.37 times at a 1% significance level. These results enable us to establish that mobile money is a significant predictive determinant of a household's financial literacy.

To justify the predictive ability of mobile money use and control for causal deflection I controlled for a household's use of a formal financial service, that is, having a bank product, a MFI product as well as a SACCO product. There have been governmental as well as non-governmental initiatives to serve

the underserved and the unbanked population in Africa as an attempt to fill the financial inclusion gap (Allen, Demirguc-Kunt, Klapper, & Peria, 2012). Consequently in addition to microfinance institutions there was as an increased presence of commercial bank branches in rural areas (Johnson et al., 2012). These three were therefore controlled for as they are all sources for an individual obtaining financial information as well as financial knowledge. From the empirical results, households with a current bank product were certainly more financially literate than those without one. This was also consistent when I run the OLS on the index and the logit regressions on the individual terms used to construct the financial literacy index. Where a household had a bank product their likelihood of being financially literate was 1.35 times higher than a household without a bank product. Given that from the descriptive statistics households with bank accounts were on average 25.7% whereas those who used mobile money were on average 51.2% it is plausible to state that individuals would more likely get financial information when the visit their local mobile money agent as opposed to their nearest bank branch.

Table 2.4: Impact of Mobile Money Usage on Household Financial Literacy

Poisson Regression Results

	FinLitIndex	FinLitIndex
Ln_Mobile agents	0.0589***	0.0549***
	(0.0052)	(0.0053)
HH female	-0.0709***	-0.0722***
	(0.0094)	(0.0094)
Rural HH	-0.0705***	-0.0620***
	(0.0094)	(0.0095)
Ln_Age	0.0979***	0.1036***
	(0.0058)	(0.0059)
Married	-0.0719***	-0.0540***
	(0.0135)	(0.0138)
No Formal Education	-0.6412***	-0.6392***
	(0.0218)	(0.0218)
Income_Transfers	0.0252**	0.0274***
	(0.0077)	(0.0077)
Employed	0.0389***	0.0385***
	(0.0082)	(0.0082)
Income_Agriculture	-0.0580***	-0.0564***
	(0.0087)	(0.0087)
Income_Business	0.0383***	0.0393***
	(0.0085)	(0.0085)
Income_Rent/Investment	0.0092	0.0095
	(0.0142)	(0.0142)
Ln_ HH Expenditure	0.0448***	0.0465***
	(0.0038)	(0.0038)
Own Mobile Phone	0.2710***	0.2705***
	(0.0117)	(0.0117)
Bank Product_Current	0.2047***	0.1988***
	(0.0083)	(0.0084)
SACCO Product_Current	0.0991***	0.0953***
	(0.0099)	(0.0099)
MFI Product_Current	0.0267	0.0335*
	(0.0150)	(0.0150)
Total Persons in HH		-0.0098***
		(0.0018)
_cons	0.7305***	0.7622***
	(0.0561)	(0.0563)
N	12509	12509
Pseudo R^2	0.1706	0.1711

Standard errors in parentheses

* $p<0.1$, ** $p<0.05$, ***$p<0.01$

Table 2.5: Averaged Marginal Effects for Poisson Regression

	dy/dx	dy/dx
Ln_Mobile Agents	0.3994***	0.3720***
	(0.0356)	(0.0358)
HH female	-0.4806***	-0.4894***
	(0.0639)	(.0638)
Rural HH	-0.4776***	-0.4200***
	(0.0636)	.0645596
Ln_Age	0.6633***	0.7020***
	(0.0390)	(0.0395)
Married	-0.4873***	-0.3658***
	(0.0917)	(0.0937)
No Formal Education	-4.3453***	-4.3316***
	(0.1470)	(0.1471)
Total Persons in HH		-0.0667***
		(0.0121)
Income_Transfers	0.1706***	0.1858***
	(0.0524)	(0.0525)
Employed	0.2635***	0.2607***
	(0.0555)	(0.0555)
Income_Agriculture	-0.3930***	-0.3824***
	(0.0593)	(0.0594)
Income_Business	0.2598***	0.2661***
	(0.0577)	(0.0577)
Income_Rent/Investment	0.0625	0.0644
	(0.0964)	(0.0963)
Ln_HH Expenditure	0.3035***	0.3153***
	(0.0254)	(.0255)
Own Mobile Phone	1.8368***	1.8327***
	(0.0788)	(0.0788)
Bank Product_Current	1.3874***	1.3470***
	(0.0556)	(0.0560)
SACCO Product_Current	0.6716***	0.6459***
	(0.0667)	(0.0667)
MFI Product_Current	0.1808*	0.2268*
	(0.1013)	(0.1014)

2.4.2   Further Determinants of Financial Literacy

2.4.2.1   *Geographical Dispersion of Households and Financial Literacy*

Intrinsically related with the access to mobile money agents is the rural/urban spread of households. Based on the accessibility of mobile services across the country, rural households were expected to be less financially literate in comparison to urban households. Looking at the averaged marginal effects to analyse the Poisson regression, a rural household had on average an expected level of

financial literacy that was 0.42 times less than that of an urban household. The logit regressions also return consistent results where a negative significant relationship was expected and recorded. This is consistent with Xu & Zia, (2012) who find disparities in financial literacy between rural and urban dwellers. This has also been found to be true in the case of general financial inclusion where population density is a strong and significant determinant of the presence of formal financial institutions in an area (Allen et al., 2014). However, for the "savings" term from the logit regressions the relationship was positive though insignificant. This can be attributed to the fact that rural households have had their own informal ways of accessing savings mechanisms (Johnson et al., 2012). From the descriptive statistics it is already evident that majority of the households are already aware of the financial term savings. Thus, reducing the significance of knowledge on savings due to the use of mobile technology.

2.4.2.2 *Formal Education and Financial Literacy*

In their study of Indonesian households, Cole et al. (2011) established two other determinants of financial literacy: household per capita expenditure and human capital. They found that households with higher per capita expenditure and cognitive ability showed better results of financial literacy in comparison to those with lower levels. To measure cognitive ability, they used individuals' level of education as well as number of schooling years. I consider an individual having or not having formal education which is characterized by one's attendance of primary, secondary and/or tertiary education. To avoid over specification as we have seven different levels of education defined the education variable is orthogonalized and we take into consideration whether an individual has attained any level of formal education or not. Results from the Poisson model are as expected, negative and highly significant, where a household with no formal education was 4.33 times less likely to be financially literate than that where the head had attained formal education. Similarly, the logit regression results which are presented for each individual financial term are negative and significant.

2.4.2.3 Income and Financial Literacy

In comparing financial literacy among individuals with varying sources of income, literature shows that income and employment type have an influence on the financial savvy of an individual (Lusardi & Mitchell, 2014b). From my findings individuals in employment as well as those owning their own businesses have an increased likelihood of being financially literate. Formally employed individuals and those who own businesses have a 0.26 and 0.27 chance respectively higher than unemployed individuals. A plausible suggestion from these findings would be that the acquisition of financial literacy would be easier when individuals are in their workplaces and/or engaged in community activity (Lusardi & Mitchell, 2014a). Where an individual or household's income is mainly agricultural, there is a 0.38 less likelihood of them being financially literate. In addition to sources of income we compare individuals with varying levels of income measured by the logarithm of a household's per capita expenditure. I find that households with higher per capita expenditure tend to have higher levels of financial literacy. Both models return positive and highly significant results with the Poisson model giving a 0.32 positive difference level for each unit increase of per capita expenditure. These results are consistent with the Indonesian survey by Cole et al. (2011) where they found that households with higher per capita expenditures performed significantly better in the financial literacy questions.

2.4.2.4 Age and Financial Literacy

Life cycle theories suggest that the pattern of financial literacy among a population will generally be bell-shaped with the young and elderly generally being less financially literate (Lusardi & Mitchell, 2014b). Among a population it is expected that people get more experience and their 'perceived' financial knowledge increases as they grow older. It therefore makes sense that the expected level of financial literacy measured as financial terms understood increases with age. Using the log value of age, a unit increase in the age of the household head increased their chance of financial literacy by 0.70 times. Inasmuch as we ascertain the positive and significant incremental change in an

individual's financial literacy with age, it is necessary to highlight that more elderly people are more easily duped in fraudulent scams (Deevy, Lucich, and Beals 2012).

2.4.2.5 *Gender and Financial Literacy*

Though interesting but not surprising the financial literacy level of a female headed household is on average 0.48 times lower than that of a male headed household. These findings are similar to Lusardi & Mitchell (2014b) who found that financial literacy differences are persistent between the two sexes both among older generations as well as younger ones. They also found an interesting phenomenon among female respondents, where in addition to the fact that more women than men answer both basic and more complex financial literacy questions wrong, they also likely tended to acknowledge their lack of knowledge. Further studies on gender and financial literacy as well as financial inclusion continue being conducted to find out the cause of the disparity in financial literacy between men and women as the differences are prevalent. Traditional reasons of gender roles specification have also been fronted as reasons for the gender differences (Lusardi & Mitchell, 2007). Another explanation given by Chen & Volpe (2002)in a study of college students was that women were generally less confident, less interested and less willing to learn about personal finances. A different proposed explanation is that men and women produce and/or acquire financial literacy differently dependent on who is responsible for making financial decisions in the household (Fonseca, Mullen, Zamarro, & Zissimopoulos, 2012). They find that financial literacy is related to financial decision making more in men than in women.

Figure 2.5: Financial Literacy Graphs Summary of Financial Literacy by Age, Gender and Education

Figure 5a) Financial Literacy by Age

Figure 5c) Financial Literacy by Gender

Figure 5b) Financial Literacy by Education Level
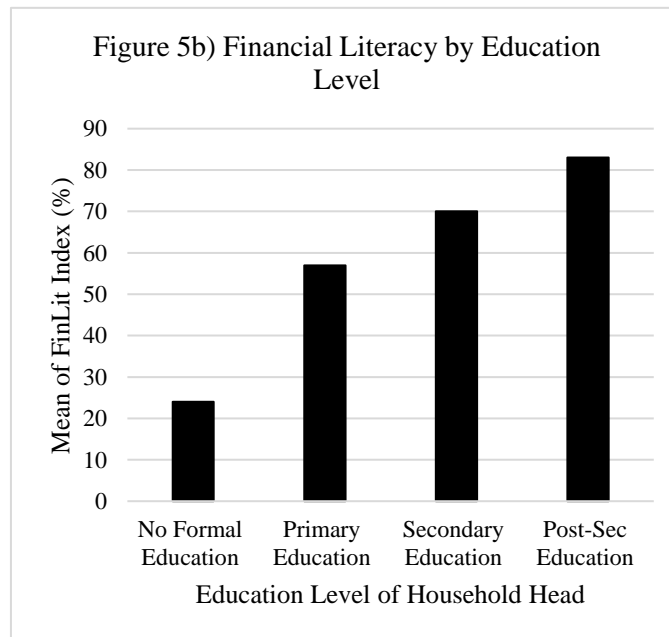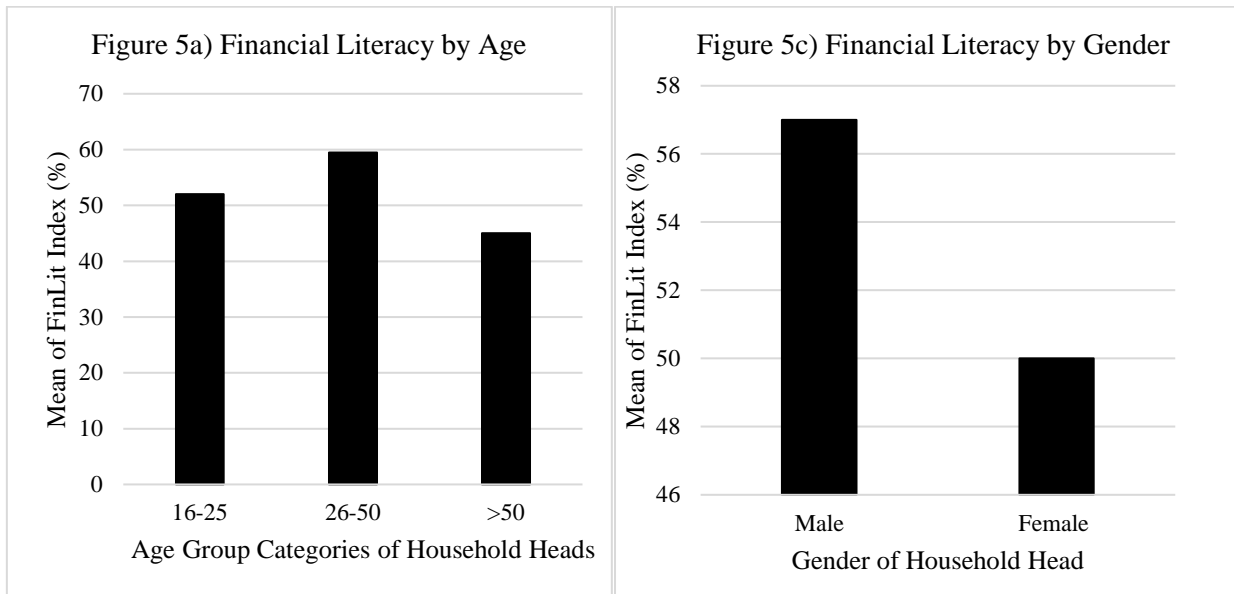
2.5   LIMITATIONS

The most important limitation faced in this paper was with reference to determining the best measure for mobile money usage. With the open question of endogeneity between the household's use of mobile money and their financial literacy it was necessary to find a variable independent of the household's influence. The endogeneity problem arising was one of reverse causality in that a household may use mobile financial services because they are financially literate as opposed to the mobile technology being responsible for the literacy. For one to convert any e-money in the mobile phone to cash and vice versa one needs to visit a mobile money agent. I determined a household's accessibility to a mobile money agent as the most viable exogenous variable.

The data available on the dispersion of mobile money agents across Kenya is presented in a static format and one cannot determine the growth in number of agents in a particular area for comparison. This makes mobile money agents less perfect but of all possible measures of mobile financial services use by a household, it remains the most viable variable. This is mainly because the presence of the mobile money agent is determined by the supplier and thus it is independent of the household's influence. Bearing in mind the fact that population density plays a role in a company's strategic decision to position its mobile agents I controlled for geographical dispersion in the regression analysis.

It is also certain that there are other environmental factors that affect a household's financial literacy but for the purposes of this paper I focus on the element of mobile technology as the main variable. I however take into consideration other factors in the regression equation that have been found in literature to be predictive determinants of financial literacy such as household demographics and socio-economic characteristics.

2.6   CONCLUSIONS

The benefits of mobile technology specifically mobile money use in Africa while increasingly tangible in transforming lives of the poor, have so far been scantily documented. The widespread use of mobile money and its tangible impact on financial inclusion in SSA has also led to the recognition of a lack of financial literacy among majority of the population. In recent economic research following the financial crisis there has been emphasis on the need for financial literacy among populations in developed economies as well.

Over the past five years researchers have found that developing economies are not immune to financial crises as a result of poor financial decision making. In addition to increasing financial inclusion levels individuals need to know and understand the particular products and services on offer for individuals to take them up. Despite the potential benefits of financial literacy on household financial behaviour there is little evidence on the effect of financial education programs to this end. This is mainly due to the fact that taking part in these programs entails an opportunity cost of time which most people in low- and middle-income countries are unwilling to forego.

In this paper I set out to establish whether use of mobile money is a significant predictive determinant of financial literacy among households in Kenya. Using household survey data from Kenya I determined whether a household's use of mobile money increases its likelihood to be financially literate. I used mobile money agents per province as an exogenous variable for the households' access and use of mobile money services. This enabled me to control the direction of prediction for mobile money use on a household's financial literacy.

For the financial literacy measure I set up a financial literacy index to measure whether households were aware of and understood basic financial terms and concepts. This index was derived using the responses on each of the 12 financial literacy terms which were set up as binary variables where "1" represented "know and understand the term" and 0 otherwise. This enabled me to construct a count variable ranging from 1-12 depending on the total number of "1-0" responses obtained. I then ran a

Poisson regression on this variable against the primary indicator variable number of mobile agents to determine predictive value. I find that the use of mobile money in a household improves the household's level of financial literacy by 0.37 times at the 1% significance level.

Although this paper has established the predictive ability of mobile money use for financial literacy among households the continued increase of financial inclusion efforts certainly had an effect on the financial literacy levels. I therefore took into consideration 3 main sources of formal financial services access, i.e. having a bank account, an MFI and a SACCO product I found that where a household had a bank product their likelihood of being financially literate was 1.35 times higher than a household without a bank product. From the descriptive statistics households with bank accounts were on average 25.7% whereas those who used mobile money were on average 51.2%. It is therefore plausible to state that individuals would more likely get financial information when they visit their local mobile money agent as opposed to their nearest bank branch. This is also compounded by the fact that mobile money agents are wider distributed than bank brick and mortar branches.

Given the limitation of data on financial literacy in developing economies empirical research on the topic is subsequently limited. It is essentially more challenging to establish causal relationships in this regard as trend surveys on the same households' period on period, i.e. 1:1 household match at a nationally representative level are not available. The first empirical paper on mobile money effects on the poor in Kenya was conducted on a few villages where it was possible for the researchers to conduct repeat surveys to establish a change in behaviour (Jack & Suri, 2014). They however needed to truncate observations where dwellers had moved in between the survey periods. I am therefore content that with the attempt on a nationally representative survey I was able to establish significant predictive ability of mobile money use on financial literacy using limited financial literacy data. Where the findings were robust across 3 different model specifications.

CHAPTER THREE

3. Mobile Money and Saving Behaviour among Kenyan Households using M-PESA

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ABSTRACT

Using Financial Sector Deepening (FSD) Kenya 2016 household survey data, this paper investigates the influence mobile money use has on household saving behaviour. Saving behaviour is measured by households' ability to save regularly, to save for emergencies as well as to access emergency funds. The main findings show that mobile money use significantly improves the household's likelihood to save for emergencies and only slightly significant for regularly saving. With reference to accessing emergency funds, mobile money users are at a higher advantage than non-users. This effect also holds true for disadvantaged demographics, i.e. female, rural, less educated and low income where their likelihood to have emergency savings as well as to access emergency funds is significantly improved for users of mobile money. Mobile money is also found to have enabled users transfer their savings from unsafe savings areas, e.g. under the mattress or a secret place to a safer platform on their mobile money account. My findings are thus in line with policy makers suggestions on the use of mobile technology to improve financial well-being among vulnerable households.

3.1   INTRODUCTION

Financial development in Sub-Saharan Africa (SSA) has become an important point of discussion among policy makers and researchers alike. Several researchers[14] have documented that access to formal financial services among households and individuals can enhance household welfare, in turn increasing asset ownership and driving economic growth. To improve household welfare, i.e. household well-being, there is a need to expound on households' ability to handle expenditure shocks that occur as a result of income shocks (Chase, Gjertson, and Collins 2011). They define expenditure shocks as those that require access to emergency savings in the form of liquid assets in order to meet them, such as sudden medical expenses not covered by insurance, support of relatives and family. All households are often faced with these kinds of shocks at one time or other. However, it is the poorer households that take the harder hit as they necessarily have to cut back on basic needs so as to meet these expenses or smooth consumption.

Households in developing countries have been found to be at a particular disadvantage with reference to managing these kinds of shocks because majority are moderately to highly vulnerable. In Kenya the lower middle to low income households represent approximately 60% of the population. Low income coupled with handicapped access to financial services compounds the problem for vulnerable households. In a comparative study of SSA countries with peer developing countries, Allen et al. (2014) found that the financial sectors of SSA countries were underperforming. The financial inclusion gap needs to be bridged so as to make households more financially capable thus reducing their vulnerability. The need for inclusive financial systems requires an understanding of the unserved or underserved group. It consists of establishing a financial system that has services catering to people with a wide range of varying needs (Demirgüç-Kunt and Klapper 2012). Low income households

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[14] See discussion papers from the World Bank Policy Research Series by (Allen et al. 2013, 2014; Demirgüç-Kunt and Klapper 2012; Demirguc-Kunt, Klapper, and Singer 2013)

without prior accessibility to formal financial services require basic financial products and services, i.e. savings and credit options.

Literature on financial inclusion and financial development has focused mainly on increasing access to formal financial services including enabling banked customers access their accounts through the mobile phone – "mobile banking". Whereas this mechanism brought about incremental development in use of formal financial services it did not address the underlying problem of the un-banked population. With the introduction and adoption of mobile money in Kenya through M-PESA the financial inclusion gap has been nearly closed. The transformational impact that mobile money has had on the Kenyan population lies in its ability to reach and match the lives of low-income households that were previously and possible still are "un-banked". This means that the use of M-PESA fits into individuals' everyday life making it possible to formalize and personalize financial services and products. Most financial inclusion literature is written from the perspective of bank-led financial solutions for the resource poor. This study adds on to the emerging literature seeking to determine how to improve financial inclusion in developing economies from a non-bank led perspective. In this case I am looking at a mobile led initiative that seems to be working and has taken the developing world by storm.

M-PESA was introduced as a platform to enable safer, faster and cheaper transfer of money mainly from main income earners based in the city to their wives and families based in rural areas. Over the past decade the mobile money portfolio has been extended to include payment options as well as offering traditional banking services, i.e. savings and credit facilities. The use of the mobile phone for the latter services evolved over time as more people found it convenient to keep the money received on their phone if they did not need to withdraw it immediately. In addition, users of mobile money with funds on their phones were in a position to help a member of their social network by "lending" what was available on their phone if it was not immediately needed. This interaction of mobile money users with financial services as earlier mentioned by Morawczynski (2010) has set the

stage for this paper. I examine the extent to which mobile money use influences households' financial well-being by analysing the relationship between the household's use of mobile money and its saving behaviour.

Saving behaviour was chosen as the measure for household financial well-being as it represents their ability to have disposable income, i.e. spare money after paying for their basic needs. Moreover, majority of households in the FinAccess survey stated that they would rely on their savings (if present) to make ends meet in the event of an unexpected shock. For this to be possible the household needs to have a saving habit which is highly dependent on accessibility to a safe and reliable saving platform. To measure saving behaviour, I used presence of regular savings and saving for emergencies. In addition to saving behaviour, I also analysed the household's capacity to access funds quickly in the event of an unexpected emergency.

My findings show that overall households that were using mobile money were on average better off with regard to saving for emergencies, saving on a regular basis as well as being able to access funds in the occurrence of unexpected shocks. This means that individuals do not only use their mobile money accounts for transactions but are on average holding money on their mobile money accounts as savings for a rainy day. This ability to hold money on their phone where it is safe and relatively easy to access when the need arises enables the household mitigate shocks arising from unexpected events. These findings also hold true across specifications using access to a mobile money agent as an instrumental variable. To better isolate the influence of mobile money use, I also ran regressions using interaction terms for mobile money use with individual characteristics that inherently affect financial decision making. These characteristics (female, rural, low income and less educated) more often than not put the individual at a disadvantage. The use of mobile money among these demographics positively and significantly improves their likelihood to save for emergencies and their ability to access funds in case of an emergency. Saving on a regular basis is also positively influenced but not with as high a statistically significant level.

The main contributions made by this paper are: (1) extending household saving behaviour research by using survey data on vulnerable households in Kenya and (2) examining the influence use of mobile money has on households' saving behaviour. The fact that it is a non-bank led provider of formal financial services and has experienced great success in Kenya makes for a worthy context to conduct this study.

The rest of this paper is organized as follows: the next section presents a brief literature review on household saving behaviour and mobile money usage; followed by a presentation and description of the data and setting out the empirical framework; next is the presentation of results and a discussion of findings; finally, the implications of the study and conclusion are presented.

3.2   LITERATURE REVIEW

3.2.1   Theories on Households' Saving Behaviour

In household finance literature three main theories have evolved in the discussion on saving behaviour of individuals. The first theory was proposed by Keynes in 1936 (the Keynesian theory) where he listed eight reasons why people save. Savings was thus defined as a function of the individuals' disposable income given their motive. The second theory on savings proposed was the life-cycle hypothesis (LCH) proposed by Modigliani and Brumberg in 1954. This theory posits that the spending decisions of households are influenced by their assessment of expenditure needs and income over their lifetime taking into account foreseeable events such as fluctuation in income. This means that households take into consideration consumption smoothing. The third theory relates to household savings to the propensity to save out of either permanent or transitory parts of income and wealth. This theory is called the permanent income hypothesis (PIH). It was proposed by Milton Friedman in 1957 in an effort to explain the constancy of savings rate in the wake of rising real incomes in the United States. The latter two hypotheses are considered the two main approaches within the rational optimization framework of consumption and income. Using micro-level household data on financial inclusion and households' management of financial resources, I base this paper on the life-cycle hypothesis to identify the determinants of saving behaviour among Kenyan households. I chose this theory for this study as well because it incorporates the *"precautionary motive"* which calls on the rationality of individuals to have a wealth reserve for a rainy day or for the uncertain future. I look at the household's ability to save on a regular basis and their emergency savings.

Rational individuals who have the information as well as the opportunity tend to maintain a reserve of wealth to enable them address expenditure shocks and unforeseen emergencies. In an extensive review of literature, Chase, Gjertson, and Collins (2011) found that much of the literature with reference to households managing their financial resources, for instance their savings behaviour, has been concerned with long term savings such as saving to buy a home, for education purposes and

mainly retirement planning[15]. However, there is a need to also focus on the more short term needs or emergency occurrences that affect households especially when faced by financial risks (Babiarz and Robb 2013). This is particularly relevant in developing economies where most households are vulnerable and are constantly faced with shocks to their income sources which devastate their welfare (Kefela 2010). When present, emergency savings serve as a buffer against shocks such as loss of employment, theft, sudden death or medical expenses. These expenditures as noted by Babiarz and Robb (2013) are expected but their timing is often is unpredictable. In order for households to have the opportunity to save money for these unpredictable events, there needs to be available safe, affordable and easy to use mechanisms to vulnerable household in order to give them the opportunity save.

3.2.2 Households' Financial Behaviour

Households' financial behaviour is characterised by the way in which the household earns and allocates funds. All individuals around the world share the same goals of economic security for themselves and future generations. However households in vulnerable economies as noted by Kefela (2010) find themselves at a disadvantage. This is because access to financial resources is limited and formal savings and credit opportunities are few and far between. According to the World Bank, approximately two billion people around the world lack access to formal financial services, i.e. are not banked (Chaia et al. 2009; Allen et al. 2013; World Bank 2017). Of the adult population globally, 59% cite lack of funds as the main reason for not having a savings account at a formal institution. The implication here is that there is still a general lack of financial services that are affordable and/or designed for the low income users (World Bank 2017). In this regard the lack of adequate savings is a fairly common occurrence among low- and middle-income households. Subsequently not having a savings account is one indicator of a lack of preparedness in the event of a financial emergency.

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[15] See works by (Lusardi and Mitchell 2005, 2007, 2011; van Rooij, Lusardi, and Alessie 2011)

In their study on the financial fragility of American households, Lusardi, Schneider, and Tufano (2011) found a limited capacity among Americans to cope with shocks. This inability to cope varied significantly with the economic and demographic characteristics of the individuals with severity among low income, less educated, minority (Blacks and Hispanics) and single female-headed households. Majority of the households who reported a "somewhat" ability to cope cited use of savings as the main source of emergency funds. It has been however observed that the savings portfolio of households has diminished over time. This is mainly due to the declining levels of income as well as the rising standards of living, especially in urban areas.

In Kenya, Zollmann (2014) together with the FSD Kenya trust carried out over the course of one year the "financial diaries project. This case study project looked at the ways in which poor households earn, spend, save, borrow and invest their money. Its aim was to deepen understanding into the financial lives of low-income Kenyans by providing a deeper view of how low-income households get by in Kenya. The main findings of this study were: households pieced incomes together from multiple sources, households faced high levels of volatility in both income and consumption spending, in addition to the main source of income for the household, remittances and contributions from social networks, often through M-PESA were a very important income source.

With reference to savings, Zollmann (2014) found that poor households made more emphasis on savings as compared to credit through higher levels of financial assets compared to liabilities. Given that levels of disposable income are low or non-existent, low income Kenyans also placed emphasis on creating elasticity in their budgets by keeping a lot of liquid savings, keeping lines of credit open, and cultivating relationships that might help provide resources when needed or open new opportunities for earning income. She also found that this group of the population were averse to leaving money idle. They need to see their savings "work for them". This means that savings are spread out to various financial devices that provide immediate auxiliary benefits for example putting their money in a rotating savings and credit association. The money held in this kind of a scheme

helps the saver as well as their social network. This implies that the amount held in liquid form and is available on demand does not exceed 10% of total income. Keeping their savings in illiquid forms enables many of the households save in order to invest. However, this brings about a problem when an urgent need arises as the household does not have money at hand to navigate the problem and at times this can have devastating consequences even death. Therefore, a financial service or product such as mobile money would provide a way to bridge this gap in terms of a safe place to store funds as well as a channel for quick access of emergency funds.

3.2.3 Background on Mobile Money in Kenya

The adoption of mobile phones has occurred in the developing world at the fastest rate and to the deepest level of any consumer-level technology in history. This mobile platform has in the last decade transformed how people around the world and especially in the global south access and use their money. In Africa the spread of mobile technology has been impressively rapid in comparison to other developments technological or otherwise. Aker and Mbiti (2010) noted that despite the low levels of infrastructure investment, SSA has had some of the highest levels of mobile telephony adoption and subsequently mobile money penetration. Figure 3.1 shows the penetration of mobile money account penetration in SSA from the Global Findex data (Demirguc-Kunt et al. 2015). The advancement of mobile technology began taking shape with the announcement of the United Nations' Millennium Development Goals. The use of technology has been fronted as an innovative way to improve financial access as a way to alleviate poverty and spur financial development (Rea and Nelms 2017).

Figure 3.1: Mobile Money Account Penetration in Sub-Sahara Africa
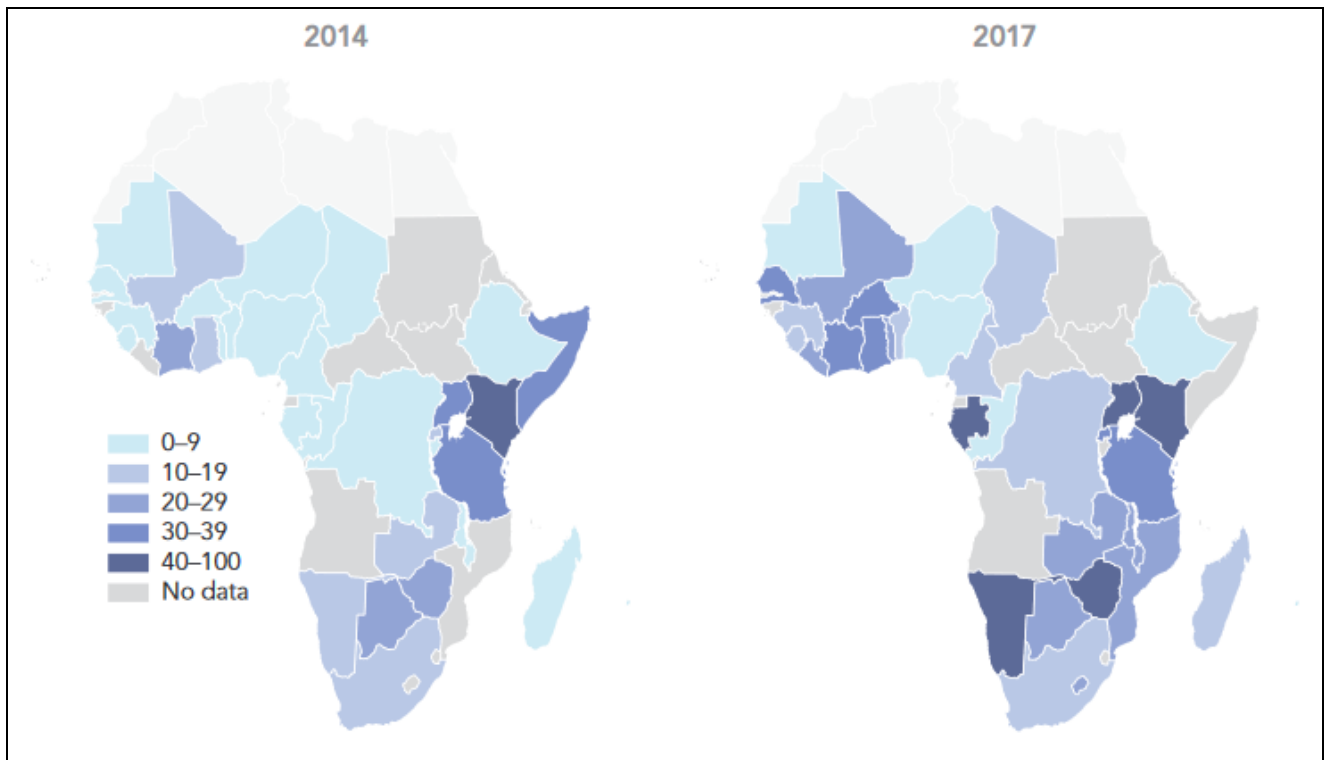
Source: Global Findex Database 2017

The mobile phone as a platform for financial services was commercially launched in Kenya in March 2007 by Safaricom, the largest mobile network operator in Kenya. With this launch, Safaricom introduced a payment and money transfer services known as M-PESA. The product allows its users to send money stored on the mobile phone using SMS technology, pay for goods and services as well as exchange e-money for cash. The introduction of mobile money transfer services was intended to address a consumer niche that needed a fast, cheap and secure way of performing low value but high-volume transactions (Jack & Suri, 2011). Its spread and relatively quick adoption is attributed to the fact that in a developing country like Kenya, it was not bogged down by existing and antiquated infrastructure (Mühleisen 2018). Money transfer services as well as cash withdrawal is made possible by the presence of Safaricom M-PESA agents who are currently located in most parts of Kenya including rural and sparsely populated areas of Kenya

The use of M-PESA over the past decade has changed the way in which households interact with the financial system. From using it solely as a remittance tool to a banking solution (Safaricom, 2017).

With the introduction of mobile banking through KCB M-PESA and M-Shwari, Safaricom has made financial inclusion possible in Kenya. With 27 million registered users, it partnered with two commercial banks to offer the aforementioned services. These services are designed to enable customers save as little as KShs1 ($0.01) and get loans from KShs. 50 ($0.485) to KShs. 1 million ($9,699.32) (Safaricom 2017).

3.2.4 Household Saving Behaviour

Majority of people from poor households cite "lack of money" as the main reason not to save and/or not have a bank account. 59% of the global population cite lack of funds as the main reason for not having a bank account (World Bank 2017). This is either because they literally have no money to save or the account is too expensive to maintain (Johnson, Brown, and Fouillet 2012). Therefore, households have devised informal mechanisms where they store money at home under the mattress or in a secret place (approximately 36%). In cases where the individual wants to protect that the money does not get stolen, they use rotating savings and credit associations (ROSCAs) where households save with friends and family (approximately 31%). These groups allow individuals to save small amounts of money, often a fixed amount, and gives them the opportunity to receive the total collection at the end of the month in turn. In some instances, these groups also provide loans, especially in case of an emergency or unexpected expense. However, the limitation lies in the fact that access to this money is not as fast as one may require it, posing a liquidity problem. Table 3.1 shows the ways in which Kenyans save.

Table 3.1: Savings Mechanisms used among Kenyan Households in percentages (%)

Variable	2006	2009	2013	2016
Savings SACCO	12.8	8.9	10.6	11.2
Savings MFI	1.5	3.2	3.1	3.06
Savings ASCA	5.4	7.8	5.9	15.2
Savings ROSCA	29.3	31.7	21.4	33.8
Savings Secret Place	27.9	55.7	31.7	35.8
Savings Bank Savings Account	12.4	12.4	9.8	9.01
Mobile Savings Account	-	-	27.0	43.3
Observations	4420	8520	6598	8665

Source: FSD Survey report (2016)

The possibility for one to maintain some amount on the M-PESA platform has given majority of poor individuals the ability to "save" from their meagre income as well as give them access to it as and when needed. The fee structure of M-PESA encourages users to accumulate funds and thus save as the deposits are free of charge whereas a withdrawal attracts a transaction fee. This consequently helps form a saving habit among individuals who will only bear the withdrawal cost when they need the money. With the extensive M-PESA agent[16] network users are able to make deposits of what is known as "*PESA kidogo*" literally translated as "small money" and through this, build up a reserve of cash. Morawczynski (2010) highlighted an interesting inter-relationship of M-PESA usage outcomes with regard to savings. She noted that in several cases the users started to use M-PESA for savings not because they put money into the system but rather because they simply did not withdraw cash after a transfer was made. One can attribute this to the care taken in incurring the transaction cost of withdrawal. However, only 14% of Kenyans consciously use their mobile money account as a savings account.

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[16] An agent is the service point for deposit and withdrawals of funds/maintaining cash in an e-wallet. These agents are maintained by Safaricom. Money is held in bank account to which they subscribe to enable them have "float", i.e. cash for withdrawal as well as space for users to make deposits.

3.2.5 Mobile Money Use and Saving Behaviour

According to Mas and Mayer (2011) saving behaviour is characterised by how a household manages its budgeting, payments and savings in order to stabilize their daily circumstances, create opportunities to improve their state in the future and be able to mitigate shocks. In many developing countries the reliance on informal saving mechanisms is relatively high due to the lack of access to formal financial services, e.g. bank savings accounts. The innovation of mobile money and/or banking has often been proposed as a possible solution to bridge the financial inclusion gaps and to provide a safe, fast and cost effective platform for formal financial services (Cole, Sampson, and Zia 2011; Allen et al. 2014).

Following its commercial launch in March of 2007, M-PESA was widely and rapidly adopted. Data from late 2009, two years after its launch, estimated that the service was being used by at least one member of more than two-thirds of Kenyan households (Jack and Suri 2011). A decade later, M-PESA had a subscription base of 27 million customers which translates to 66% of the adult population in Kenya. Figure 3.2 shows the adoption trend of M-PESA over the years. It has grown to not only being used for person to person money transfer but also to make payments, i.e. person to business, business to business and person to government. It has, in addition provided a platform for saving to households without access to other formal saving mechanisms and job creation for the over 130,000 M-PESA agents (Safaricom 2017).

Figure 3.2: Adoption of M-PESA since Inception
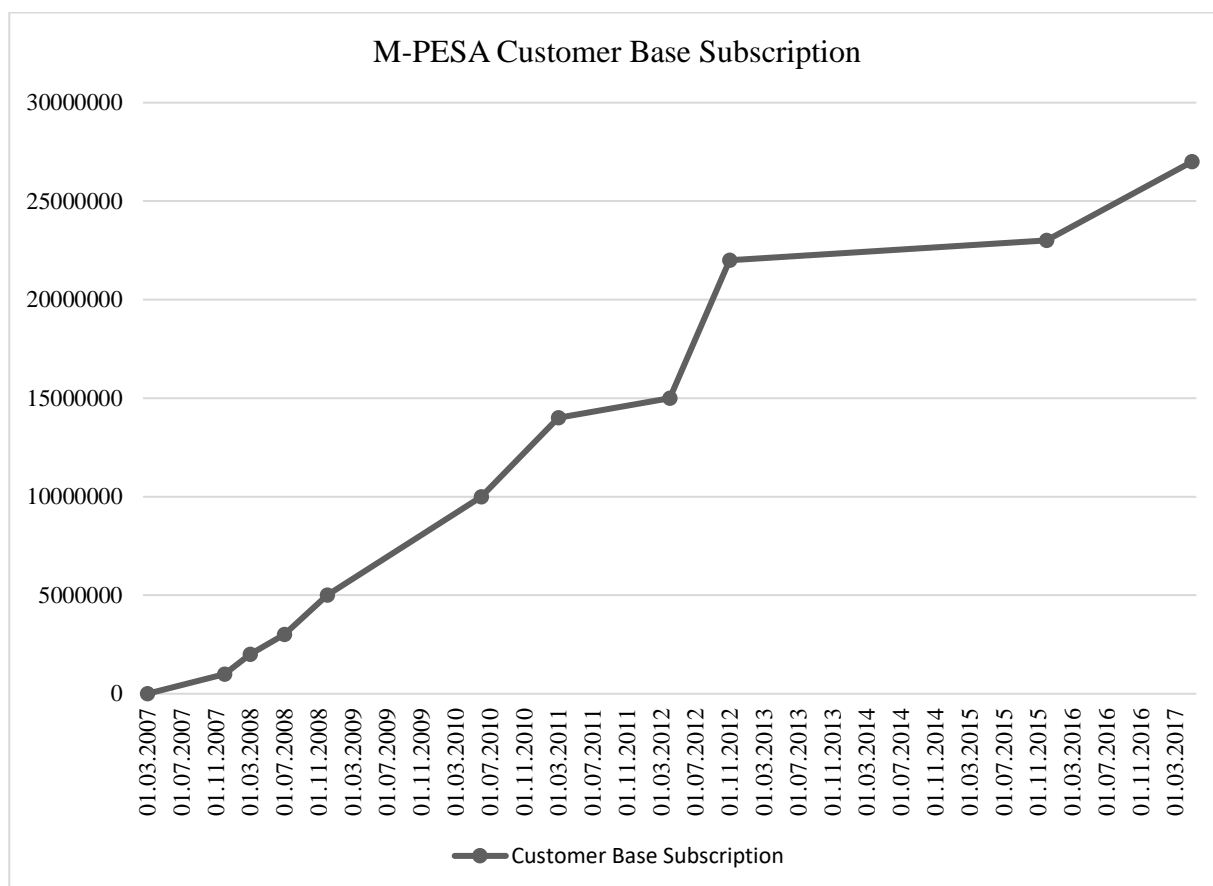
Source: Author compilation from Safaricom data in annual reports.

3.2.6 Bank-Integrated Mobile Money Services

The growth of M-PESA has been viewed as the global success of any mobile money service. In order to attain universal financial access for poverty alleviation financial system of countries need to come up with more flexible mechanism the incorporate the financial needs of low income households. Mas and Mayer (2011) suggest that the achievement of inclusive finance needs savings vehicles that allow people to set a pattern of regular savings. This frequency of savings is necessarily an amount they can afford and maintain a clear linkage between their multiple goals and their saved balances. With this in mind Safaricom has partnered with two banks to come up with banking services through the mobile phone. These two services are M-Shwari and KCB M-PESA which have enabled Safaricom to propel the financial inclusion agenda (Safaricom 2016).

M-Shwari is a banking system created by Safaricom and hosted by the Commercial Bank of Africa which is the trustee bank for the mobile network operator. It was launched as the first mobile lending and saving solution in Kenya in December 2012. Its aim is to enable M-PESA customers to access banking services where they save, earn interest and borrow money through their mobile phone. It is important to note here that the users cannot access their accounts through the bank branch, only through their mobile phones. Since its inception, M-Shwari has provided convenient and affordable financial services to approximately 21 million Kenyans. It has disbursed Kshs 230 billion (US$ 2.27 million) in loans and has a savings stand of Kshs 12.6 billion (US$124 million) (Commercial bank of Africa 2017). With the ease of transaction via the mobile phone, majority of M-Shwari users know and use it for its affordable emergency loans. This provides a practical solution for individuals who may not have anyone to request for money to be sent in the event of an unexpected expense.

KCB M-PESA on the other hand is a partnership between Safaricom and the Kenya Commercial Bank that similarly enables customers' access loans and savings based on their M-PESA account. The major differentiating feature to M-Shwari is that this is bank-led, and its users can access their accounts at the bank branch or bank agent. These services have enabled more subscribers, especially those previously un-banked access banking services that they would otherwise not have. Users are able to borrow amounts at a lower rate than commercial banks[17] at 7.5% and earn interest on their savings at 2%. It is important to note here that users of M-PESA who simply store money on the M-PESA account do not earn any interest on their stored amounts. However, those who opt to use the M-Shwari account through their M-PESA earn interest which is credited to their M-PESA account every three months.

Morawczynski (2009) proposed that Safaricom should offer a savings account on their M-PESA platform which allows users to earn interest on savings. Following this article and continued requests from users, Safaricom introduced M-Shwari. Through this mechanism, M-PESA users have the

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[17] Current official lending rate at a commercial bank is 13% (see Central Bank of Kenya Website).

option of a mobile savings facility that is attractive but also instils discipline in their saving toward a specific goal. In this regard, Safaricom has developed a lock savings account on the M-Shwari platform which acts like a fixed savings account and one can only withdraw after a certain "lock-period" in order to earn interest. However, if one has an emergency, they can request to make a withdrawal through M-PESA but would only access it after 48 hours.

The attractive feature of these mobile banking services is the ease with which one can use the service. There are no application forms, no ledger fees, no limits on the frequency of withdrawal, no minimum operating balance and no charges for moving money from M-PESA to M-Shwari and vice versa (Safaricom 2015). The amounts that these mobile bank accounts offer users are well tailored for the poor. Users can save as little as Kshs 1 (US$0.011) and get loans from as little as Kshs 100 (US$1). The introduction of these mobile bank accounts has overcome the main hurdles that majority of low-income households' face that keep them away from formal financial institutions. With the advent of mobile financial services the last ten years have seen the formal rate of access to formal financial services more than double to reach 75.3% of Kenyan households (FSD Kenya 2016). Figure 3.3 shows the trend of financial inclusion, i.e. increases in use of formal and reduction in use of informal financial services and those that are excluded from financial service.

Figure 3.3: Trends in Financial Inclusion in Kenya
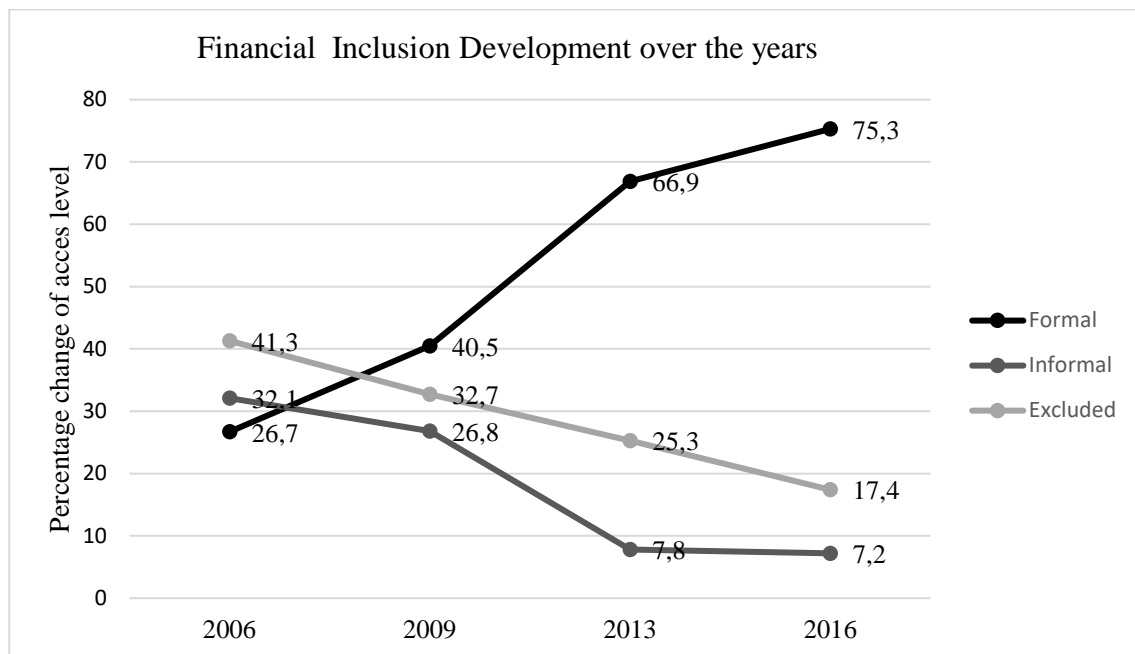
Source: FSD Household Survey Report 2016

3.2.7 Savings and Vulnerability

The M-PESA platform has therefore provided a space where vulnerable members of a household especially women can accumulate a store of wealth. Many women living in rural areas or in the slums without a regular income-generating activity rely on their husbands' income. The introduction of M-PESA enabled men working in the city send money home to their wives and if they were not married to their elderly parents. Where not all the money is withdrawn, what is accumulated and saved is used as a means to reduce household vulnerability through mainly consumption smoothing. Morawczynski (2010) found that in the slums of Kibera[18] most women had accumulated "secret savings" which they used to manage the household when their husbands "refused" to give them money or had "drunk" all their wages. This is unfortunately a common occurrence in Kenya especially in the rural areas and among the urban poor living in slum dwellings where the man is the household head and sole income earner. The other extreme making the household vulnerable is when the main income earner loses his job/source of household income.

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[18] Kibera is a slum in Nairobi and is the largest slum in sub-Sahara Africa with a total population of approximately 500,000.

In addition to consumption smoothing, M-PESA has been found to provide a store for emergency funds as well as the mid to long term savings instrument used to address shocks. This was evident during the 2008 post-election violence[19] where individuals who had some money stored on M-PESA were able to purchase food, water and other basic needs or pay for transport to their rural homes. The post-election violence also brought about out a new saving behaviour among individuals from poor households who set up an emergency "account" on their mobile phone. In her dissertation, Morawczynski (2010) had one of the respondents confirm that he has targeted to continually save Kshs. 200 ($2) per day toward his emergency funds. This was aimed at reducing his vulnerability as well as avoiding a situation where he would need to sell off his productive assets in the event of a shock to his income. Its ability to reduce household vulnerability makes the M-PESA platform a certain tool to improve households' ability to manage the financial resources available to them. From a financial inclusion perspective, its reliability in terms of cost, safety and ease of use can be termed loosely as the "panacea" of financial capability in developing economies.

3.2.8 Other Factors influencing Household Savings Behaviour

3.2.8.1 Household Demographics

The main factors that influence household financial decision making *inter alia* are income levels, gender, location and education. In their book *Portfolios of the Poor* (Collins et al. 2009) develop a term for the interaction of these elements known as the *"triple whammy[20]."* They find that in addition to low incomes households in developing countries are also plagued with the unpredictability of these incomes. Furthermore, they lack alternatives for access to financial instruments for savings and credit. This means that they often do not choose between alternatives but rather maximize access to both where what is available does not fit perfectly and its access is limited. In Kenya this piecing together of incomes and maintaining relationships so as to maximize credit opportunities as the need may arise

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[19] The post-election violence with was ethnic targeted broke out in early 2008 following the disputed presidential elections of December 2007.
[20] The triple whammy: low incomes, irregular and unpredictable incomes, lack of tools (Collins et al. 2009) p. 16.

was documented in the financial diaries by Zollmann (2014). This project was similar to the one conducted for the book by Collins et al. (2009) in India, South Africa and Bangladesh. Households were asked to diarize their income sources, spending habits, savings and borrowings. In both projects, it was found that households rely heavily on informal mechanisms to intermediate the low and unpredictable incomes.

In addition to incomes being low and unpredictable, access to financial instruments is also influenced by gender, location and education levels. First, women have been found to be comparatively more financially excluded than men all other factors being equal. This means that compared to men they have less access to formal financial services such as savings accounts and credit (Demirguc-Kunt, Klapper, and Singer 2013). Majority of women therefore rely mainly on informal mechanisms such as ROSCAs to save money and get loans. In a randomized field experiment on savings behaviour of men and women in Kenya, Dupas and Robinson (2013a) found that increasing access to basic savings bank account, albeit interest free, increased the women savings. This may point to a higher influence of mobile money usage on women's savings.

Second, access to formal financial services becomes more difficult where one is rural based. This is due to the fact that though there is a relatively high population in rural areas, their sparsity makes it uneconomical for banks to invest in capital infrastructure. This leaves rural households excluded from the possibility of accessing formal financial services. With informal mechanisms proving to be unreliable, unsafe, and relatively slow, for e.g. sending money to someone in case of an emergency, the use of mobile money provides a platform to counter these problems. M-PESA was introduced mainly as a money transfer tool. It made sending money back "home" cheaper, faster and safer. Certainly, the early adopters of mobile money were urban dwellers, educated, having access to a bank account and predominantly male, there has been a shift toward the members of the other dichotomy. This is especially so among rural households who otherwise would keep money under a mattress, the likelihood that mobile money reduces their vulnerability compared to urban households is plausible.

Third is the question of basic literacy through basic education. Less educated individuals tend to be more averse toward using financial instruments as they do not understand them. Basic literacy enables one to read and write. Access to basic education for all in Kenya is only fifteen years old after the introduction of free primary education in 2003. The levels of basic literacy have improved over time. The higher up the ladder of education one goes, the higher the likelihood that they will interact with elements in the financial system. Therefore, in addition to basic literacy it is important to consider basic financial knowledge or financial literacy.

3.3   DATA DESCRIPTION AND SUMMARY STATISTICS

The data used for empirical analysis in this paper were drawn from the 2016 FinScope survey data collected and maintained by Financial Sector Deepening (FSD) Kenya. FSD (K) is an independent trust funded by the Department for International Development (DfID) in partnership with the government of Kenya and the Central bank of Kenya. These data are the fourth set in the FinAccess household surveys. The data is cross-sectional in nature providing information on the level of financial inclusion at the national level. In addition to financial services access the surveys have collected information on the level of financial literacy among households. Given that the household surveys do not interview the same households in each round, it is not possible to conduct a trend analysis hence a cross-sectional analysis has been undertaken in this paper. The final sample considered all respondent interviewed in the 2016 cycle which consisted of 8,665 individuals, aged 16 years and above. Observations needed to have complete values for the financial literacy and mobile money usage variables.

The aim of this paper is to determine a household's financial well-being by analysing its savings behaviour and ability to access emergency funds as a consequence of mobile money usage. Control variables of household demographics: gender, age, education level, location and marital status socioeconomic characteristics including level of income, source of income, wealth quintile and percentage of income that goes to savings were included in the empirical model. These variables have in prior research been found to have a direct influence on the household's financial decision making and behaviour. In addition to these characteristics, financial literacy levels of the household were also included. This was included as research over the past ten to fifteen years has found that the more conversant individuals or households are with financial elements the better off they are. Financial access controls were also included so as to enable the distinct measure of mobile money usage with reduced deflection of influence. Summary statistics are presented in Table 3.2.

To reduce bias through missing values I conducted multiple imputation on the variables of interest in the regression equation. Given the varied nature of variables in the model (both binary and continuous) I used the multivariate imputation by chained equations (MICE) method. This method offers flexibility in how each of the variables is modelled.

Table 3.2: Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Dependent Variables					
Saving for Emergencies	8,591	0.5445	0.4980	0	1
Saving Regularly	8,595	0.5375	0.4986	0	1
Access to Emergency Funds	8,665	0.3440	0.4751	0	1
Financial Literacy					
Financial Literacy Index	8,665	5.7432	3.6326	0	13
Financial Numeracy	8,665	0.8759	0.8052	0	2
Mobile Money					
Own Mobile	8,665	0.7395	0.4389	0	1
Mobile Money User	8,665	0.6595	0.4739	0	1
Mobile banking usage	8,665	0.1504	0.3575	0	1
Demographics					
Rural	8,665	0.5600	0.4964	0	1
Age	8,665	37.1972	16.5707	16	100
Female	8,665	0.6095	0.4879	0	1
Married	8,642	0.6056	0.4887	0	1
Education_None	8,665	0.1802	0.3843	0	1
Education_Primary	8,665	0.4460	0.4971	0	1
Education_Secondary	8,665	0.2788	0.4484	0	1
Education_Tertiary	8,665	0.0950	0.2932	0	1
Livelihood and Wealth Group					
Livelihood_Employed	8,665	0.1084	0.3109	0	1
Livelihood_Self Employed	8,665	0.1950	0.3963	0	1
Livelihood_Agriculture	8,665	0.3046	0.4602	0	1
Gross Income*	8,642	6000.00	181924.60		
Savings Percentage of Income	8,479	0.2354	1.4131	0	100
Wealth Quintile_Poorest	8,665	0.2229	0.4162	0	1
Wealth Quintile_2nd Poorest	8,665	0.1867	0.3897	0	1
Wealth Quintile_Middle	8,665	0.2000	0.4000	0	1
Wealth Quintile_2nd Wealthiest	8,665	0.1967	0.3975	0	1
Wealth Quintile_Wealthiest	8,665	0.1938	0.3953	0	1
Financial Access Controls					
Nearest Fin Provider_Bank	8,665	0.0575	0.2328	0	1
Nearest Financial Provider_					
Mobile Agent	8,665	0.7658	0.4235	0	1
Safe Place to keep funds	8,665	0.8905	0.3123	0	1
Bank Usage	8,665	0.2905	0.4540	0	1
Informal Group Usage	8,665	0.4485	0.4974	0	1
MFI Usage	8,665	0.0329	0.1784	0	1
SACCO Usage	8,665	0.1151	0.3191	0	1

Note: *The median is reported for the gross income not the mean.

3.3.1 Descriptive Statistics

Following Lusardi, Mitchell, and Curto (2010) I describe the responses to the financial well-being questions across a set of sociodemographic characteristics by performing t-tests for differences in means between different groups of the categorical variables (e.g. male/female, rural/urban, marital status, education level). Households surveyed were mainly rural, male headed but with the respondent being the female partner, having agriculture as their main source of income. The households were on average high-moderate level of vulnerability with the middle to low income households constituting 60% of the sample. From the data I establish that 66% of the respondents are registered users of mobile money. Of this proportion 71% use M-PESA. Of the remaining proportion 1% use other mobile money service providers available in Kenya while the rest are not registered users of mobile money. This gives the justification for me to concentrate on M-PESA users to define mobile money usage.

3.3.2 Mobile Money and Household demographics

In order to minimize selection bias with reference to use of mobile money in surveyed households, I conducted two-way t-tests on household demographics of rural/urban, gender, marital status, and education. I also run tests on female headed households given their frequency and vulnerability with reference to access and use of financial resources. Tables displaying these results can be submitted upon request. From the data I established that M-PESA has 66% registered users of mobile money. On average 76% of the urban population and 58% of the rural population are registered mobile money users. The gender demographic has a fairly even distribution with 61% of female respondents and 68% of male respondents being registered users of mobile money. Households where the household head was married recorded an average of 70% registered mobile money users whereas the unmarried population had an average 60% registered mobile money users.

The education demographic included four levels of analysis: no education, primary, secondary and tertiary levels. On average among the population of people who had no education at all only 31%

were registered mobile money users. This is expected as the use of mobile money application requires one to have at least a basic level of education, i.e. literate to understand how to use the platform. The M-PESA application is available in both English and Kiswahili to make it accessible to all. Of the group that had only a primary level of education recorded as the highest level, 65% were registered mobile money users. This shows a 50% increase in the use of mobile money that can be plausibly attributed to the respondents having a basic level of education. This proportion increases as the level of education increases with 79% and 96% of the population with secondary and tertiary level of education being registered mobile money users respectively. The trend was similar in female headed households at 44% for no education, 69%, for primary, 85% for secondary and 91% for tertiary levels of education. For the regression however to avoid over specification I contrast an individual having formal education, vis a vis a lack of it thereof.

It is interesting to note that the proportion for female headed households registered as mobile money users among the population without education is higher than that of male headed households. A plausible explanation for this is that the urban based working man registered his rural based uneducated wife or elderly mother or other female relative onto the M-PESA platform to enable him to send her money. The other explanation is women in both rural areas and urban slum dwellings have through informal peer groups managed to understand the need and use of mobile money despite their lack of education.

The M-PESA platform has helped alleviate levels of vulnerability among the marginalised groups. Women have for a long time in Africa and Kenya drawn the short stick in terms of financial independence. Household headship is rightly attributed to the member of the household who has the greater authority. This means that the one who has more control over the general affairs of the family including decision making regarding its economic, social and political interactions (Zarhani 2011). However, given the long-standing patriarchy in society household headship is automatically assigned to the man and the work of nurturing is assigned to the woman. Survey data is not exempt from this

stereotype. With the introduction of mobile money and the fact that the use of the platform can be kept private, women have over the years managed to reduce their vulnerability becoming better able to deal with shocks to the household.

3.3.3 Does Mobile Money Use Affect Household Savings?

Majority of households cited lack of money as the main reason why they do not have savings or have never saved. To determine the saving behaviour among households I considered both the regular saving which refers to habitual saving to simply have money stored or for a particular project; and the emergency savings which refers to money set aside specifically to help the household deal with unexpected expenses. The proportions of respondents with reference to what they do with the money they receive on M-PESA were as follows. 40% of the respondents who use M-PESA withdraw the whole amount sent to enable them either meet day to day expenses or make a pending payment which is often debt repayment. 55% reported that they do not withdraw the whole amount when they receive money. 25% of this group withdraw most of the money and save a little, 26% save most of the money and withdraw a little. 5% of the respondents kept all the money received on mobile money. The remaining 4% either transfer the money to their mobile bank account (3%) or to their bank account or to their other savings mechanisms.

Of the group of respondents who kept some money on M-PESA 28% stated that they store the money to enable them to withdraw it in cash as and when needed. A total of 13% of the respondents stated that they used the money in the following ways: to make regular payments (2%), to make daily purchases (1%), to send someone later (1%) and to buy airtime (6%) the remaining 3% stated for other reasons but did not specify). The majority of this proportion, 59%, saved the money with 33% saving for emergencies, 15% saving for no particular reason and 11% saving with a specific goal in mind. This was an impressive proportion for the use of mobile money as a savings tool. The money on the M-PESA account can be held in "secret" and is accessible only to the owner of the phone given the PIN security code that one must have in order to withdraw or send the money. This keeps their

money safe unlike if it were under a mattress and accessible as opposed to if it were saved with a group of friends or ROSCA[21]. To illustrate the positive impact of mobile money use on households, Morawczynski (2010) found that majority of the urban poor, mainly women in slum areas stored money on their M-PESA account mainly to pay for school fees for their children.

With regard to emergency savings households were on average more likely to have a store of wealth if they were male headed at 58%, had at least a secondary level of education (61%) and lived in urban areas (60%). Where a household was female-headed, the likelihood of having emergency savings was higher if she had attained at least secondary school level of education (67%) and was married (57%) as compared to a male-headed household despite his level of education or marital status. Overall, it was impressive to find that 54% of respondents had kept money aside for emergencies in the year prior to the survey. The savings mechanisms varied from informal under the mattress to family and friends' groups to more formal channels such as mobile money and bank accounts.

In order for emergency funds to meet their purpose the holder needs to be able to access the funds quickly. To measure this, respondents were asked if they were able to access a certain amount of funds (Kshs. 2,500 for rural and Kshs 6,000 for urban) within three days to meet emergency expenses. Overall only 34% of the respondents were able to access funds to meet an emergency need within three days. This proportion matches the proportion of respondents who stated that they had kept money on their mobile money account as emergency savings. Though one cannot attribute this coincidental proportional match solely to mobile money usage, it does point in the direction of a positive and significant correlation between mobile money use and access to emergency funds. In order to minimize bias and check for robustness in the results I consider an instrumental variable for the use of mobile money with the household's proximity to a mobile money agent. Agents are an important part to the completion of the mobile money chain link. Without the agent, the user cannot

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[21] ROSCAs are rotating savings and credit associations usually with a group of friends, family members or other people in one's social network. Their aim is to help its members save money through a constant and specified monthly contribution. The total money collected at the end of the month is then lent/given to each member in turn to enable them to finance a household expenditure, often to purchase non-consumables e.g. house furnishings.

deposit money in to or withdraw money from their account. This second level of analysis considers the mobile money agent as exogenous to the household. This enables one to encompass the probability that in the event of an emergency households can access money sent by a friend or family member without having prior savings on their phone.

3.3.4   The Role of Mobile Money Agents

To enable the use of mobile money the presence of mobile money agents is indispensable. Given the exponential growth of mobile money agents all over the country, it is not necessary for users to have a particular mobile money agent to whom they go, although 31% of the respondents stated that they have a regular mobile money agent to whom they go. Respondents were asked about their ability to access the mobile money agent closest to their household with respect to time taken, mode of transport used and the total cost it took them to reach the mobile money agent.

Majority of the respondents managed to get to their nearest mobile money agent more or less hassle free. This meant that they could walk all the way (80%) and it took under thirty minutes (81%). With reference to time taken, 44% of the respondents managed to get to the mobile money agent within ten minutes while the remaining 37% recorded a time of between ten and thirty minutes. Where the respondents were able to walk to the mobile money agent eliminated the cost of transport. This meant that they only needed to cater for the cost of withdrawal or sending money at the mobile money agent in the case where they do not have the application on their mobile phone. It is important to note here that there are users of mobile money who do not have a mobile phone. This means that they rely solely on the mobile money agent to send and withdraw money. However this is a small percentage of the population as the mobile network reach is at a high of 90% of the population (Safaricom 2017). In the section that follows I discuss the empirical framework and conduct regression analyses to determine the impact mobile money use has on household saving behaviour.

3.4 EMPIRICAL FRAMEWORK

In Kenya the inaccessibility of banks and other formal financial institutions to the resource poor had meant that approximately 75% of the population had been financially excluded (Johnson, Brown, and Fouillet 2012). With the introduction of M-PESA, households in Kenya that were previously excluded got a chance to access a cheap, fast and easy to use mode of financial transacting. The success of M-PESA in Kenya has led to several outcomes and consequences expanding its initial purpose which was a money transfer service (Morawczynski 2010). One of the unexpected outcomes of mobile money use has been an increase in savings among households. This meant that households previously using predominantly informal savings mechanisms e.g. under a mattress had the option of having an e-wallet which was necessarily safer.

Given that the households surveyed varied in each survey cycle made a trend analysis or construction of a panel impossible thus difficult to draw causal relationships. It is however possible to conduct a cross-sectional analysis to determine the extent to which households' use of mobile money has influenced their saving behaviour. This gives a snapshot of one of the outcomes of mobile money expanding its initial purpose, ten years since its introduction.

To do this I run a logit regression model using the maximum likelihood estimation to determine the propensity of the household to hold savings given their individual characteristics and controlling for environmental factors that may influence saving behaviour. To find out the extent to which the use of mobile money has influenced household saving behaviour, I propose the following hypothesis: If the propensity to save and access emergency money of both users and non-users of mobile money does not differ, the coefficient β_1 should not be significantly different from zero. However, if users of mobile money have a higher capability to save than non-users, then this coefficient should be positive and statistically different from zero. The relationships tested thus are:

1. The use of mobile money improves the household's saving behaviour, i.e. improving their capacity to save on a regular basis and to have emergency savings.

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2. To the extent that mobile money is affordable and accessible disadvantaged groups such as women, low income, rural based and less educated individuals benefit from the use of mobile money to increase their savings.

3. To the extent that mobile money is accessible and affordable are users of mobile money are able to access funds faster in case of unexpected shocks.

3.4.1 Measuring Household Savings

To measure household savings behaviour, the variables selected were based on the fact that majority of respondents indicated that that they would use their savings to: 1) make ends meet in the event that they encountered an unexpected financial risk (emergency savings) and 2) meet a particular goal toward which they have been regularly saving, e.g. educate their children or themselves, for old age. The variables were in response to the following questions:

- *"In the last year, you have regularly kept money aside for emergencies or unexpected expenses?"*

- *"In the last year have you regularly kept aside money for a particular reason?"*
  The possible responses to both questions were either "Agree", "Disagree" or "Don't Know or N/A". A binary variable was created with the value set equal to 1 if the respondent answered "Agree" and 0 if the respondent answered "Disagree. I did not include observations where the respondent answered "Don't know" or "N/A" as the proportion was negligible at 0.01% in both cases.

To measure the household's ability to access emergency funds I considered the responses as to whether they were able to raise/access a certain amount of money in the event they face a financial risk.

- *If you needed KShs. 2,500 for rural and 6,000 for urban within three days in case of an emergency would you be able to get it?*

The possible responses were "Yes" and "No". Each variable was coded as a binary variable where 1=Yes and 0=No

3.4.2   Measuring Household Mobile Money Usage

To measure mobile money usage, I considered the respondent answering in the affirmative to being a registered mobile money user, i.e. having an M-PESA account. The other variable that was included in the regression due to its inherent nature to the household's use of mobile money was the ownership or access to a mobile phone. The questions asked were as follows:

- *Are you a registered mobile money user?*

  The responses to this question were "currently have", "used to have", and "never had". I merged the two responses that indicated the respondent did not have a mobile money account to enable the creation of a binary variable. The values of the created binary variable were set equal to 1 if the respondent answered "Currently" and 0 if the respondent answered "Used to have" and "never had

- *Do you own a working mobile/cell phone?*

  The responses to this question were either "yes or "no" making this a binary variable whose value was set to 1 if the respondent answered in the affirmative and 0 if the response was negative.

Table 3.3 defines the variables to be used in the model and shows how they will be operationalized

Table 3.3: Definition and Operationalization of Variables

Dependent variable	Operationalization / Definition
Saving Behaviour (binary variable)	Responses to the following questions:
Emergency Savings	In the last year have you kept money aside for emergencies or unexpected expenses?
Regular Savings	In the last year have you kept aside money for a particular reason?
Access to emergency funds	If you needed Kshs. 2,500 for rural and 6,000 for urban within three days in case of an emergency would you be able to get it?
Key independent variable (variable of interest)	
Mobile Money User	Response to the question: Are you a registered mobile money user? encoded as yes = 1, no = 0
IV Instrument	
Mobile money agent	Response to the question how far the nearest mobile money agent is from the respondent's house in terms of distance measured by the time taken to get there, transport and cost
Control Variables	
Location	the location of the respondent encoded as Rural = 1; Urban = 0
Age	Indicate the age of the respondent
Marital Status	Indicate the marital status of the respondent encoded as Married = 1; Single* = 0
Education level	Education level of respondent encoded as None = 0; Primary = 1; Secondary = 2; Tertiary = 3
Gender	Indicate the gender of the respondent encoded as Male = 1; Female = 0
Occupation or employment status	Indicate the employment status of the respondent encoded as (Employed, entrepreneur, farmer,) = 1; Unemployed = 0
Level of income	Indicate the monthly gross income of the respondent encoded as Kshs 0 - 3,000 = 1; Kshs 3,001 - 7,500 = 2; Kshs 7,501 - 15,000 = 3; Kshs 15,001 - 30,000 = 4; Kshs 30,001 - 50,000 = 5; Over Kshs 50,000 = 6
Income source	Indicate whether it is Agriculture, employment, own business or rental/investment income
Use of other financial services	Indicate whether respondent has usage of a bank product; mfi, sacco, other formal financial service
Total number of persons earning income in the household	Indicate the total number of persons living in the household and earning an income
Number of persons in the household	Indicate the total number of persons living in the household
Household having dependants	Indicate whether the household has dependants, i.e. children under the age of 16 and school going children

*Single encompasses all respondents who are not living with a partner either because they are single, i.e. never married, widowed, separated/divorced.

3.4.3 Model Specification

Given that the response variables representing household saving behaviour were binary in nature, I estimated the following general logit model:

$$Prob\ (Y_i = 1) = \Phi(\beta_0 + \beta_1 MMUser_i + \beta_2 HC_i) \tag{1}$$

In the equation above Y_i is the dependent variable for household i which takes the value 1 if the respondent reported saving regularly for a particular reason and having emergency savings and 0 otherwise β_1 and β_2 are the parameters to be estimated, HC is a set of control variables for household demographics, socioeconomic characteristics, financial literacy and use of other formal financial instruments. .

The possible use of M-PESA, *inter alia*, to save is correlated with inherent household demographic characteristics that directly influence a household's financial decision making and access to financial services and products. This means that β_1 cannot necessarily be interpreted as capturing the sole effect of M-PESA itself on saving behaviour. To deal with this issue and reduce the noise I extend equation 1 to include interaction terms of the individual's use of M-PESA with a dummy variable describing whether individuals are disadvantaged or not. I consider this specification strategy borrowing from Ky, Rugemintwari, and Sauviat (2016). They proposed this strategy when they found that the impact of mobile money use on households' saving for health emergencies or to develop an activity is inherently influenced by the individual's characteristics. This meant that the resulting mobile money coefficient was relatively biased. Equation 2 shows the modified specification. The interaction term as previously discussed is alternatively included for rural vs urban, male vs female, low vs high income, educated vs uneducated. The variables are defined as binary variables which take on a value of 1 for the disadvantaged group and 0 otherwise.

$$(Prob\ Y_i = 1) = \Phi(\alpha + \beta_1 MMUser_i + \beta_2 HC_i + \beta_3 MMUSer_i \times DV_i + \beta_4 DV_i + \beta_5 DV_i \times HC_i) \tag{2}$$

Where DV refers to the demographic variable for the disadvantaged group. This is a dummy variable as explained above that enables the assessment of the effect of mobile money use on saving behaviour. HC refers to the controls for household characteristics excluding the dummy variable that is considered for the demographic individual characteristics.

The other explanatory variables for the empirical analysis that were included were as follows: (1) standard household demographics including gender, rural/urban, age, education and marital status, (2) socioeconomic characteristics which detailed a household's level of income source of income, wealth quintile and the proportion of income that went to saving; (3) other forms of formal financial services that the household may have used, i.e. bank account, micro-finance account and savings and credit cooperatives; (4) use of informal savings mechanisms, i.e. the rotating savings and credit associations.

3.4.3.1   Multi-Collinearity and Over specification

To determine whether multicollinearity was present among the explanatory variables I conducted a variance inflation factor (VIF) analysis using the OLS regressions with the above specifications. The VIF is measured by 1/Tolerance which is based on the proportion of variance the ith independent variable shares with the other independent variables in the model (O'brien, 2007). The VIF analysis returned a mean value of approximately 1.42 with range from 1.03 – 2.21 on all specifications. This confirmed the stability of the model and maintained the statistical significance and signs of the other variables as expected.

3.4.3.2   Endogeneity and the Instrumental Variable Approach

In order to determine the possible causal effect of mobile money use on savings behaviour, there is a need to assume that mobile money as a variable is exogeneous and uncorrelated with the error term. This may, however, not be easy to do given that access to formal financial services in Kenya had been until recently, limited to a large majority of the population. With the introduction of mobile money, households previously relying solely on informal money management mechanisms became privy to

the possibility of an easier, cheaper and safer manner to receive, transfer and more recently save money. The endogeneity problem envisaged with this situation arises from the simultaneous determination of the use of mobile money and individuals' choice to save. This is plausible since even though mobile money was introduced for transfers, its use has expanded to providing a savings option due to its convenience, safety and ease of access irrespective of the lack of interest (Dermish et al. 2011; Demombynes and Thegeya 2012).

In this regard to control for the likelihood that individuals would decide to use mobile money with the expectation of saving with it, I consider a standard instrumental variable approach. The endogeneous covariate is the use of mobile money and for this I need at least one instrumental variable. I then use this instrumental variable in a 2-stage IV probit to minimize the bias. The instrumental variable chosen was an instrument otherwise excluded from the estimated equation: the distance travelled by an individual from their household to the nearest mobile money agent. The use of mobile money agents as an instrumental variable is proposed by Jack and Suri (2011).

Mobile money agents are necessary to the use of M-PESA as they are the points at which one makes deposits of money into or withdraws from their mobile money account. The presence of mobile money agents has spread rapidly over time. This spread of M-PESA agents means that more individuals would be registered for mobile money and hence would be more likely to make use of it. Access to mobile money agents by the household should make it easier for the household to save regularly, save for emergencies and access emergency funds.

To do this I consider the accessibility of the household to a mobile money agent as determined by responses to the following question:

- *If you were to go to the nearest Mobile Money Agent, how long would it take you to get there if you go there directly? The responses were coded using a 5-point likert scale where: 1 =under 10 minutes; 2 = 10 – 30 minutes; 3 = over 30 minutes to 1 hour; 4= about 2 hours; 5= 3 hours and over.*

- *The Don't Know response constituted a total of 2% of the respondents. These responses were therefore coded 0 so that they could still enter the equation and avoid measurement errors.*

The underlying hypothesis for this instrument is that the deposit and withdrawal functions of mobile money use are enabled by the presence of mobile money agents. This means that for the time taken instrumental variable I expect a negative sign for the coefficient as the time taken increases. This is simply because the longer it takes an individual to get to the mobile money agent the harder it will be for them to use mobile money. In turn this would necessarily reduce their ability to make use of the mobile phone for saving.

3.5   RESULTS AND ANALYSIS OF FINDINGS

The results are displayed in table 3.4 and the first stage regression results in are presented in table 7.4 in appendix B1. These results show the household's likelihood to save regularly, save for emergencies, and have quick access to funds in case of an emergency (columns 1 to 3). To check for robustness and test for endogeneity of mobile money use and saving behaviour, I used the instrumental variable approach and the results are displayed in columns 4 to 6. In order to minimize specification bias, I ran a second set of regressions interacting the mobile money use with certain individual characteristics that would necessarily influence household financial behaviour as well as use of mobile money. These characteristics determine the use of mobile money among disadvantaged individuals, i.e. female, rural based, poor and uneducated. The results are presented in tables 3.5 (a) to (d). I analyse the results from the dependent variable perspective split into savings behaviour and access of emergency funds.

3.5.1   Mobile Money and household Saving behaviour

From the results in table 3.4 the coefficient for users of mobile money is positive and statistically different from zero. This means that users of mobile money are generally more likely to save regularly, save for emergencies and have faster access to emergency savings than non-users. Across the columns 1 to 3 the coefficient for users of mobile money is positive and significantly different from zero. Users of mobile money are 7.4 percentage points more likely to hold savings for emergencies or unexpected shocks than non-users of mobile money. With reference to households saving on a regular basis, not necessarily for unpredictable events, user of mobile money are 5 percentage points more likely to save on a regular basis than non-users. Mobile money users are also more likely to have access to emergency funds than non-users by 4.2 percentage points.

Columns 4 to 6 report the IV results as well as a test statistic (Wald test of exogeneity) for endogeneity. This test rejects the hypothesis of presence of endogeneity with reference to the use of mobile money saving for emergencies. This means that we can rely on the results from the probit

model for emergency savings. However, the test statistic is significant for the use of mobile money for regular savings as well as access to emergency savings. This means that there is a possibility of simultaneous determination in the use of mobile money for regular savings. In this regard we have to reject the null in these two cases. The results therefore interpreted refer to the time taken to reach the mobile money agent. All the IV results are negative and significant, meaning that the further away one is from a mobile money agent the less likely one will be able to save regularly on the mobile phone. The results show that an increase in the distance to a mobile money agent by one unit will reduce the likelihood of one using mobile money for saving by 0.23 percentage points.

Table 3.4: Mobile Money Usage and Household Savings

	Saving for Emergency (1)	Saving Regularly (2)	Access to Emergency Funds (3)	IV Results Saving for Emergency (4)	Saving Regularly (5)	Access to Emergency Funds (6)
Mobile money use	0.0741***	0.0488***	0.0422***	0.0745	0.0474	0.0365
	(0.0126)	(0.0123)	(0.0119)	(0.1480)	(0.1325)	(0.1177)
Rural	-0.0062	-0.0038	-0.1488***	-0.0075	-0.0081	-0.1524***
	(0.0119)	(0.0117)	(0.0108)	(0.0119)	(0.0117)	(0.0136)
Age	-0.0053**	-0.0035*	-0.0021	-0.0056	-0.0039	-0.0023
	(0.0016)	(0.0016)	(0.0015)	(0.0035)	(0.0031)	(0.0029)
Age2	0.0000*	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Female	-0.0207	-0.0475***	-0.0401***	-0.0205	-0.0467***	-0.0404***
	(0.0109)	(0.0107)	(0.0095)	(0.0112)	(0.0115)	(0.0101)
Educ_Primary	0.0458**	0.0354*	-0.0482***	0.0435*	0.0310	-0.0524***
	(0.0147)	(0.0145)	(0.0130)	(0.0203)	(0.0194)	(0.0146)
Educ_Secondary	0.0362*	0.0338*	-0.0068	0.0334	0.0292	-0.0101
	(0.0159)	(0.0159)	(0.0136)	(0.0255)	(0.0243)	(0.0196)
No Educ Female Head	-0.0631***	-0.0487***	-0.0172	-0.0630***	-0.0469**	-0.0135
	(0.0129)	(0.0128)	(0.0117)	(0.0188)	(0.0180)	(0.0149)
LnIncome	0.0434***	0.0479***	0.0833***	0.0419***	0.0474***	0.0821***
	(0.0049)	(0.0048)	(0.0044)	(0.0103)	(0.0106)	(0.0110)

Employed	0.0228	0.0511**	-0.0053	0.0229	0.0516*	-0.0054
	(0.0191)	(0.0192)	(0.0156)	(0.0203)	(0.0209)	(0.0166)
Self Employed	0.0453**	0.0631***	0.0347**	0.0464**	0.0625***	0.0349*
	(0.0138)	(0.0135)	(0.0117)	(0.0160)	(0.0164)	(0.0136)
Married	0.0307**	0.0360**	0.0038	0.0313**	0.0369**	0.0054
	(0.0114)	(0.0112)	(0.0102)	(0.0115)	(0.0114)	(0.0102)
No. Income Earners	0.0316***	0.0348***	0.0187**	0.0317***	0.0347***	0.0197**
	(0.0070)	(0.0069)	(0.0062)	(0.0083)	(0.0085)	(0.0071)
Savings% of Income	0.0680***	0.0432***	0.0275***	0.0495***	0.0372***	0.0265***
	(0.0107)	(0.0088)	(0.0054)	(0.0080)	(0.0074)	(0.0051)
2nd Poorest Quintile	0.0705***	0.0575***	0.0611***	0.0689*	0.0543	0.0539
	(0.0163)	(0.0160)	(0.0162)	(0.0330)	(0.0309)	(0.0282)
Middle Quintile	0.0820***	0.0523**	0.1024***	0.0802	0.0484	0.0939*
	(0.0168)	(0.0165)	(0.0162)	(0.0419)	(0.0381)	(0.0366)
2nd Wealthiest Quintile	0.0687***	0.0691***	0.1838***	0.0657	0.0625	0.1733***
	(0.0183)	(0.0179)	(0.0167)	(0.0472)	(0.0443)	(0.0451)
Wealthiest Quintile	0.0846***	0.0898***	0.2665***	0.0813	0.0811	0.2585***
	(0.0210)	(0.0207)	(0.0184)	(0.0475)	(0.0452)	(0.0489)
Bank Product	-0.0573***	-0.0958***	-0.0747***	-0.0589	-0.0965**	-0.0776*
	(0.0134)	(0.0129)	(0.0110)	(0.0364)	(0.0366)	(0.0311)
SACCO Product	-0.0282	-0.0502**	-0.0683***	-0.0284	-0.0469*	-0.0705***

	(0.0180)	(0.0182)	(0.0146)	(0.0183)	(0.0186)	(0.0161)
MFI Product	-0.0176	-0.0315	-0.0087	-0.0174	-0.0314	-0.0092
	(0.0298)	(0.0300)	(0.0243)	(0.0311)	(0.0311)	(0.0257)
N	8665	8665	8665	8665	8665	8665
pr2	0.0803	0.1046	0.1874			
Wald test of Exogeneity				1.96	7.68**	10.50***

Note: Dependent variables save for emergency, save regularly and access to emergency funds are dummy variables equal to 1 if respondents answered in the affirmative and 0 otherwise. The variable of interest MM_User is also a dummy variable equal to 1 for users and 0 otherwise. The coefficients reported in the table are the average marginal effects for the impact of mobile money on household saving behavior. Robust Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

3.5.2 Household Demographics and Household Savings

3.5.2.1 Rural

From the results rural households in comparison to urban households were at a disadvantage with reference to saving regularly and saving for emergencies though not significantly disadvantaged. This may be explained from the income perspective where rural based households mainly have subsistence income and lack the disposable income to save. However rural dwellers are significantly disadvantaged with reference to their ability to access emergency funds. The rural based household is 1.5 percentage points less able to access emergency funds in comparison to the urban dweller. This is probably due to the fact that one has fewer alternative sources of funds available to them in the rural areas as compare to urban areas. The IV results return similar results as rural dwellers will have a harder time finding a mobile money agent to carry out a transaction as compared to urban dwellers.

3.5.2.2 Gender

The gender demographic is negative for female and only statistically significant for regular savings. It seems not to be significant whether the household head is male or female with reference to saving for emergencies. However, when it comes to regular savings, women are 4.8 percentage points less likely to hold savings than men. This can be attributed to the inequality in earning potential of women as compared to men as well as the savings mechanisms available to them. The situation is similarly weary for a female headed household where she lacks basic education. This combination reduces the household's likelihood to save for emergencies and save regularly by 6.3 and 4.9 percentage points compared to the male headed household without basic education. These results are statistically significant at the 1% level. With reference to accessing emergency funds, the results returned were not significant.

3.5.2.3 Marital Status

Where the household head is married the results are positive and statistically significant for both the emergency savings and regular savings. Being married improves the likelihood to save for

emergencies by 3 percentage points and save regularly by 3.6 percentage points. The positive impact of one's marital situation (married) may be explained by the size effect. This is where there is a possibility of more than one income earner and discursive financial decision making. The results were similar in the IV specifications as well without much disparity in effect size.

3.5.2.4 *Education*

The education variable used in the equation represents the basic levels of education, i.e. primary and secondary. These are mandatory levels of education attainment in Kenya. The other two levels (no education and tertiary) were omitted due to over-specification and multicollinearity respectively. Where the household head has basic primary education the likelihood that they will save for emergencies increases by 4.6 percentage points and the likelihood to save regularly increases by 3.5 percentage points. Education seems not to increase the likelihood of one's ability to access emergency funds. Similarly, the results are positive and significant (10% level) for respondents who have attained secondary school with regard to emergency and regular savings, but not with reference to accessing emergency funds.

3.5.2.5 *Socioeconomic Characteristics*

Socioeconomic characteristics of income amount, employment status, number of income earners in the household and wealth bracket have the expected signs and significance with reference to individuals' saving behaviour. Where the respondent had a constant flow of income, i.e. employed, the coefficient was not statistically significant for the household having emergency savings and only statistically significant for regularly saving. However, for self-employed individuals, the results were positive and statistically significant at the 5% level for both having emergency savings and saving on regular basis as well as being able to access emergency funds. A plausible explanation, for this, is the likely illusion of security in employment income that is absent where one is self-employed. The lack of a safety cushion of insurance and retirement provided by the co-joined contribution with the

employer, in the case of a person who is self-employed makes them more aware of the need to have a stock of wealth in the event of a shock to income or occurrence of an unexpected event.

In addition to income source and employment status, I considered the amount of income, the number of income earners in the household as well as whether savings was an expense accounted for against income. The income variable measured by the log of income returns a positive and highly significant coefficient as would be expected. This means that a unit incremental change in income improves the likelihood of an individual having emergency savings and regular savings by 4.3 and 4.8 percentage points respectively. This is expected as where the household is able to meet their basic needs and have disposable income, the idea of saving would not be foreign to them. The opposite is necessarily true where the household is being run hand-to mouth. Similarly, the household's ability to access emergency funds with higher levels of income increases by 8.3 percentage points as compared to lower income households.

Where the household has more than one income earner, means that there will be more money available for savings. From the results, an extra income earner in the household improves its likelihood to hold emergency savings and save on a regular basis by approximately 3.2 and 3.5 percentage points respectively as compared to a household with only one income earner. This result is statistically significant at the 1% level for both these variables. An explanation here may be the size effect of the marital status, married. As discussed above the two partners may both be income earners and contribute to the household income pot thus increasing disposable income for saving. Similarly, the likelihood of a household with more than one income earner being able to access emergency funds improves by 1.2 percentage points as compared to a household with only one income earner.

Where the household expensed savings as a percentage of income, the likelihood of having emergency savings, and instinctively regular savings, improved by 6.8 and 4.3 percentage points respectively as compared to if they do not have savings as a percentage of income. These coefficients

are statistically significant at the 1% level. This means that inasmuch as the household may have disposable income as well as access to various formal savings mechanisms, there needs to be a conscious decision by the to set money aside. Naturally where the household has set aside money for savings on their budget, the it is expected that they will be more likely to access emergency funds. From the results expensing savings as a percentage of income improves the likelihood of access or raising emergency funds by 2.8 percentage points.

3.5.3 Influence of Individual Characteristics

As earlier discussed, in an attempt to isolate the effect that mobile money use has had on a household, I interact the mobile money user term with those demographic characteristics that may disadvantage a user of mobile money. These interactions are an attempt at reducing the simultaneous determination bias that may arise with reference to savings occurring as a result of mobile money use *vis a vis* use of mobile money accounts as a saving mechanism. The instrumental variable approach to deal with the endogeneity in mobile money use means that we have now two instruments for the M-PESA user and the other for the interacted term: *MM User* X disadvantaged demographic. Results are displayed in tables 3.5 (a) to (d).

Table 3.5 a: Saving Behaviour and Rural vs Urban

	(1)	(2)	(3)	IV Results (4)	(5)	(6)
MM_usage	0.0688**	0.0116	0.0058	1.1521	1.9907***	3.3529***
	(0.0217)	(0.0213)	(0.0215)	(0.7919)	(0.6041)	(0.3122)
Rural	-0.2122	-0.0739	0.0984	-0.4433	-0.2562	0.2819
	(0.2054)	(0.2050)	(0.1855)	(0.5859)	(0.5662)	(0.5216)
MMUse_Rural	-0.0039	0.0355	0.0065	0.4474	0.0442	-1.1961
	(0.0261)	(0.0255)	(0.0257)	(0.6335)	(0.6134)	(0.6110)
Controls Included	YES	YES	YES	YES	YES	YES
Rural X Controls	YES	YES	YES	YES	YES	YES
N	8665	8665	8665	8665	8665	8665
pr2	0.0851	0.1172	0.1804			
Wald test of Exogeneity				3.79	9.66**	28.25***

Note: Dependent variables save for emergency, save regularly and access to emergency funds are dummy variables equal to 1 if respondents answered in the affirmative and 0 otherwise. The variable of interest MMUser is also a dummy variable equal to 1 for users and 0 otherwise. The coefficients reported in the table are the average marginal effects of the use of mobile money on saving behavior. The controls included are own a mobile, financial literacy index, financial advice source, rural, age, female, no education for female household head, income, employed, self-employed, married, income earners, savings as a percentage of income, financial access controls. The rural variable is the individual characteristic of interest hence not included in the controls. Robust Standard errors in parentheses. $^{*}\,p < 0.10$, $^{**}\,p < 0.05$, $^{***}\,p < 0.01$

Table 3.5 b: Saving Behaviour and Male vs Female

	(1)	(2)	(3)	IV Results (4)	(5)	(6)
MM_usage	0.0578*	0.0097	0.0134	0.3531	1.9993	2.9187***
	(0.0228)	(0.0223)	(0.0209)	(1.4204)	(1.0230)	(0.6520)
Female	-0.0451	0.1480	-0.1517	-0.3449	0.0335	-0.7224
	(0.2233)	(0.2168)	(0.1950)	(0.6081)	(0.5788)	(0.5600)
MMUse_Female	0.0136	0.0341	-0.0092	1.1051	-0.0795	-0.4421
	(0.0263)	(0.0256)	(0.0247)	(0.9561)	(0.8912)	(0.8221)
Controls Included	YES	YES	YES	YES	YES	YES
Female X Controls	YES	YES	YES	YES	YES	YES
N	8665	8665	8665	8665	8665	8665
pr2	0.0841	0.1162	0.1809			
Wald test of Exogeneity				4.05	6.79**	22.85***

Note: Dependent variables save for emergency, save regularly and access to emergency funds are dummy variables equal to 1 if respondents answered in the affirmative and 0 otherwise. The variable of interest MMUser is also a dummy variable equal to 1 for users and 0 otherwise. The coefficients reported in the table are the average marginal effects of the use of mobile money on saving behavior. The controls included are own a mobile, financial literacy index, financial advice source, rural, age, female, no education for female household head, income, employed, self-employed, married, income earners, savings as a percentage of income, financial access controls. The female variable is the individual characteristic of interest hence not included in the controls. Robust Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.5 c: Saving Behaviour and Education vs No Education

	(1)	(2)	(3)	IV Results (4)	(5)	(6)
MM_usage	0.0720***	0.0275	0.0067	0.0720***	0.0275	0.0067
	(0.0165)	(0.0161)	(0.0153)	(0.0165)	(0.0161)	(0.0153)
MMUse_NoEducation	-0.0610	-0.0142	0.0127	-0.0610	-0.0142	0.0127
	(0.0318)	(0.0311)	(0.0311)	(0.0318)	(0.0311)	(0.0311)
Education_None	-0.4622	-0.3902	-0.3185	-0.4622	-0.3902	-0.3185
	(0.5556)	(0.4538)	(0.4123)	(0.5556)	(0.4538)	(0.4123)
Controls Included	YES	YES	YES	YES	YES	YES
No Education X Controls	YES	YES	YES	YES	YES	YES
N	8665	8665	8665	8665	8665	8665
pr2	0.0879	0.1190	0.1789			
Wald test of Exogeneity				2.32	7.25**	19.32***

Note: Dependent variables save for emergency, save regularly and access to emergency funds are dummy variables equal to 1 if respondents answered in the affirmative and 0 otherwise. The variable of interest MMUser is also a dummy variable equal to 1 for users and 0 otherwise. The coefficients reported in the table are the average marginal effects of the use of mobile money on saving behavior. The controls included are own a mobile, financial literacy index, financial advice source, rural, age, female, no education for female household head, income, employed, self-employed, married, income earners, savings as a percentage of income, financial access controls. The no education variable is the individual characteristic of interest hence not included in the controls. Robust Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.5 d: Saving Behaviour and High vs Low Income

	(1)	(2)	(3)	IV Results (4)	(5)	(6)
MM_usage	1.1521	1.9907***	3.3529***	1.4050	2.2096***	2.6355***
	(0.7919)	(0.6041)	(0.3122)	(0.7434)	(0.5017)	(0.4080)
MMUSe_Low Inc	0.4474	0.0442	-1.1961	-0.3844	-0.2912	-0.1850
	(0.6335)	(0.6134)	(0.6110)	(1.0064)	(0.9656)	(0.9956)
PovertyIndex_ Poor	-0.4433	-0.2562	0.2819	-0.4862	-0.2281	-0.5800
	(0.5859)	(0.5662)	(0.5216)	(0.9753)	(0.9230)	(0.8862)
Controls Included	YES	YES	YES	YES	YES	YES
Low Income X Controls	YES	YES	YES	YES	YES	YES
N	8665	8665	8665	8665	8665	8665
pr2	0.0852	0.1166	0.1874			
Wald test of Exogeneity				2.20	7.48**	13.48***

Note: Dependent variables save for emergency, save regularly and access to emergency funds are dummy variables equal to 1 if respondents answered in the affirmative and 0 otherwise. The variable of interest MMUser is also a dummy variable equal to 1 for users and 0 otherwise. The coefficients reported in the table are the average marginal effects of the use of mobile money on saving behavior. The controls included are rural, age, female, education none, no education for female household head, income, employed, self-employed, married, income earners, savings as a percentage of income, financial access controls. The low-income variable is the individual characteristic of interest hence not included in the controls. Robust Standard errors in parentheses. $^* p < 0.10$, $^{**} p < 0.05$, $^{***} p < 0.01$

3.5.3.1   Rural vs urban

The disadvantaged rural household is assumed to have limited access to financial services and products that would enable its saving behaviour. The use of mobile money makes a difference in saving behaviour of rural households improving the likelihood for emergency savings by 7 percentage points and 1.2 percentage points for regular savings though the latter results are not significant. However, the IV results are significant for both regular savings and access to emergency funds. This can be explained by the fact that presence of mobile money agents is very important to enable one make deposits into their mobile money account. Therefore, the nearer a mobile money agent is to the household the higher their likelihood to save regularly using the mobile phone and similarly be able to access emergency funds.

3.5.3.2   Female vs Male

For women the ability to save for emergencies is increased by 5.8 percentage points for users of mobile money. The resulting coefficient is positive with a slight significance (10%). This result agrees with the hypothesis where women when provided with a relatively personal method of holding money they will be in a better position to improve their financial situation. However, saving regularly is seemingly not affected by the use of mobile money. This may be because the women already had saving mechanism for their households prior to the introduction of mobile financial services.

3.5.3.3   Educated vs less educated

The results displayed show that there is no significant difference between an individual with a basic education and one without when it comes to regular savings. However, the level of education matters when it comes to an individual having emergency savings. For the less educated individual mobile money has a positive significant influence on their ability to save for emergencies, improving it by approximately 7.2 percentage points. Similarly, for access to emergency funds, mobile money does not make a difference between the two groups.

3.5.3.4 Low vs High Income

It is assumed that individuals with low incomes may find mobile money innovation a convenient and more accessible way to save money as in comparison to other formal saving mechanisms. This is mainly because majority of the financial services and products are inaccessible to them because of cost. The reported result agrees with this assumption. The resulting coefficient for the variable of interest (MM User) has a positive and statistically significant effect on saving regularly and being able to access emergency funds. Higher income individuals are more likely to save regularly by 200 percentage points and be more likely to access emergency funds by 330 percentage points as compared to low income individuals, increasing the likelihood by 200 percentage points.

3.6 IMPLICATIONS OF FINDINGS

In the event of a shock to income or the occurrence of an unexpected expense, most households rely on savings to help them make ends meet or smooth consumption. According to Chase, Gjertson, and Collins (2011) if two individuals of varying wealth capacity face financial shocks equal in value and need to cut back the same amount on consumption, the wealthier individual will cut back on 'extras' while the poorer individual will cut back on essentials. This means that the need to encourage savings among vulnerable households to enhance their financial well-being is of paramount importance. It is however not sufficient simply to encourage savings as sound financial behaviour there is also a need to make accessible and available the means to save. With the ubiquitous presence of mobile phones in countries where most households are moderately to highly vulnerable, mobile financial services are being rightly given the forefront in enhancing individuals' lives to manage the little financial resources they have.

This paper considered the Kenyan population, with a 72% proportion of the adult population, having a mobile phone and 66% using mobile money. The use of M-PESA has evolved from being a simple money transfer mechanism to providing a payment system and most recently a platform for banking services. The information from the household survey, empirically analysed and discussed here confirms Morawczynski (2010) on the evolving consequences of mobile money use. Overall households using mobile money have on average improved individuals' ability to save whether on a regular basis for no specific use or specifically for emergencies. The ability of individuals to hold money on their phone where it is safe and relatively easy to access when the need arises enables the household mitigate shocks arising from unexpected events.

From the descriptive statistics 33% and 26% of the respondents consciously use their mobile money account to save for emergencies and make regular savings respectively. With this relatively large proportion of respondents relying on their mobile phone to save, it makes

economic sense for Safaricom to continually encourage use of the M-Shwari platform. The implication here for the household is their increasing earning on their savings through interest. The statistics here show that only 15% of the respondents use either one of the mobile banking services M-Shwari or KCBM-PESA. It would be interesting to further this study with a focus on the uptake of the mobile banking services provided by Safaricom. As a starting point I ran a logit regression to determine what kind of profile a user of these bank-integrated mobile financial services has. The results are presented in table 7.5 in appendix B2.

With regard to individual characteristics that put one at a financial disadvantage (female, rural, low income and less educated) mobile money use significantly improves the household's ability and likelihood to have emergency savings and regular savings. It also improves their ability to access emergency funds given that they can safely and "secretly" hold money on their mobile phones. It is however important to mention the significant role that the mobile money agent plays with regard to accessing emergency funds. The shorter the distance the household is from the mobile money agent the higher the probability of mobile money use for the household. In this regard Safaricom is continually improving accessibility of the mobile money agents with increased agents especially in rural areas.

This paper makes two main contributions: (1) extending saving behaviour research among vulnerable households in Kenya and (2) in the wake of improved financial inclusion using mobile financial services, I examine the extent to which mobile money use influences households' saving behaviour. In this regard I document the transformational potential of mobile technology with regard to use of financial service.

3.7   CONCLUSIONS

In Kenya as in most developing countries, limited access to formal financial services and products leads individuals to rely mainly on informal mechanisms of saving the little money they have to spare. With a predominant use of informal saving mechanism, the likelihood that households are unable to insure themselves against shocks due to unexpected events increases. This handicapping of the household in turn negatively influences its economic activity and hampers economic growth or development on both a micro and macro level. In this regard, providing a safe, convenient, affordable and easy to use device or mechanism for saving can reduce the households' vulnerability of the household especially in emergency situations. This reduction in vulnerability can go a long way in poverty reduction and in improving people's financial well-being.

Using the FSD nationally representative household survey data set of 2016, this paper analysed the influence that mobile money use has on households' saving behaviour. I find that users of mobile money overall have a higher likelihood to save on a regular basis, save for emergencies and be able to access emergency funds faster than non-users. In addition to this general implication, disadvantaged groups of females, rural-based, low income and less educated individuals were also better placed to have savings especially for emergencies if they were users of mobile money. With the ever increasing need for households to be able to mitigate shocks or smooth consumption (Jack and Suri 2014), mobile money makes an important contribution to the question of how households manage their financial resources. This inherently encompasses the financial inclusion issue faced by majority of the population in developing countries.

In Kenya the rapid adoption of mobile money proved that people are searching for financial services and products that cater to their needs. In a developing economy with a majority of people constituting the middle- and lower-income levels, and sparse population making

investment in physical banking infrastructure uneconomical, mobile technology can be said to be the panacea of these lands. The situation is similar in Burkina Faso as documented by Ky, Rugemintwari, and Sauviat (2016). Several other functionalities have over time also developed through the M-PESA platform which is a proof of both supplier and demand led innovation. With the fairly recent introduction of the banking services on the mobile phone through M-Shwari and KCB MPESA, I propose further analysis of household financial behaviour with reference to these mobile banking mechanisms.

CHAPTER FOUR

4. Financial Literacy and Saving Behaviour among Kenyan Households

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ABSTRACT

In this paper I examine financial literacy and saving for retirement in Kenya using the household survey of 2016 from FinAccess Kenya. I use probit regressions to determine the effect financial literacy has on individuals saving regularly as well as saving for retirement. My findings show that households with higher levels of financial literacy will tend to have a higher likelihood to save on a regular basis and subsequently save for retirement. I find that women, the less educated, rural and lower income households tend to have lower levels of financial literacy measured by both knowledge of financial concepts and effective numeracy. Inasmuch as this disparity exists between the groups with regard to levels of financial literacy, there is interestingly neither location disparity between rural and urban households nor gender disparity with reference to saving. To investigate the nexus of causality between financial literacy and saving for retirement, I develop an instrumental variable approach by using the proximity of a household to the nearest public secondary school. I find a positive effect of financial literacy on saving for retirement.

4.1   INTRODUCTION

From a conventional microeconomic perspective, a fully rational and well-informed individual will make savings and consumption decisions in such a way that they consume less and save more in times of high earning. These savings will be expected in turn to finance their consumption when they are no longer able to earn an income, i.e. during old age or retirement. This optimization is necessarily complex given that the consumer must arrange his saving and decumulation patterns to smooth marginal utility over his lifetime taking into account survival probabilities, expected labour income, uncertain future pensions and social security benefits, inflation rates, retirement ages and family needs (Lusardi & Mitchell, 2006, 2007a). The task of getting the savings/consumption ratio right and implementing the plan has been found to be quite daunting and discrepancies between ideal and observed behaviour have arisen. In majority of the cases Campbell, (2006) notes that these discrepancies can be rationalized and ignored, however in poorer and less educated households the consequences of these discrepancies could be devastating. In this regard financial literacy and education trainings have been conducted to equip consumers with the knowledge and skills required to make sound financial decisions.

According to Lusardi & Mitchell, (2014) financial literacy refers to individuals' ability to process economic information and make informed decisions about financial planning, wealth accumulation, debt and pensions. Financial literacy has been found to influence financial behaviour such as borrowing (Gathergood, 2012; Japelli, Pagano, & di Maggio, 2013; Lusardi & Tufano, 2015), saving and investment (Jappelli & Padula, 2013; van Rooij, Lusardi, & Alessie, 2011) as well as wealth accumulation (Behrman, Mitchell, Soo, & Bravo, 2012; van Rooij, Lusardi, & Alessie, 2012). The studies aforementioned have been concentrated in developed markets of the United States (US) and Europe where access to financial products and services is fairly high. In areas where financial inclusion is still a hurdle being crossed especially due to cost barriers, there is evidence showing that in addition to price and other confounding

factors, financial knowledge has a high predictive ability for households' demand for financial products and services (Cole, Sampson, & Zia, 2011).

Financial literacy studies analysing its effects on financial behaviour in developing countries have been few and far between. Cole et al., (2011) conducted a study of India and Indonesia on the effects of price and knowledge on financial behaviour, in Turkey Sevim, Temizel, & Özlem, (2012) conducted a study to determine the effects of financial literacy on households' borrowing behaviour. In sub-Sahara Africa (SSA) the studies are similarly scarce mainly due to the lack of available and reliable data. In Rwanda Sayinzoga, Bulte, & Lensink, (2016) studied the effects of financial literacy among rural households and Murendo & Mutsonziwa, (2017) conducted a study of financial literacy effects on saving behaviour among Zimbabwean households. The dearth in financial literacy research from developing countries has been caused by a lack of comprehensive and reliable data. However, since the emergence of the global financial inclusion databases (Demirguc-Kunt, Klapper, Singer, & van Oudheusden, 2015) and the Financial Access Surveys[22], more nationally representative data has been collected and can be used to assess, albeit not fully, how households make financial decisions subsequently influencing their behaviour.

The recent global financial literacy survey by Klapper, Lusardi, & van Oudheusden, (2015) offers an insight into the levels of financial literacy around the world. Developing countries were found to be on the lower end of the spectrum with the lowest levels of financial literacy. Kenya was found to have a financial literacy level of 38%. In proving the case for financial literacy in developing countries, Miller, Godfrey, Levesque, & Stark, (2009) stated that increasing the level of financial knowledge and understanding of consumers gives them the skill set needed to evaluate and compare financial products available to them and make the

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[22] These are nationally representative household surveys conducted in different cycles. In Kenya these are conducted by Financial Sector Deepening Kenya which is mandated by the FinMark trust that "owns" the FinAccess and FinScope surveys.

choice that best fits their needs. Expanding the view to the benefits of consumer financial literacy on the financial system, where consumers are knowledgeable service providers are kept in check to provide more appropriately priced and transparent services as the consumers will be asking the right questions, compare options and negotiate more effectively. This in turn pushes governments and oversight authorities to provide acceptable market standards and reduce the possibility of people getting duped in financial scams (Miller et al., 2009).

With improved financial inclusion in developing countries, previously un-or-under-served households have higher levels of access to financial products and services. With this access comes a need to increase individuals' understanding of these financial instruments to make it possible for them to demand and use the instrument that best fits their needs. As previously mentioned there has also been an improvement in data collection through household surveys that give one an insight into the financial lives of individuals at household level. In this paper I use the FinAccess household survey of 2016 to determine the influence financial literacy has on household saving for retirement among the Kenyan population.

Financial literacy was measured using two metrics; one is a financial literacy index constructed as a composite measure of knowledge and understanding of financial terms and concepts, individuals' attitude toward their finances and individuals' propensity to save. The second metric was individuals' effective numeracy where I used two mathematical questions on division and interest rate calculation. Savings for retirement was measured based on an individual planning to draw on savings to finance their retirement. For one to be able to draw on savings they need to be saving regularly. To this effect I ran a regression to check the influence financial literacy has on saving regularly.

My findings show that financial literacy has a positive and significant effect on individual's propensity to save regularly and to save for retirement. These results were after controlling for

demographic and socioeconomic characteristics which also play a part in influencing one's financial decisions. Of these characteristics the most significant were education, income and use of mobile money. To counter possible bias due to endogeneity found in a lot of financial literacy research, I ran an IV regression. The results were also positive and significant for financial literacy index in the second stage, confirming the initial results. This paper attempts to add to the pool of emerging financial literacy research in developing countries to reduce the dearth in literature in these countries. Its second contribution to literature is in the replicating a financial literacy index, albeit customized, to measure household financial literacy. This is consistent with work by Hilgert et al. (2003); Lusardi & Mitchell (2014); Murendo & Mutsonziwa (2017); van Rooij et al. (2011).

The rest of the paper is organized as follows: section 2 presents a review of literature, section 3 describes the data and sets out the methodology used for analysis, section 4 reports the results and a discussion of the findings, and section 5 concludes and provides implications of the study and suggestions for further research.

4.2   LITERATURE REVIEW

4.2.1   Financial Literacy around the World

The concept of financial literacy has been debated over the past decade and a half with one of the main tasks being to come up with an encompassing definition. Financial literacy is best considered as a construct where individuals' knowledge and awareness of financial elements, terms, services and institutions converges with their ability to use it to make sound financial decisions. The concept of financial literacy has been discussed and measured across various countries with majority of the work[23] done in the US and Europe as well as Asian countries. From these studies it has become evident that financial literacy affects financial decision making and subsequently financial behaviour. It has therefore become necessary to comprehend the extent to which people around the world understand basic financial concepts (Lusardi & Mitchell, 2014).

Until the 2015 Standard & Poor's Global Financial Literacy Survey (S&P Global FinLit Survey), a comprehensive global gauge of financial literacy did not exist. Klapper, Lusardi, & van Oudheusden, (2015) conducted a global financial literacy survey to find out on average what segment(s) of the global population had an understanding of basic financial concepts and those who did not. From their survey, Klapper et al., (2015) found that among the global population individuals who were wealthy, more educated and used financial services had higher levels of financial literacy than their counterparts. Given the complexity of financial markets in terms of the products and services available to consumers, financial literacy skills are of paramount importance to enable consumers make the right financial decisions for their well-being.

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[23] (Behrman, Mitchell, Soo, & Bravo, 2012; Bucher-Koenen & Lusardi, 2011; Jappelli & Padula, 2013; Klapper, Lusardi, & van Oudheusden, 2015; Lusardi, 2012; Lusardi & Mitchell, 2014; Sevim, Temizel, & Özlem, 2012; van Rooij, Lusardi, & Alessie, 2009; van Rooij, Lusardi, & Alessie, 2012)

In their gauge of global levels of financial literacy, (Klapper et al., 2015) found that only 1 out of 3 adults worldwide were financially literate. This means that approximately two-thirds of the global population is financially illiterate. They also established that in addition to the levels of illiteracy being widespread, there were huge variations among countries (developing vs more developed) and groups. For instance, women respondents with lower levels of income as well as lower levels of education were found to have a higher likelihood of suffering from financial knowledge gaps. The variations among the groups were found to be consistent for both developing counties as well as countries whose financial markets were well developed. When they compared within groups, they found that respondents who had higher levels of financial literacy had a number of things in common despite their domicile. For example, use of formal financial services tends to generally increase where individuals were more financially literate. However, the relationship can also go the other way where use of financial services leads one to increase their financial knowledge. Meaning that if two poor households are compared, where the respondent uses a formal savings mechanism e.g. bank account or mobile money system, they will have a higher level of financial literacy than the respondent of the other similarly poor household who does not have a bank account or mobile money account.

Financial literacy has also been found to be significantly correlated with households' economic well-being. In a survey on Dutch households, van Rooij, Lusardi, & Alessie, (2012) analysed the relationship between financial literacy and wealth. They found that higher levels of financial literacy were associated with higher levels of wealth, a higher probability of the household to invest in the stock market, to develop a savings plan, and to plan for retirement. Using data from 14 European countries[24] Jappelli & Padula, (2013) analysed the effect of financial literacy on wealth and saving. Consistent with van Rooij, Lusardi, & Alessie, (2009) and Lusardi,

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[24] The study used data from Austria, Belgium, Denmark, France, Greece, Germany, Italy, Netherlands, Spain, Sweden, Switzerland, Czech Republic, Poland and Ireland.

(2012) they also found a positive and significant correlation between financial literacy and wealth as well as savings decisions.

4.2.2 Economic Importance of Financial Literacy

Where people lack understanding of basic financial concepts, there is a tendency to make less informed financial decisions. This means that individuals are not well equipped to make decisions related to financial management, i.e. choices with regard to saving and investments, borrowing and retirement planning (Klapper et al., 2015). Over the years, evidence has showed that financial ignorance carries significant costs. Lusardi & Tufano (2015) found that financially illiterate households spent more on transaction costs, get caught up in bigger debts due to inflated borrowing and incurred higher interest on loans. In addition to this they were also less likely to be set up for retirement. Financial literacy has overtime been found to be crucial in helping consumers save enough or make investments to provide adequate income in retirement. In this regard Behrman, Mitchell, Soo, & Bravo, (2012) found that financially illiterate consumers had accumulated less wealth than the financially literate for their retirement

With reference to households making informed consumer choices, evidence from various settings has shown the need for financial literacy. For instance van Rooij, Lusardi, & Alessie, (2011) found that households with higher levels of financial literacy participated in the stock market whereas those lacking basic financial literacy skills did not participate in the stock markets. Further with reference to participating in financial markets financially illiterate consumers tended to choose mutual fund with higher fees because they did not understand the financial terminology (Hastings & Tejeda-Ashton, 2008). This particular study found that financially illiterate consumers needed the concepts to be broken down in simpler terms. This level of financial ignorance puts the individuals at a disadvantage as they are not able to engage with financial markets when there is no one to explain the concepts and terms. Similarly, in the

survey used for this paper, the financial literacy questions were language restricted to also test the interaction of households with financial terminology.

4.2.3 Financial Literacy in Developing Countries

For majority of the poorer population especially in developing economies the first hurdle that needed to be overcome was the lack of access to financial product and services. In SSA countries the rate of financial development was especially slow. This was found to be mainly due to the relatively wide financial inclusion gaps in comparison to other developing countries (Allen et al., 2014). In this regard a lot of financial inclusion surveys in African countries were concentrated on determining the level of access or lack thereof and come up with a solution to the access problem (Allen et al., 2013, 2014). The transformative innovation of mobile money that started in Kenya through M-PESA has continued to grow through more countries in Africa and in the world. The use of mobile money has seen previously un-or-under banked segments of the global population gain access to financial products and services that they previously could not access (Aker & Mbiti, 2010; Dermish, Kneiding, Leishman, & Mas, 2011; Gray, 2006; Morawczynski & Pickens, 2009).

Financial inclusion is more a means to an end rather than an end in itself. Improved access to credit and savings facility, for example through a mobile money service provider, is only a first step to participating in the financial system. In this regard Demirguc-Kunt, Klapper, Singer, & van Oudheusden, (2015) established that with access to financial services such as credit, savings, payments products as well as investment options, individuals need to make responsible choices to safeguard their families' future well-being. It is therefore important for people who make use of financial services to be financially literate. This has come to the forefront especially in the wake of the financial crises caused in part by poor financial decision making leading to over indebtedness due to financial illiteracy.

In developing countries financial services providers have expanded the range of products available to the previously un-or-under-served population. Researchers and policy makers have found that lack of financial knowledge with regard to use of these financial instruments is a major underlying issue due in part to their complexity. According to Kefela, (2010) financial literacy is the empowering and enlightening of consumers, making them knowledgeable about finance in a manner that is relevant and beneficial to their lives or circumstances.

Evidence from an experiment by Cole et al., (2011) among Indonesian households showed that in addition to price, financial literacy has a significant predictive ability for households' demand for financial products. They found a positive correlation between financial literacy and households' probability to open and use a bank account. In rural Rwanda, Sayinzoga et al., (2016) found that farmers who had undertaken a financial literacy training were more inclined to open a savings account as well seek advice to take up a loan for farm equipment financing. In determining the effects of financial literacy on saving decisions, Murendo & Mutsonziwa, (2017) found that among the Zimbabwe population, improved financial literacy increased the probability of a household holding savings.

Whereas households are aware that their lack of knowledge about financial products and services negatively affects their interaction with financial instruments, the use of financial education programs has produced mixed results. The main reason for this, albeit the positive results on financial decision making following financial education is that the opportunity cost of being absent from work to attend a financial education program is too high. This is especially the case for poor and rural households (Cole et al., 2011).

In an attempt to narrow the gap in the literature on financial literacy effects on household financial decision making in developing countries this paper uses a survey of Kenyan households to determine the link between financial literacy saving for consumption in old age.

4.2.4   Financial Literacy and Retirement Planning

Prior research has shown that there is a strong link between financial literacy and planning for retirement (Lusardi & Mitchell, 2005, 2006, 2007b, 2011a). Financially literate individuals will tend to save and make investments in their working years in order to prepare themselves for retirement. However the individuals' tendency to save is influenced by their ability to earn an income and to calculate the amount they need to save taking into consideration several factors that confound their income and saving ability. Lusardi & Mitchell (2006, 2007a) found that the computational burden for consumers to "get it right" with reference to what they needed to save for retirement posed a daunting task to them. For majority of the households, any computational discrepancies can be easily rationalized and ignored as is often the case in standard finance theory. However for households with lower levels of income and education not getting it right can have potentially serious consequences (Campbell, 2006). This means that individuals need to be relatively well prepared to enable them figure out their financial planning given their current financial situation with reference to income amount and source.

Though important financial literacy is not the only influencer of household financial decision making. Sociodemographic characteristics of age, gender, income, education and ethnicity play a significant part as well. Some studies have focused on financial literacy among these groups especially women and the young. Lusardi, Mitchell, & Curto, (2010) found that young adults were severely financially illiterate with less than one third of the sample being able to carry out the inflation, risk diversification and interest calculations. In the same study women proved to also be at a disadvantage with reference to financial literacy. The differences in literacy between the sexes persisted despite the authors controlling for other sociodemographic characteristics. In further studies on financial literacy and women it has been found that women are consistently at a disadvantage with regard to financial capability. This encompasses the different areas of

financial inclusion, financial knowledge and household financial decision making (Lusardi, 2006; Lusardi & Mitchell, 2008).

However, women have also been found to be more honest than men in gauging their financial literacy. Women have been found more likely than men to admit that they did not know how to calculate the financial literacy questions or were unfamiliar with a financial term (Lusardi & Mitchell, 2008; van Rooij et al., 2011). This limited level of financial literacy among women has contributed to their being locked out of participating in the stock markets as well as making use of most of the other formal financial products. In addition to the participating in the financial markets or lack thereof, Lusardi, (2006) in one of her earlier papers found that among the female respondents majority of the women lacked the capability to plan for retirement successfully. This is despite the fact that women generally live longer than men, have shorter careers and have lower wages. This interconnectedness creates the need for increased financial literacy to enable more households engage in the financial system for the benefit of the macro economy.

4.3   METHODOLOGY

4.3.1   Data Description and Summary Statistics

The data used for this paper were drawn from the 2016 nationally representative FinAccess household survey. Similar to the other papers in this collection of essays the surveys were cross sectional hence it was not possible to establish a trend or create a panel due to the differing households interviewed in each survey round. This most recent survey was selected for this paper because there were more questions relating to financial literacy as compared to the previous surveys. The final sample of households with completed responses in the survey were 8,665 with a respondent age of 16 and above. The aim of this paper was to establish to what extent financial literacy influences households' retirement financial planning. In this regard I remove the respondents who were below the age of 20 and above the age of 60, which in total were 1,925 respondents. After deducting these respondents, I was left with a sample size used for analysis at 6,740.

Over the past ten to fifteen years research has found that households' financial welfare is *inter alia* highly dependent on their levels of financial awareness and understanding of financial concepts. This paper complements the paper on mobile money and household financial behaviour using the same data set but focusing on the financial capability element of financial literacy. To minimize missing values bias and to achieve completeness of variables the multiple imputation technique was employed with reference to the variables of interest. This means that responses to questions on financial literacy knowledge of terms, effective numeracy and responses with reference to retirement planning, i.e. saving behaviour and social security were checked for completeness.

Control variables for household demographics and socio-economic characteristics were included in the empirical model. These too were checked for completeness. In addition to these characteristics, I included use of mobile money. Given the context of the study, the use of

mobile money has become a renowned phenomenon for access to financial services. In addition to access, the use of mobile money has been found to also have a predictive ability for a household's propensity to be financially literate. Table 4.1 below displays the summary statistics.

Table 4.1: Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Dependent Variable					
Saving Regularly	8,595	0.5375	0.4986	0	1
Saving for Old Age	8,665	0.3184	0.4659	0	1
Household Demographics					
Rural	8,665	0.5600	0.4964	0	1
Female	8,665	0.6095	0.4879	0	1
Age	8,665	37.1972	16.5707	16	100
No formal Education	8,665	0.1802	0.3843	0	1
Primary Education	8,665	0.4460	0.4971	0	1
Secondary Education	8,665	0.2788	0.4484	0	1
Tertiary Education	8,665	0.0950	0.2932	0	1
Household Size	8,665	4.3918	2.4855	1	20
Married	8,665	0.6057	0.4887	0	1
Socioeconomic Characteristics					
Income*	8,665	6000.00	181924.60		
Wealth Quintile _ Poorest	8,665	0.2229	0.4162	0	1
Wealth Quintile_Second Poorest	8,665	0.1867	0.3897	0	1
Wealth Quintile_Middle	8,665	0.2000	0.4000	0	1
Wealth Quintile_Second Wealthiest	8,665	0.1967	0.3975	0	1
Wealth Quintile _Wealthiest	8,665	0.1938	0.3953	0	1
Employed	8,665	0.1950	0.3963	0	1
No. of Income Earners in household	8,665	1.2537	0.7554	0	6
Savings as a percentage of Income	8,479	0.2354	1.4131	0	100
Use of Formal and Informal Saving Mechanisms					
Mobile Money Use	8,665	0.6595	0.4739	0	1
Savings_SACCO	8,665	0.1124	0.3159	0	1
Savings_MFI	8,665	0.0306	0.1722	0	1
Savings_ROSCA	8,665	0.3139	0.4641	0	1
Savings_Bank Account	8,665	0.0901	0.2864	0	1

*The median is reported for household gross income not its mean

4.3.2 Descriptive Statistics

I describe the responses to the financial literacy questions across a set of household socio demographic characteristics using the two-way t-test difference in means between different groups. The gender distribution was 48% to 52% male to female, average age range of 26-35 years. Of the respondent, majority were rural dwellers at 63% with the main source of income being agriculture at 32% of the respondents. Only 12% of the respondents were employed and 18% ran their own businesses. The rest were either dependent, casual workers or had no established source of income. The descriptive statistics on the responses to knowledge of financial terms as well as responses on numeracy are displayed in tables in appendix C4 and C5 respectively.

With regard to respondents' effective numeracy, table 4.2 below displays a summary of how well the respondents did with reference to answering the mathematical questions. Majority of the respondents, approximately 40% answered none of the questions correctly. Only 27% of respondents managed to get both questions correct. The remaining 33% answered either one of the questions correctly. The division question was better performed at an average of 58% of respondents getting the answer correct. The interest rate question was relatively poorly performed with 39% and 32% of respondents either stating that they didn't know or computing incorrectly respectively.

Table 4.2: Summary Statistics for Effective Numeracy

Panel A: Division		Mean in %	Frequency
Division Correct	8,665	57.7	4997
Division Incorrect	8,665	21.9	1901
Division Don't Know	8,665	20.4	1767
Total		100	8665
Panel B: Interest Rate			
Interest Rate Correct	8,665	29.9	2593
Interest rate Incorrect	8,665	31.5	2726
Interest rate Don't know	8,665	38.6	3346
Total		100	8665
Panel C: Overall			
All Correct Answers	8,665	26.98	2338
Only One correct answer	8,665	33.63	2914
No correct answer	8,665	39.39	3413
Total		100	8665

Note: This table shows summary statistics for the performance of the two financial literacy questions measuring numeracy. It displays the frequency in percentage and the proportion of households with respect to whether they got the questions correct, incorrect or didn't know. Panel A refers to the Division question and Panel B to the interest rate calculation. In addition, the overall performance on both questions is summarized in panel C.

4.3.3 Financial Literacy and Household Demographics

Financial literacy is described here from two angles first based on a simple, albeit subjective index of financial knowledge second a mathematical measure gauging the ability of respondents' numeracy skills. To measure the level of awareness and knowledge of financial terms by individuals, I constructed a basic financial literacy index. This index constitutes 12 terms (savings account, National Social Security Fund (NSSF), National Health Insurance Fund NHIF), Investment, Inflation, Interest, Credit Reference Bureau (CRB), Pension, Shares, Nairobi Securities Exchange (NSE), Mortgage, and Collateral). Using this index, I assess financial knowledge based on the total number of terms that the respondent responds in the affirmative. The higher the number of responses in the affirmative the higher the level of basic financial knowledge. In addition to the index, I analyse respondents' financial knowledge of savings terms against the set of household demographics.

With reference to households' numeracy skills, I use the responses to two mathematical questions: one on division and the second on interest rate calculation. The responses possible were "Correct", "Incorrect" and "Don't Know". Prior research has shown that people are generally not numerate with respect to performing calculations that have percentages (Lusardi, 2012). The distribution of financial literacy and effective numeracy across demographic variables of gender, location, age and education are displayed in panels of appendix C4 and C5 respectively.

4.3.3.1 Financial Knowledge and Effective Numeracy by Location

Urban dwellers had on average higher levels of financial knowledge with a mean of 6 terms and rural dwellers were on average familiar with 5 terms. The most understood terms were "NSSF" at 72% of the rural respondents and 88% of the urban respondents and a combined average of 79% for the sample. "Savings account" by location had a combined average of 76% with 69% of the rural dwellers and 85% of urban dwellers being conversant with the term. The

least understood terms by the respondents were "NSE" with a combined average of 34% for the sample and only 26% of rural dwellers and 43% of urban dwellers knew and understood the term. In contrast to the NSE term however, the term "Shares" was relatively better understood with a combined average of 65% where rural dwellers had a mean of 57% and urban dwellers averaged at 75%. These findings are similar to those in Rwanda where urban dwellers were more likely to have had the opportunity to come into contact with financial terms and financial institutions as compared to rural dwellers (Sayinzoga et al., 2016).

With regard to numeracy skills, the combined average of the respondents providing a correct answer to the division question was 58%. Urban dwellers had the upper hand here as well with an average of 66% of the respondents answering correctly. Impressively respondents living in rural areas recorded an average 51% for correct answers. The interest calculation question was however, not as well performed as the division question. The respondents returned a combined average of 30% for the correct answer. The distribution was similar with urban dwellers performing better than rural dwellers returning an average correct answer of 36% and 25% respectively.

4.3.3.2 *Financial Knowledge and Effective Numeracy by Gender*

From the data male respondents had a relatively higher level of financial knowledge as compared to female respondents. On average male respondents were aware of 7 out of the 12 terms as compared to 5 for the female respondents. The most known and understood terms were "NSSF" with a combined average of 79%, and "savings account" with a combined average of 76%. Of the male respondents those familiar with the term "NSSF" averaged 85% whereas the average for the female respondents was 75%. For the "savings account" term knowledge the male respondents averaged 82% and the female respondents averaged 72%. The least understood terms were "CRB" and "NSE" with a combined average of 23% and 33% respectively. These findings are consistent with findings from financial literacy and gender

research where women have been consistently found to have lower levels of financial knowledge than men (Chen & Volpe, 2002; van Rooij et al., 2011).

With regard to numeracy skills the division question was also better performed than the interest calculation question reporting a combine average of 50% and 30% respectively. Male respondents also performed better than their female counterparts for both questions. Of the male respondents an average of 69% got the division question correct against 51% of the female respondents. For the interest calculation question 38% of male respondents and 25% of female respondents recorded a correct answer on average. This trend is consistent with the financial literacy differences in gender reported by Lusardi, 2006; van Rooij et al., (2011).

4.3.3.3   Financial Knowledge and Effective Numeracy by Age

Based on the life cycle hypothesis and evidence from prior research, the rates of financial literary increase with age then decline later with age. This means that older people are less financially literate than middle aged ones (Klapper et al., 2015). In Kenya, the data reveals a similar pattern with majority of respondents who are familiar with at least 6 out of the 12 terms aged 18 – 45. The trend increases gradually as one moves across the spectrum and plateaus between the ages of 26 – 45. It then starts declining culminating with the older generation, respondents aged 55 years and above being familiar with an average of 4 out of 12 financial terms. With regard to numeracy skills respondents' ability to perform mathematical tasks increases gradually with age from 18 – 45 and is highest among the middle aged 36 – 45. It then starts declining and is lowest among the demographic 55years and above. This somewhat bell shape for age and financial literacy is consistent throughout the literature (van Rooij et al., 2011).

For the Kenyan cross section examined in this paper, on average 61% of the younger population (18 – 35) calculated the division question correctly. The middle-aged group between 36 and 55 reported a 1 percentage point drop for those who got the calculation correct. Among the older

aged respondents only 35% of them were reported to have got the question correct. The interest rate calculation was relatively poorly performed with the best age group having an average of 34% of its respondents having a correct answer. The pattern here is a distorted bell curve since the younger lot between 18 and 25 performed better than those aged 26 – 35. A plausible explanation here is that the former group is in an institution of higher learning and thus exposed to these computations. In Kenya, the latter group constitutes mainly of graduates who are seeking employment or non-graduates who are casual labourers. This poses a likelihood that the respondent who had just finished their national examination awaiting campus or has their first job will be more conversant with the mathematical questions. The older respondents are less likely to need the technical know-how of how to compute interest on a simple amount.

4.3.3.4 Financial Knowledge and Effective Numeracy by Education

The education household demographic was analysed based on the four levels of education attainment possible; no education, primary level, i.e. 8 years of schooling, secondary level (14 years) and tertiary level either having a university degree or college diploma. Higher levels of education are generally associated with higher levels of financial literacy proving a high and positive correlation between education attainment and financial literacy (Klapper et al., 2015; Lusardi, 2012; van Rooij et al., 2011).

Consistent with prior research, a positive correlation is established here as well where financial literacy increases with increase in education level attained. This is true for both financial knowledge and numeracy skills. On average respondents who had attained a tertiary level of education recorded being aware of and understanding the highest number of financial terms (9 out of 12). Respondents with no formal education recorded being familiar with only 1 out of 12 terms. From the analysis of individual terms, respondents were most familiar with the terms "NSSF" and "savings account" with approximately 98% for tertiary level respondents and 33% for respondents with no formal education. The least understood terms were the "NSE" and

"CRB" especially for those without formal education at 0.07% and 0.04% respectively. The level of financial knowledge improved as expected with increased level of education where these terms recorded an understanding rate of 70% for "NSE" and 52% for "CRB".

With reference to numeracy skills the average respondents with correct answers recorded increased by 50% with each leap to a higher education level. For instance, of the respondents who had no formal education 27% of these got the question correct. When compared to those with a primary level of education the average percentage of respondents with correct answers leapt to 51%. Similarly, for secondary education (77%) and tertiary education (90%). For the interest calculation question, the trend was the same, albeit smaller proportions of correct answers. The range of correct answers was more compressed for interest rate calculation as compared to division. The average correct answers ranged from 10% of respondents with no formal education to 60% of respondents with a tertiary level of education.

4.4 EMPIRICAL FRAMEWORK

Retirement planning is expected of all individuals as soon as they start their working life. It entails one preparing themselves to finance their future when they are no longer gainfully employed or able to run a business. Most financially literate individuals will do either or both of these things to ensure they have a safety net for their sunset years. They will either save regularly and consistently or make investments in money generating ventures such as financial instruments or real assets. These investment mechanisms ensure a constant stream of income for the investor in terms of either rental income, interest or dividends.

From the data used respondents were asked how they intended to make ends meet in their old age and majority of the respondents, approximately 32%, stated that they will draw on their savings. The second most frequent responses were: rely on family and children or run their own business at approximately 15% for both. It was however worrisome to note that approximately 15% of respondents had no plans at all for their old age. Given that the majority of respondents stated relying on savings for their livelihood in old age, the analysis conducted for this paper aims to determine the level to which (if at all) financial literacy influences household saving behaviour.

The hypothesis tested to determine the influence financial literacy has on household saving for retirement was:

If the likelihood to hold savings for retirement for both financially literate and illiterate respondents does not differ, the coefficient β_1 should not be significantly different from zero. However, if financially literate respondents have a higher likelihood to save for retirement then this coefficient should be positive and significantly different from zero. In this regard the relationships tested were:

1. Financially literate individuals will have a higher tendency to save on a regular basis.

2. Financially literate individuals will have a higher tendency to save specifically for retirement to finance their lives in old age.

4.4.1   Measuring Financial Literacy

Financial literacy was considered from two perspectives: self-reported awareness measured using awareness and knowledge of financial terms, households' perception or attitude towards their finances and their propensity to save; and 2) a more objective measure using the respondents' numeracy skill.

The subjective financial literacy measure was created as a composite score using the principal component analysis from responses of questions on awareness of financial terms related to savings and investments: "Interest", "savings account", "NSSF", "investment", "shares", "NSE", and "pension". The responses were binary in nature where 1 represented an affirmative response and 0 otherwise. Perception to finances was measured using responses to questions pertaining to how respondents dealt with money in their day to day lives (see appendix C1). The responses to each question were "Agree" or "Disagree" where the affirmative was coded 1 and the negative 0. A total of six questions were used. The third element was the respondents' propensity to save. To determine these three questions on individuals' attitude toward old age, regular savings and emergency savings were used. The response here as well was binary in nature where 1 represented response "Agree" and 0 "Disagree". The resulting index was used as a measure for financial knowledge and awareness.

The stability of this index was measured using Cronbach's alpha where it returned a test coefficient of 0.76 which is above the average threshold of 0.60 required for scale reliability. Further discussion on the index is presented in appendix C1 and C2 where the table of eigenvalues is also displayed.

The effective numeracy skills were measured using two mathematical questions on division and interest rate calculation. The questions were framed and asked as below:

- *You are in a group and win a promotion or competition for Kshs. 100,000. With 5 of you in the group, how much do each of you get?*

- *You take a loan of Kshs. 100,000 with an interest rate of 10% a year. How much interest would you have to pay at the end of the year?*

  The possible responses to both questions were "Correct", "Incorrect" or "Don't Know".

To avoid measurement error bias, all the responses are included in the equation. This means that the *"Don't Know"* response is neither considered wrong nor excluded or converted to missing. Where a respondent got both questions correct, their effective numeracy was labelled high, one of the questions was middle effective numeracy and none correct or don't know were grouped together in the low effective numeracy category.

To further disaggregate the financial literacy variable, I run two OLS regressions to find out the determinants of financial literacy for both the subjective responses and numeracy skills. These regressions complement the individual assessment of financial knowledge in the descriptive statistics section. This identification strategy follows Murendo & Mutsonziwa, (2017) in their paper on financial literacy effects on household saving behaviour in Zimbabwe. The regression estimation model was as follows:

$$FinLit_i = \beta_0 + \beta_1 DC_i + \beta_2 SC_i + \varepsilon \qquad (1)$$

Where *FinLit* refers to financial literacy both in terms of awareness and knowledge of financial terms and effective numeracy; β_1 and β_2 are the parameters to be estimated; DC_i and SC_i represents a set of household characteristics that influence financial literacy. These characteristics include both demographics (age, gender, location, education) and

socioeconomic characteristics (income source and size, use of formal financial institutions, use of mobile money, wealth group). Two separate OLS regressions are run to distinctly determine the predictors of financial literacy as measured by knowledge and by effective numeracy. The results are displayed in tables 4.3 and 4.4.

4.4.2 Measuring Household Saving Behaviour and Retirement Planning

To measure saving for retirement the variables selected were based on responses to the questions on whether respondents were saving on a regular basis and how they expected to make ends meet in their old age. The selected variables were in response to the following questions:

- *In the last year, have you regularly kept money aside for a particular reason?*

  The possible responses here were either "Agree", "Disagree" or "Don't Know" / "N/A". A binary variable was created with the value set equal to 1 if the respondent answered Agree and 0 where the response was Disagree. The observations with "Don't Know" or "N/A" were negligible with a proportion of 0.01% and thus were excluded from the model.

- *How do you intend to make ends meet in your old age?*

  Respondents had a selection of 24 possible options to choose from. For this paper, the response to this question that was selected was, "Draw on Savings", where a dummy variable was created with the value set to 1 for those respondents who stated that they will draw on savings in their old age and 0 otherwise.

With the responses to an individual using drawing on savings for retirement planning being binary in nature, I estimated the following probit model:

$$Prob\ (Y_i = 1) = \ \Phi(\beta_0 + \beta_1 FinLit_i + \ \beta_2 DC_i + \ \beta_3 SC_i) \tag{2}$$

Where Y_i is the dependent variable for household i which takes a value of 1 if the respondent reported saving regularly and relying on savings in old age and 0 otherwise. DC is a set of

control variables for the household demographic characteristics. SC is a set of controls for a household's socioeconomic characteristics, i.e. their access and use of formal financial instruments including mobile money use. *FinLit* represents financial literacy which is measured using both awareness and knowledge of financial concepts and numeracy skills.

4.5 RESULTS AND ANALYSIS OF FINDINGS

4.5.1 Determinants of Financial Literacy

Tables 4.3 and 4.4 report the OLS results on the determinants of financial literacy measured by the financial literacy index. The two regressions differ in the education variable where in regression (2) the education variable is disaggregated to show the individual levels of education attained. This was done due to the high correlation between education level attained and individual financial literacy. Both specifications returned relatively high values for the R^2 and low VIF levels averaging 1.36 and 1.57 for equations (1) and (2) respectively. The VIF range was 1.0 – 1.91 and 1.10 – 2.94 for the specifications respectively.

The household demographic characteristics of location, and gender, are negative and significant. The age variable measured using its natural log returns a mixed result for both specifications. It is insignificant but negative for the first specification whereas it is slightly significant and positive for the second specification. The negative specification implies a declining level of financial literacy as one gets older. With the disaggregation of the education variable the age variable is positive suggesting relatively higher levels of financial literacy as one gets older and influenced by increasing levels of education attainment.

With reference to location, the demographic is negative and significant, suggesting that rural households will have lower levels of financial literacy than urban households on average by 9%. This finding is consistent with Sayinzoga et al. (2016) who found that households in rural Rwanda had lower levels of financial literacy and less than desirable financial behaviour as compared to urban dwellers. Similarly Cole et al. (2011) found that households in rural India and Indonesia, in addition to lower levels of financial access, were less financially literate and could not bear the opportunity cost to undertake financial education programs. In addition to

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this rural dwellers were also less likely to demand for financial products partly because of their

ignorance (Cole et al., 2011).

Table 4.3: Determinants of Financial Literacy

	(1)	(2)
Rural	-0.0984**	-0.0901**
	(0.0350)	(0.0343)
Female	-0.5013***	-0.4346***
	(0.0336)	(0.0331)
Log of Age	-0.0555	0.0934*
	(0.0411)	(0.0416)
Highest Education Level Attained	0.8887***	
	(0.0232)	
Primary Education		1.6164***
		(0.0559)
Secondary Education		2.4294***
		(0.0620)
Tertiary Education		2.5774***
		(0.0702)
Log of Income	0.0575***	0.0916***
	(0.0141)	(0.0139)
Employed	0.0299	0.1678***
	(0.0477)	(0.0453)
Self-Employed	0.1427***	0.1316***
	(0.0410)	(0.0399)
Married	-0.0069	-0.0367
	(0.0334)	(0.0327)
No. of Income Earners in household	0.2226***	0.1833***
	(0.0214)	(0.0210)
Mobile Money	0.8119***	0.7352***
	(0.0434)	(0.0430)
Savings with Bank Account	0.1632***	0.2393***
	(0.0453)	(0.0425)
Informal Savings Group	-0.2838***	-0.2389***
	(0.0180)	(0.0179)
Wealth Group_ Poorest	-0.8492***	-0.6814***
	(0.0490)	(0.0494)
Wealth Group_ Wealthiest	0.1073*	0.2182***
	(0.0465)	(0.0446)
TV Possession	0.2028***	0.2160***
	(0.0425)	(0.0413)
Constant	-2.1303***	-2.6686***
	(0.2075)	(0.2128)
N	8665	8665
r2	0.5323	0.5527

Note: Dependent variable is an index of financial literacy (see appendix C1 for a discussion on the same). The above are both OLS regressions determining the predictors of financial literacy among households or lack thereof. Robust Standard errors in parentheses. $^{*} p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

With regard to gender women have lower levels of financial literacy than men by approximately 50%. With the various education variables considered this level of illiteracy decreases by 7 percentage points. The intuition here is that where women have higher levels of education, there is a likelihood that their level of financial literacy will improve. In comparing this finding with another SSA country, it is consistent with a study conducted in Zimbabwe by Murendo & Mutsonziwa (2017) who found lower levels of financial literacy among women than in men. Women being at a disadvantage with reference to financial literacy has also been found to have a negative impact on their financial decision making and behaviour. They will thus be less likely to participate in financial markets as well as to plan for retirement in comparison to men (Lusardi, 2012; van Rooij et al., 2009, 2011).

Given the expected correlation between education and financial literacy, I ran two regressions where one uses a variable that lists the education variable giving it a count value as the level increase. The other specification uses a binary measure for each education variable where 1 represents a respondent having attained the particular level of education and 0 otherwise. From both specifications, education is highly significant and positive where an individual's level of financial literacy increases as one's education level increases. From equation 1 we see that an individual's financial literacy level increases by approximately 89% as one's education level increases from no formal education to tertiary level. From equation 2 a more specific result shows the stepwise increase of the level of financial literacy by increase in education attainment.

Access to formal financial services, e.g. saving through a bank account and use of mobile money also have positive and significant effects on individual financial literacy. With the introduction of mobile money more households have been included in the financial products and services bracket from which some were previously excluded. In this regard the awareness of financial terms, availability of financial products and services as well as the ability to save

with ease has become a reality (Morawczynski, 2010; Morawczynski & Pickens, 2009). From the results in table 4.3 the use of mobile money through M-PESA, for instance, significantly increases individuals' financial literacy by 81% and 73% in equations (1) and (2) respectively. Where individuals use financial products and services, they become more familiar and confident in them. With an increase in awareness of products and knowledge and understanding of financial products and services, individuals tend to become more financially literate. This result shows the important role that financial inclusion has in increasing household financial capability by providing a channel for financial literacy.

In addition to access and use of formal financial services as a source of financial literacy, a household's possession of a television was found to have a positive and significant effect, improving the level of financial literacy by approximately 21% across both specifications. In Kenya, there is a show that airs on television targeting farmers, called "Shamba Shape-up[25]" where in the most recent production in 2016 that aired in 2017 and 2018, financial literacy issues were discussed. These included matters on keeping farm records, budgeting and computing simple investment costs for their farm animals and farm implements. The viewers also had the opportunity to participate by sending questions through the mobile phone and getting either private responses or aired response. This result is consistent with findings by Murendo & Mutsonziwa, (2017) where similarly a household's possession of a television in Zimbabwe improved its levels of financial literacy.

4.5.2 Determinants of Effective Numeracy

Table 4.4 reports the average marginal effects results of the probit regressions run to determine the factors that influence individuals' numeracy skills. The mathematical questions used to

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[25] Shamba Shape-up directly translates to "Farm Shape-up". In this program selected farms and farmers are given the opportunity to have their farms improved. The farmers also get training on simple farming matters where they are taught on how to make the best use of their farm implements, to farm in the best way to utilize learn simple record keeping and accounting for farm inputs and match these with the output.

gauge the respondents' numeracy skills provided an objective measure of financial literacy for the paper. From the results presented in table 4.4 household demographics of gender, age and education level were the most significant determinants. Interestingly location, albeit with the correct sign, did not seem to matter for numeracy skills.

With regard to gender and age the coefficients are both negative and highly significant. Similar to the financial literacy results female respondents also have lower numeracy skills in comparison to men. The chance of calculating both mathematical questions correct was reduced by approximately 8 percentage points. In considering each question individually, women were less likely to compute the division and interest rate calculation questions correctly by 12 and 8 percentage points than men. These results are consistent with Lusardi (2006, 2012) who found that women fared generally more poorly than men in the financial literacy questions they designed to determine levels of financial literacy and its role in financial decision making. Interestingly though women performed better in the interest rate calculation question than the division question when compared to men.

The age demographic is also negative and highly significant with the likelihood of individuals to calculate the questions correctly reduced as one became older. Age in relation to financial literacy has been found to have a bell-shaped curve with a fairly flat top where financial literacy is highest and stagnates over the middle ages of the individual, between the age of 36 - 50. In this time individuals are also expected to be at the peak of their income generating years and thus preparing themselves for retirement (Lusardi & Mitchell, 2007a).

Table 4.4: Determinants of Effective Numeracy (Average Marginal Effects)

	Division (1)	Interest Rate (2)	High Numeracy (3)
Rural	0.0173	0.0114	0.0199[*]
	(0.0107)	(0.0102)	(0.0099)
Female	-0.1210[***]	-0.0836[***]	-0.0816[***]
	(0.0102)	(0.0097)	(0.0093)
Log of Age	-0.1079[***]	-0.0627[***]	-0.0570[***]
	(0.0121)	(0.0123)	(0.0119)
Primary Education	0.1069[***]	0.0647[***]	0.0370[*]
	(0.0147)	(0.0165)	(0.0161)
Secondary Education	0.2765[***]	0.2323[***]	0.2022[***]
	(0.0168)	(0.0177)	(0.0172)
Tertiary Education	0.3827[***]	0.3299[***]	0.2948[***]
	(0.0254)	(0.0221)	(0.0212)
Log of Income	0.0298[***]	0.0151[***]	0.0188[***]
	(0.0043)	(0.0042)	(0.0041)
Employed	0.0314	0.0261	0.0262
	(0.0184)	(0.0155)	(0.0147)
Self - Employed	0.0320[*]	0.0329[**]	0.0346[**]
	(0.0126)	(0.0119)	(0.0114)
Married	-0.0058	-0.0205[*]	-0.0312[**]
	(0.0103)	(0.0100)	(0.0096)
No. of Income Earners in household	-0.0020	-0.0103	-0.0159[**]
	(0.0065)	(0.0063)	(0.0061)
Mobile Money	0.0801[***]	0.0296[*]	0.0276[*]
	(0.0114)	(0.0118)	(0.0115)
Savings Bank Account	0.0301	-0.0128	-0.0127
	(0.0189)	(0.0158)	(0.0150)
Informal Savings Group	0.0012	-0.0121[*]	-0.0065
	(0.0056)	(0.0054)	(0.0052)
Wealth Group_ Poorest	-0.0708[***]	-0.0508[***]	-0.0493[***]
	(0.0131)	(0.0141)	(0.0138)
Wealth Group_ Wealthiest	-0.0036	0.0039	0.0042
	(0.0172)	(0.0148)	(0.0141)
TV	0.0644[***]	0.0544[***]	0.0645[***]
	(0.0140)	(0.0126)	(0.0120)
N	8665	8665	8665

Note: The dependent variables for effective numeracy (division and interest) rate are binary in nature equal to 1 if the respondent had a correct answer and 0 otherwise. A dummy variable was also created for overall numeracy where if a respondent got both questions correct the variable was given a value of 1 and 0 otherwise. Robust Standard errors in parentheses. [*] $p < 0.05$, [**] $p < 0.01$, [***] $p < 0.001$

The education variable as expected had a positive and highly significant effect on the likelihood that the respondent would calculate the questions correctly. This likelihood increases gradually as the respondents' education level increases and is at the highest where one has attained tertiary level. The likelihood that one is highly financially numerate improves by 29 percentage points.

The likelihood that the respondent will correctly compute the division question improves by 38 percentage points and 33 times for the interest rate question. The use of formal financial services such as mobile money and bank account have limited to no significant effect on the respondent's likelihood to answer the questions correctly and this on their numeracy skills. However, access to a television improved the likelihood of the individual's numeracy level by approximately 18 – 22 percentage points. The intuition for the positive and significant effect of television could be from the various programs such as "Shamba Shape-up" where viewers get "financial training" through the practical examples on care of the farm.

With regard to the socioeconomic characteristics of income, poorer households displayed lower levels of financial numeracy whereas households with higher levels of income recorded higher levels of financial literacy. The income variable returned a positive and highly significant result. With the increase in likelihood of answering both the division and interest calculation questions correctly, higher income individuals were likely to be more numerate by 2 percentage points as compared to lower income individuals. Further using the wealth group variables, households in the lower wealth group were less likely to answer the questions correctly. The regression returned a negative and highly significant result for the poor wealth group. Households that were poorer were likely to have lower numeracy skills by approximately 5 percentage points and they were less likely to answer the questions correctly by 7 percentage points for division and 5 percentage points for interest rate. This finding is consistent with Cole et al., (2011) who find lower levels of financial literacy among poorer households as well as Klapper et al., (2015) who found that among the emerging markets[26], only 23% of the poor individuals were financial literate as compared to 35% of the richer group.

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[26] The emerging market countries used in the S&P review of financial literacy around the world included the BRICS economies. These are Brazil, Russia, India, China and South Africa. These being the major emerging economies were used as a gauge against the major advanced economies of the world.

4.5.3 Financial Literacy Influence on Saving Behaviour

In the previous section I have discussed the determinants of individuals' financial literacy. In this section I discuss the result of the probit regressions that were ran to establish the effect financial literacy has on planning for old age. To do this I ran a set of regressions to determine financial literacy effect on individuals saving regularly and another set to determine financial literacy on their saving for old age. It was important to determine to what extent financial literacy influences the saving behaviour which is required for one to have a stock of wealth for later years. The results are displayed in table 4.5. Financial literacy in these regressions encompasses both financial knowledge and effective numeracy, albeit as distinct variables.

Table 4.5: Effect of Financial Literacy on Household Saving

	(1)	(2)	(3)	(4)	(5)	(6)
All Correct	0.0467***			-0.0207		
	(0.0112)			(0.0115)		
Division Correct		0.0466***			-0.0321**	
		(0.0109)			(0.0107)	
Interest Correct			0.0371***			-0.0184
			(0.0109)			(0.0111)
Finlit Index	0.0437***	0.0429***	0.0439***	0.1102***	0.1111***	0.1101***
	(0.0035)	(0.0035)	(0.0035)	(0.0029)	(0.0029)	(0.0029)
Rural	0.0270*	0.0271*	0.0274*	0.0086	0.0085	0.0085
	(0.0109)	(0.0109)	(0.0109)	(0.0107)	(0.0107)	(0.0107)
Female	-0.0047	-0.0035	-0.0056	-0.0154	-0.0173	-0.0152
	(0.0105)	(0.0106)	(0.0105)	(0.0104)	(0.0104)	(0.0104)
Age	-0.0079***	-0.0079***	-0.0078***	-0.0076***	-0.0076***	-0.0076***
	(0.0017)	(0.0017)	(0.0017)	(0.0015)	(0.0015)	(0.0015)
Age-squared	0.0000	0.0000	0.0000	0.0001***	0.0001***	0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Education_None	0.0012	-0.0000	-0.0007	0.1821***	0.1799***	0.1823***
	(0.0261)	(0.0261)	(0.0261)	(0.0258)	(0.0257)	(0.0258)
Education_Primary	0.0046	0.0000	0.0016	0.0778***	0.0773***	0.0784***
	(0.0193)	(0.0192)	(0.0193)	(0.0205)	(0.0203)	(0.0204)
Education_Secondary	0.0260	0.0223	0.0246	0.0038	0.0048	0.0041
	(0.0179)	(0.0179)	(0.0179)	(0.0193)	(0.0192)	(0.0193)

Education_Tertiary	ref	ref	ref	ref	ref	ref
Ln Income	0.0149**	0.0144**	0.0151***	0.0406***	0.0411***	0.0405***
	(0.0046)	(0.0046)	(0.0046)	(0.0045)	(0.0045)	(0.0045)
Poorest	-0.0172	-0.0161	-0.0176	0.0223	0.0210	0.0223
	(0.0156)	(0.0156)	(0.0156)	(0.0144)	(0.0144)	(0.0144)
Middle	0.0132	0.0125	0.0130	-0.0076	-0.0071	-0.0076
	(0.0129)	(0.0129)	(0.0130)	(0.0127)	(0.0127)	(0.0127)
Wealthiest	0.0176	0.0185	0.0184	-0.0105	-0.0108	-0.0107
	(0.0145)	(0.0145)	(0.0145)	(0.0151)	(0.0151)	(0.0151)
Employed	0.0058	0.0060	0.0058	0.0447*	0.0446*	0.0447*
	(0.0167)	(0.0167)	(0.0167)	(0.0177)	(0.0177)	(0.0177)
Self-employed	0.0054	0.0059	0.0057	0.0485***	0.0486***	0.0484***
	(0.0126)	(0.0126)	(0.0126)	(0.0126)	(0.0126)	(0.0126)
Married	0.0030	0.0020	0.0020	0.0483***	0.0485***	0.0487***
	(0.0109)	(0.0109)	(0.0109)	(0.0105)	(0.0105)	(0.0105)
No. of Income Earners	0.0107	0.0103	0.0103	0.0144*	0.0142*	0.0146*
	(0.0068)	(0.0068)	(0.0068)	(0.0067)	(0.0067)	(0.0067)
Savings%Income	0.0014	0.0013	0.0014	0.0299***	0.0303***	0.0299***
	(0.0033)	(0.0034)	(0.0033)	(0.0061)	(0.0061)	(0.0061)
Mobile Money	0.0308*	0.0285*	0.0306*	-0.0255*	-0.0240*	-0.0255*
	(0.0126)	(0.0126)	(0.0126)	(0.0120)	(0.0120)	(0.0120)

	(1)	(2)	(3)	(4)	(5)	(6)
Savings_SACCO	0.0239	0.0256	0.0250	0.0156	0.0153	0.0154
	(0.0159)	(0.0158)	(0.0159)	(0.0166)	(0.0166)	(0.0166)
Savings_MFI	0.0132	0.0132	0.0145	0.0038	0.0049	0.0034
	(0.0266)	(0.0265)	(0.0266)	(0.0284)	(0.0284)	(0.0284)
Savings_ROSCA	0.0168	0.0182	0.0169	0.0438***	0.0430***	0.0438***
	(0.0110)	(0.0110)	(0.0110)	(0.0110)	(0.0110)	(0.0110)
BankAcc_Savings	0.0195	0.0181	0.0193	0.0187	0.0192	0.0187
	(0.0165)	(0.0165)	(0.0166)	(0.0178)	(0.0178)	(0.0178)
HHoldSize	-0.0036	-0.0037	-0.0035	-0.0017	-0.0014	-0.0017
	(0.0022)	(0.0022)	(0.0022)	(0.0021)	(0.0021)	(0.0021)
N	8595	8595	8595	8595	8595	8595

Note: The table presents the average marginal effects for the probit estimates of the effect of financial literacy as well as various controls on households saving for retirement. Columns (1) to (3) show the results for the dependent variable old age saving, columns (4) to (6) show the results for the dependent variable regular saving. "ref" indicates the omitted category. The dependent variables are dummy variables equal to 1 if the respondent answered in the affirmative and 0 otherwise. The main variables of interest Finlit Index is a composite index constructed using the principal component analyses factoring variables of financial knowledge, attitude and propensity to save. The numeracy variables of division and interest rate as well as "all correct" are constructed dummy variables equal to 1 where the respondent got the questions correct and 0 otherwise. Robust Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.5.4 Financial Literacy and Saving for Old Age

From the average marginal result displayed in table 4.5 columns (1) to (3), both financial literacy and effective numeracy positively and significantly influence the individual's likelihood to save for old age. For a highly numerate individual, meaning that the respondent answered both questions correctly, the likelihood that they would have savings to finance their old age increases by 5 percentage points. Similarly, for an individual who calculates the division question correctly there is an increase in likelihood by 5 percentage points. The interest rate question was poorer performed and thus the effect on savings likelihood increases by approximately 4 percentage points less. Financial knowledge and attitude toward finances as measured in the composite score for financial literacy improved the likelihood to save for old age by approximately 4.3 percentage points. These results showing the positive and significant effect of financial literacy on saving for old age are consistent with prior research by Lusardi & Mitchell, (2011, 2007, 2006, 2005) where financial literacy was highly significant for retirement preparedness in the United states and in the Netherlands (van Rooij et al., 2009) as well as for accumulation of wealth for later years (van Rooij et al., 2012).

Household demographics on location were positive and significant at the 10% level where rural dwellers seemingly were more concerned about saving for their old age as compared to urban dwellers. The likelihood improved by approximately 2.7 percentage points for rural dwellers. The gender and education demographics were not significant with regard to saving for old age. However, age was negative and highly significant. This implies that as people grow older the likelihood that they will save diminishes as they near their retirement years. This is consistent with Almenberg & Säve-Söderbergh, (2011) who had similar results for the Swedish population.

Of the socioeconomic characteristics, income is the only significant influencer of household saving. An increase in amount of income earned increases the likelihood of the individual

saving for old age. This is plausible since the ability to save is directly dependent on one having a source of income. As this pot of money increases the likelihood that one will have some to save after meeting their basic needs will necessarily be higher. From the results this likelihood improves by approximately 1.4 percentage points. With reference to access and use of financial products and services only use of mobile money returns a slightly significant result at the 10% level. Across the three specifications the likelihood that one will save for old age because they use mobile money improves by approximately 3 percentage points.

Similarly, financial literacy plays an important role in improving the likelihood that one will save for retirement as is for saving regularly. It is also important to note that the group of respondents who save for retirement is only 32% of the total sample whereas a relatively large proportion (15%) is on the other end of the spectrum with no plans whatsoever for retirement.

4.5.5 Financial Literacy and Saving Regularly

From the results on regular savings displayed in table 4.5 columns (4) to (6), financial literacy which encompasses knowledge and awareness of financial terms as well as attitude toward savings, has a positive and significant coefficient across all three specifications. The numeracy coefficient was only significant at the 5% level for the division question whereas the interest rate calculation as well as the combined measure of numeracy did not have any significant effect on an individual saving regularly. The financial literacy index on the other hand improved the likelihood of an individual saving regularly by approximately 11 percentage points across all specifications. This seems to suggest that in the Kenyan context knowledge of terms and one's attitude toward their finances and money in general has a higher effect on one's propensity to save in comparison to being numerate. This finding is consistent with Murendo & Mutsonziwa (2017) who found that financial literacy computed as a composite of knowledge, attitude and behaviour with money significantly improved the chances of Zimbabweans saving. Similarly the knowledge result is consistent with Cole et al. (2011) who found that where

households were more aware and understood the basic financial concepts increased the demand for savings accounts.

The results relating to gender and location are not significant influencers of individuals' saving decisions. However, the female variable is negative indicating that it is still relatively more difficult for women to save as compared to men. In Kenya this can be backed up by the fact that majority of women have less opportunities to earn money and often rely on their husbands' income. This is especially true of rural dwellers and the urban poor. Women also have limited access to financial services and savings products meaning that they end up saving less than their male counterparts. This is especially true in developing countries women have been excluded from formal finance for a long time until the advent of mobile money (Cole et al., 2011; Morawczynski, 2010; Morawczynski & Pickens, 2009; Murendo & Mutsonziwa, 2017).

For these regressions I measured age using its continuous variable and its square term. The results are negative and significant implying that as one grows older the propensity to save decreases. This makes sense as one needs to start saving early for the later years. When one is nearing retirement, (at 60 years of age in Kenya), there is a lower chance that they will be able to start saving if they had not been doing it earlier when they were gainfully earning an income. The education variable in this case returns significant results for the primary level as well as no education but insignificant results for the other education terms. The intuition here is that one does not need to be formally educated to know that they need to save. This explains in some way the positive and significant coefficient of the use of ROSCAs for saving.

ROSCAs are an informal method of saving where one saves together with friends in one's community and each member receives the total amount saved and contributed to the group in turn. In this way the members are incentivized to save some money during the month in order to make their contribution making them eligible to receive the money at the end of the month

when it is their turn. The likelihood that an individual who is a member of this kind of a savings and credit group will save regularly increases by approximately 4 percentage points across all specifications. This positive and significant result shows the important role of peer influence in household financial matters. Interestingly the use of other financial products for saving such as SACCOs and MFIs are not significant to individuals' saving regularly. The explanation for this is that from the data collected very few respondents were making use of these financial institutions to save.

With regard to the socioeconomic characteristics of income source, amount and income group, the results were positive and significant at the 1% level for income measured using its natural log and for the self-employed. The coefficient for employed respondents was positive but significant only at the 10% level. With reference to income the results mean that for each unit increase in income the likelihood that the individual will regularly save increases by approximately 3 percentage points across all specifications. Self-employed respondents had a higher likelihood to save as compared to employed individuals. This is foreseeable because the self-employed person will also be thinking about saving for the continuity of his or her business. The income group or wealth group did not return significant results.

Where the individual was married the likelihood to save regularly increased by approximately 5 percentage points. This coefficient was also significant at the 1% level across all three specification. In the event that there is more than one income earner in the household, the likelihood to save increases slightly by approximately 1.4 percentage points. The number of income earners variable is however only significant at the 10% level. In the event that the household sets aside money in their monthly expenditure for savings, their likelihood to save increases by 3 percentage points across all specifications. In addition to being positive this coefficient is significant at the 1% level. This means that where people are concerned with their

finances, they will take into consideration an amount to be saved from their income as part of the expenditure plan.

From the above discussion, financial literacy plays a major role in an individual making the decision to save some money. Being financially numerate, though helpful, does not have that significant a role in the individuals' likelihood to save on a regular basis. With reference to demographic characteristics, only age and some form of formal education matter, gender and location do not have significant effect on the individual's likelihood to save regularly, though the gender variable was expected to be significant. The socioeconomic characteristics in relation to income have higher significant value as having money is directly correlated with one's ability to save.

4.5.6 Robustness Checks

4.5.6.1 Financial Literacy Index Reliability Test

In a further attempt to determine the reliability of the financial literacy index scale, I re-constructed it to include the numeracy level of the respondent. In this identification strategy I come up with only one financial literacy measure. I used similarly the principal component analysis and the results of eigenvalues greater than 1 are reported in table 7.6 appendix C1. Using the Cronbach's alpha to measure the scale reliability, I find that the new index is similarly reliable returning a test coefficient of 0.77 which is above the recommended threshold of 0.60. I then use this index in the probit regressions to determine its effect on household saving regularly as well as saving for old age. The results are displayed in table 4.6.

From the results the financial literacy index has a positive and highly significant effect on household savings. The result is similar to the previously constructed index where the financial literacy variable and effective numeracy variables were separately considered. This consistent finding confirms the reliability of the previously constructed financial literacy index.

Table 4.6: Effects of Financial Literacy on Household Saving

	(1)	(2)
FinLit Index	0.1074***	0.0464***
	(0.0029)	(0.0034)
Rural	0.0077	0.0275*
	(0.0107)	(0.0109)
Female	-0.0119	-0.0066
	(0.0104)	(0.0105)
Age	-0.0075***	-0.0078***
	(0.0015)	(0.0017)
Age2	0.0001***	0.0000
	(0.0000)	(0.0000)
Education_None	0.1919***	-0.0035
	(0.0258)	(0.0260)
Education_Primary	0.0943***	-0.0025
	(0.0203)	(0.0191)
Education_Secondary	0.0110	0.0227
	(0.0193)	(0.0179)
Ln Income	0.0402***	0.0150***
	(0.0045)	(0.0046)
N	8595	8595

Note: The table reports the probit regression results (reduced) for the re-constructed financial literacy index effect on saving. Dependent variables regularly saving (1) and saving for old age (2) are dummy variables equal to 1 where the respondent answered in the affirmative and 0 otherwise. In addition to the displayed control variables, the other controls included in the regression were 3 levels for wealth group, employed or self-employed, marital status, no. of income earners in the household, household savings as a percentage of income, household size and use of formal financial services for saving. The variable Tertiary Education was omitted due to multicollinearity. Standard errors in parentheses. $^{*} p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

4.5.6.2 *Instrumental Variable Approach*

Financial literacy research is often plagued by the endogeneity problem where three main issues might occur: reverse causality, omitted variable bias and measurement error bias. From the probit regression for financial literacy effect on saving behaviour positive and highly significant results have been reported. These results may be biased due to various reasons: firstly, it may be that there is a case of reverse causality where the direction of influence flows from savings to financial literacy rather than the other way around: meaning that respondents who have savings have through their saving mechanism become financially literate. Secondly there could be bias from measurement error of the financial literacy variable which would bias the variable downwards. Third there may be omitted variable bias due to missing information on people's

attitudes toward finance topics as most people tend not to want to discuss financial matters. This biases the estimates upward (Bucher-Koenen & Lusardi, 2011).

In order to account for these issues, I use an instrumental variable approach to determine financial literacy. I use an excluded instrument which measures the household's or individual's proximity to the nearest secondary school. Given that education is highly correlated with financial literacy, a person who has the chance to attain higher levels of education will tend to have higher levels of financial literacy. In this regard, accessibility to a secondary school was chosen as the instrumental variable.

The instruments used for financial literacy index were responses to the following questions:

- *If you had to go to the nearest public secondary school,*
    a) *How would you get there?*
    b) *How long would it take you to get there, if you go direct?*
    c) *(Do not ask if answer to A is 'walk') On average how much would it cost to get there by public transport?*

I test the three measures of distance to secondary school for time, transport and cost. All three instruments return significant correlation with the financial literacy index in the first stage regression. However, given the fact that majority of the respondents do not give responses to the cost (only 1,906), I exclude this regression from the analysis. The results for the second stage regressions are displayed in table 4.7, results for the first stage regression are presented in table 7.8 appendix C3

From the IV results, in table 4.7 the instrumented financial literacy index has a positive but not significant effect on household saving regularly and for old age except for the first result which returned a negative sign. This means that in general financially literate individuals will tend to

have a higher propensity to save regularly as well as to save for old age as compared to less financially literate individuals. From the results it is necessary to be cautious in the interpretation of financial literacy's effect of household saving. Whereas the evidence shows that there are other household characteristics and dynamics that have an effect on household savings, financial literacy also plays a major role. In developing countries with the example of the Kenyan market through this study, financial literacy in addition to other inherent household characteristics plays an important role in the individual's likelihood to save for old age. This is especially so because there is a need to understand the reason for them to save for old age and not naively expect to rely solely on family and friends.

The instrument proximity to education is fairly strong as shown in the first stage regressions given its ability to represent individual financial literacy. However, when looking at the Wald test of exogeneity displayed in table 7.8 appendix C3, the test statistics are not significant. This means that there is not sufficient evidence to reject the null hypothesis of no endogeneity. In this regard we rely on the original probit regression results which have smaller standard errors. These results in effect maintain the reliability and relevance of the original probit model results on financial literacy's influence on household saving behaviour, albeit a cautious interpretation is maintained.

Table 4.7: IV Probit Results for Effect of Financial Literacy on Household Saving

	(1)	(2)	(3)	(4)
FinLit Index (Sec School proximity)	-0.7069	0.4243*	0.6567	0.0990
	(0.5848)	(0.2157)	(0.4583)	(0.2234)
Rural	-0.0744	0.0359	0.1332*	0.0817*
	(0.0742)	(0.0394)	(0.0575)	(0.0395)
Female	-0.4855	0.0156	0.1993	-0.0393
	(0.2547)	(0.0992)	(0.1995)	(0.1022)
Age	0.0150	-0.0271**	-0.0433*	-0.0219*
	(0.0227)	(0.0095)	(0.0179)	(0.0100)
Age2	-0.0002	0.0002*	0.0003	0.0001
	(0.0002)	(0.0001)	(0.0002)	(0.0001)
Education_None	-2.1503	0.8221	1.3409	-0.1041
	(1.5452)	(0.5705)	(1.2106)	(0.5907)
Education_Primary	-0.8094	0.4027	0.5352	-0.0495
	(0.6257)	(0.2386)	(0.4897)	(0.2452)
Education_Secondary	-0.1386	0.0595	0.1554	0.0672
	(0.1308)	(0.0723)	(0.0991)	(0.0684)
Ln Income	0.2145***	0.1266***	0.0037	0.0497*
	(0.0531)	(0.0231)	(0.0414)	(0.0233)
Poorest	-0.7233	0.1441	0.3355	-0.0846
	(0.4494)	(0.1713)	(0.3524)	(0.1776)

Middle wealth group	-0.0798	-0.0153	0.0688	0.0336
	(0.0674)	(0.0427)	(0.0520)	(0.0425)
Wealthiest	0.3123	-0.0597	-0.1148	0.0694
	(0.2075)	(0.0887)	(0.1619)	(0.0896)
Employed	0.2466*	0.1201*	-0.0344	0.0140
	(0.1006)	(0.0603)	(0.0755)	(0.0564)
Self-Employed	0.2975**	0.1380**	-0.0549	0.0300
	(0.1021)	(0.0506)	(0.0793)	(0.0504)
Married	0.0587	0.1775***	0.0561	-0.0043
	(0.0759)	(0.0406)	(0.0596)	(0.0413)
No. of Income Earners	0.2393*	0.0304	-0.0607	0.0331
	(0.1091)	(0.0432)	(0.0852)	(0.0445)
Savings as % of Income	0.1081***	0.0939***	-0.0010	0.0051
	(0.0232)	(0.0195)	(0.0128)	(0.0106)
Mobile Money	0.6816	-0.1335	-0.2773	0.1278
	(0.4257)	(0.1595)	(0.3334)	(0.1652)
Savings_SACCO	0.3133	0.0168	-0.0567	0.0956
	(0.1741)	(0.0784)	(0.1351)	(0.0775)
Savings_MFI	0.2632	-0.0309	-0.0812	0.0665
	(0.1947)	(0.1057)	(0.1476)	(0.1001)
Savings_ROSCA	0.4665*	0.1025	-0.1072	0.0695
	(0.1887)	(0.0751)	(0.1473)	(0.0768)

	(1)	(2)	(3)	(4)
Savings_Bank Account	0.3126	0.0422	-0.0636	0.0766
	(0.1605)	(0.0784)	(0.1234)	(0.0760)
Household Size	-0.0123	-0.0055	-0.0078	-0.0105
	(0.0102)	(0.0068)	(0.0080)	(0.0069)
Constant	-1.7398**	-0.8747***	0.0615	-0.4058
	(0.5404)	(0.2404)	(0.4219)	(0.2435)
N	8595	8412	8595	8412
Wald test of exogeneity	0.619	0.844	0.619	0.844

Note: The table reports the second stage of the IV probit regressions where the FinLit Index variable is measured using the IV household's proximity to secondary school. The regression was run with the imputed variables. The specifications (1) and (3) refer to access to secondary school based on transport mode used; (2) and (4) proximity by time taken. Dependent variables are respondent regularly saving and saving for old age. Specifications (1) and (2) refer to regular savings and (3) and (4) refer to saving for old age. The variation in the size of N for the cost IV estimation is different as it only accounts for those respondents who stated in that they use public means of transport to get to the nearest secondary school. Standard errors in parentheses. $^{*} p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$.

4.6 CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

Using the 2016 nationally representative FinAccess household survey data I have analysed the influence of financial literacy on household saving for retirement in Kenya. Summary statistics reveal that there are still relatively low levels of financial literacy among Kenyan households. Irrespective of this, individuals still manage to make some savings. This means that in as much as financial literacy plays an important role in the individual's financial decision making, the individual's characteristics also form part of the decision factors. Using the individuals' financial knowledge based on awareness and understanding of financial terms and financial service providers, respondents were aware of 5 out of 12 terms. With reference to effective numeracy, only 27% of the respondents managed to correctly calculate both the division and interest rate questions. In considering the determinants of financial literacy, Women, the less educated and the elderly in Kenya similar to other places are most disadvantaged with regard to financial literacy. In addition to these characteristics, rural based individuals were found to have lower levels of financial literacy, but not necessarily effective numeracy.

With regard to financial literacy and saving behaviour, individuals who have higher levels of financial literacy were found to have a higher propensity to save on a regular basis and especially save for retirement. Interestingly the results are consistent with prior research on financial literacy and retirement planning in developed countries (Almenberg & Säve-Söderbergh, 2011; Lusardi & Mitchell, 2011, 2007a; van Rooij et al., 2009), as well as financial literacy and wealth accumulation (Behrman et al., 2012). Individuals who are well informed are necessarily better off as they will also make better consumer choices. Being financially numerate, though helpful, does not have a significant role in the individuals' likelihood to save on a regular basis. It is therefore plausible that the attitude aspects of how an individual relates to money and finances has a higher influence on their financial decisions as opposed to their being able to do mathematical computations.

Gender and location do not have significant effects on the individuals' ability to save regularly. Education positively influences saving behaviour whereby it was most important that the individual had some form of formal education, e.g. primary or secondary level. It was not necessary that they had tertiary level. This corresponds to the positive and high correlation that education has with financial literacy. Income and access to mobile money also had a positive and significant effect on saving behaviour. This is explained by the fact that income is directly correlated with one's ability to save whereas mobile money plays an important role in providing access to a safe and easy way to store money.

Given the important role financial literacy plays with reference to household saving behaviour, an implication of this study is for the provision of financial literacy programs through mechanisms that are easily accessible to majority of the population. Including financial literacy elements in television programmes such as "Shamba Shape-up" will go a long way in improving levels of financial literacy among the Kenyan population. Acknowledging the fact that there is still a sizeable percentage of Kenyans (40%) who save through informal mechanisms such as ROSCAs, a few members of ROSCAs could be trained who in turn train the other members during their meetings disbursing information in bite-size chunks.

Further research on financial literacy and saving habits among the Kenyan population can be extended using proposed financial education remedies. First by checking the relationship between financial education and financial literacy and second determining its effects on saving behaviour. In this regard the teaching techniques and content need to be evaluated and implemented based on the audience. It would also be interesting to measure impact of possible financial education programs that could be implemented in secondary schools. This is proposed due to the fact that a majority of respondents were found to have attained no further than secondary level of education. Lastly, based on the high significance and positive effect of a household's possession of a television, a study on agricultural households and the impact that this particular segment on financial literacy has had on their financial decisions and behaviour would be interesting.

CHAPTER 5

5. CONCLUSIONS, LIMITATIONS AND AREAS OF FURTHER RESEARCH

5.1 CONCLUSIONS

The overall aim of the essays presented in this dissertation was to contribute to the ongoing discussion about the interconnectedness of access to formal financial services, financial literacy and sound financial decision making. With a focus on developing economies taking the example of Kenyan households the essays herein provide an academic talking point for researchers and policy makers alike on how best to serve the un-/under-served segment of the population. Using nationally representative data collected in the series of household surveys conducted by FinAccess, I manage to provide a snapshot of Kenyan households' financial management situation. I do this with reference to access, demand and use of formal financial services and products as well as knowledge and understanding of said products and services. Complimentary to the data on households' characteristics and their knowledge of financial terms and concepts, I also draw out information on their use of mobile technology to access formal financial products and services. The rapid adoption and use of M-PESA in Kenya especially among the lower income households, forms part of the chain link that is financial capability. In considering these aspects of literacy, access and behaviour, the essays in this dissertation provide some insights to the missing pieces of the jigsaw puzzle that is financial capability.

5.2   MAIN RESULTS AND IMPLICATIONS

5.2.1   Mobile Money as a tool for Financial Literacy

The widespread adoption and use of mobile money and its tangible impact on financial inclusion in SSA has led to the recognition of the low levels of financial literacy among the population. In addition to improving the levels of financial inclusion it is important for individuals to know and understand how to use the particular products and services available to them. this points to a clear advantage of having individuals who are financially literate. However, despite the potential benefits of financial literacy, there is little empirical evidence showing the relationship between financial education programs and changes in financial behaviour. In this paper I sought to find out whether the use of mobile money would put the user in a superior position of financial literacy, through their benefitting from the small nuggets of financial information that can be passed on through their interaction with the mobile money platform.

I find that users of mobile money tend to have a higher level of financial literacy than non-users. This finding is however also encompassed by the fact that there is a social network that develops around the use of mobile money given the need to access the mobile money agent. This means that whereas mobile money use is a predictive determinant of financial literacy, the interpretation of the results needed to incorporate the fact that there is an external factor, i.e. the mobile money agent who plays an important role in the wheel making mobile money use a channel for financial literacy.

The implication here is that mobile technology in addition to providing a cheap, easy to use and safe mechanism for money transfer, is also a possible platform for providing financial information to its users. The direct approach would be for providers of financial services and products to send basic financial information through the SMS platform to users. The indirect approach involves providing financial information through the mobile money agents who are a contact point for all users.

5.2.2 Mobile Money and Saving Behaviour

In most developing countries, lack of access to formal financial products and services leads individuals to rely mainly on informal mechanisms such as saving under the mattress or through a group of friends or family the little money they have to spare. In Kenya, the situation is no different. With majority of individuals relying on their savings to provide a safety net in the event of an unexpected expenditure or shock to income, the predominant use of informal saving mechanisms leaves households exposed. This exposure handicaps individuals in turn negatively affecting their economic activities and thus hampering economic growth. Therefore, it is the duty of financial services providers to come up with safe, convenient, affordable and easy to use mechanisms for saving that can reduce households' vulnerability.

In Kenya, the introduction and rapid adoption of mobile money, M-PESA, has shown one way of filling this gap. Users of mobile money, initially as a transfer tool, have contributed to its evolution as a platform for holding money for later use and recently as a formal saving and credit channel (M-Shwari). The ability that users have to safely store their money on their mobile wallet when they have no immediate need for it gives them an option for a safe place and easy access for their money. the effect here is twofold: one where individuals transfer their savings from under their mattress, where it is prone to theft, to their mobile phone; and two the user does not withdraw all the money they receive and keep it for use at a later date. The findings from this essay showed that users of mobile money were more likely to save on a regular basis as well as save for emergencies as well as be able to access funds faster in case of emergencies than non-users. Further to this, vulnerable demographics, of females, rural-based, low income and less educated individuals were also better placed to have savings especially for emergencies if they were users of mobile money.

The implication here is that mobile money is a broad concept that can be used to facilitate financial inclusion on a very wide spectrum. The example taken in this essay shows that it is possible for other functionalities for mobile technology to evolve through both demand need led, and supplier led innovation. With the relatively recent collaboration between mobile service providers and

banking institutions, there is room for further exploration on the possible ways of improving household financial well-being.

5.2.3 Financial Literacy and Saving Behaviour

In this essay the results show that individuals who were financially literate were more likely to hold savings that will sustain them in old age. This finding is consistent with research in developed economies on financial literacy and retirement planning. This means that irrespective of one's economic circumstances, individuals will more likely make sound financial decisions when they are better informed. With the expectation that individual characteristics have an effect on one's financial literacy, I determined the factors that affect financial literacy among households. Vulnerable demographics, i.e. women, rural based, lower income and less educated were found to have lower levels of financial literacy. In addition to saving for retirement or old age, individuals who are financially literate also have a higher tendency to save on a regular basis which necessarily has a direct impact on individual's saving for old age.

Financial literacy was measured here using a financial literacy index which included financial terms, concepts, attitude to money matters and financial behaviour. The second measure used was financial numeracy. From the results, being financially numerate though helpful does not play as significant a role in influencing saving behaviour as the attitude aspects of how an individual relates to money and finances. This shows that inasmuch as it is important to have individuals being able to do mathematical computations, it is more important that they first have an understanding of financial concepts and terms. The implication here is that where one has a basic to advanced level of understanding of financial terms and concepts, it has a positive effect on their attitude toward money and finances. Where individuals feel confident about their ability to interact with finances, they would be more likely to make sound financial decisions.

A second implication came about while establishing the determinants of financial literacy. I found that in addition to individual characteristics, the ownership of a television set by the household

increased their likelihood to be financially literate. The implication here is that another channel through which individuals can get information about financial matters becomes available. For example, in Kenya, through programs such as "Shamba Shape Up" which is directed toward farmers and how to improve the output from their farms and farm animals.

5.3   LIMITATIONS OF THE STUDY

The lack of consistent data to perform a trend analysis or create a panel from the data posed a great limitation to the study. However, this is a normal limitation where nationally representative household surveys are concerned. In this regard I used the data as a cross section and could only therefore provide a snapshot of how mobile money and financial literacy affect household financial decision making. The other common data problem with household survey data is the probability of incomplete responses. To counter this, I imputed variables that were relevant to the regressions using the multiple imputation by chained equations (MICE) due to the variation in the types of variables to be imputed.

The second limitation was with reference to the endogeneity problem. This is a common problem in financial literacy research. In this regard, I used the instrumental variable approach to counter the effect of endogeneous variables. The limitation here is often to find the right instruments or excluded variables to use as exogeneous variables.

5.4   SUGGESTIONS FOR FURTHER RESEARCH

The essays in this dissertation only scratch the surface with reference to empirical work on financial well-being among individuals in developing economies. Though mobile money has made strides in narrowing the financial inclusion gap in Kenya, what is its replicability in other SSA countries? There is evidence from Burkina Faso, however, there is opportunity for further research into the effects of mobile money on household financial well-being. In addition to saving mechanisms, there is also opportunity for further research on mobile money's effect on household's' credit decision making. This is especially ripe with the introduction of loans through M-PESA on the M-Shwari and KCB M-PESA platforms. I see another opportunity for research into the inter-connection between mobile service providers and banking institutions. This relatively new way of offering traditional banking services through a mobile account is an interesting opportunity to study its effect on household economics.

With regard to financial literacy, work in developing economies is still scarce. There is an opportunity to find out what financial literacy needs people actually have, what would be the best way to transmit this information without forcing them to sit in a financial education program. Then finally a measurement and evaluation study to see the progress made on a pilot of the financial literacy enhancing mechanism.

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7. APPENDICES

Appendix A

7.1 Appendix A1: Financial Literacy Questionnaire Extract

There are many words used in Kenya that apply to, or concern, financial services. Please tell me which of the following best describes your experience with each word or phrase. Use English and Swahili only for these words. Do NOT translate into the vernacular.

- *Read out each word/phrase.*
- *Single mention per word/phrase.*
- *Rotate order of reading out and mark starting point with an asterisk (*).*

Financial word or phrase	Never heard of this word or phrase *Sijawahi kusikia neno hili*	Heard this word or phrase but don't know what it means *Nimesikia neno hili lakini sifahamu maana yake*	Heard of this word or phrase and know what it means *Nimesikia neno hili na ninafahamu maana yake*
1. Savings account/ Akaunti ya akiba 2. Insurance/Bima 3. Interest/Riba			
4. Shares/Hisa 5. Cheque/Cheki 6. Collateral/Dhamana			
7. Budget/Bajeti 8. Investment/Uwekezaji 9. ATM card/Kadi ya ATM			
10. Inflation/Mfumuko wa bei 11. Mortgage/Ununuzi wa nyumba 12. Nairobi Securities Exchange/Soko la Hisa la Nairobi			

Source: FSD Kenya Questionnaires for surveys 2009 and 2013.

Note: Financial terms selected for this paper were used to measure financial literacy in both survey rounds. All terms not used in both rounds were excluded. This was done to allow for a fair cross-sectional analysis.

7.2   Appendix A2: Logit regression results for the individual financial terms

	Savings account	Insurance	Interest Rate	Shares	Cheque	Collateral	ATM Card	Budget	Investment	Inflation	Mortgage	NSE
Ln_Mobile Agents	0.1460***	0.2561***	-0.0489	0.2675***	0.3903***	0.1188***	0.4130***	0.0804*	0.0526	0.0558	0.2818***	0.3172***
	(0.0400)	(0.0370)	(0.0358)	(0.0342)	(0.0361)	(0.0341)	(0.0385)	(0.0378)	(0.0318)	(0.0323)	(0.0344)	(0.0372)
HHfemale	0.1086	-0.4255***	-0.3490***	-0.2892***	-0.2927***	-0.2359***	-0.4045***	-0.2160**	-0.3427***	-0.3340***	-0.2281***	-0.4674***
	(0.0708)	(0.0633)	(0.0569)	(0.0597)	(0.0646)	(0.0633)	(0.0629)	(0.0694)	(0.0544)	(0.0569)	(0.0603)	(0.0625)
Rural HH	-0.0726	-0.2936***	-0.3959***	-0.1775**	-0.1041	-0.3202***	-0.5386***	-0.1837*	-0.3791***	-0.3792***	-0.3812***	-0.5031***
	(0.0761)	(0.0648)	(0.0591)	(0.0599)	(0.0661)	(0.0591)	(0.0640)	(0.0718)	(0.0539)	(0.0542)	(0.0570)	(0.0637)
Ln_Age	-0.4641***	0.7549***	0.4140***	0.7471***	0.5466***	-0.0155	0.5784***	0.5746***	0.2653***	0.0818**	0.0325	1.0985***
	(0.0460)	(0.0350)	(0.0320)	(0.0333)	(0.0347)	(0.0335)	(0.0353)	(0.0368)	(0.0304)	(0.0308)	(0.0330)	(0.0370)
Married	0.2327*	-0.3807***	-0.2287**	-0.2285**	-0.1967*	0.0943	-0.6781***	-0.1295	-0.2418***	0.0061	0.1172	-0.8542***
	(0.1011)	(0.0760)	(0.0716)	(0.0732)	(0.0777)	(0.0774)	(0.0778)	(0.0818)	(0.0688)	(0.0708)	(0.0765)	(0.0758)
No Formal Education	-1.0935***	-1.6957***	-1.1862***	-1.6971***	-1.3849***	-0.7273***	-1.8628***	-1.4299***	-1.3825***	-1.0835***	-1.1774***	-1.8363***
	(0.0668)	(0.0668)	(0.0636)	(0.0698)	(0.0604)	(0.0987)	(0.0749)	(0.0609)	(0.0731)	(0.0897)	(0.1059)	(0.0812)
Total_HH Persons	-0.0291**	-0.0412***	-0.0225*	-0.0626***	-0.0438***	-0.0123	-0.0234*	-0.0536***	-0.0397***	-0.0295**	-0.0357***	-0.0507***
	(0.0109)	(0.0101)	(0.0093)	(0.0097)	(0.0101)	(0.0107)	(0.0102)	(0.0109)	(0.0090)	(0.0098)	(0.0107)	(0.0103)
Inc_ Transfers	0.2426***	0.1804***	0.1699***	0.1324**	0.2540***	-0.0259	0.1734***	0.3538***	0.0545	0.1316**	0.1329**	0.0313
	(0.0584)	(0.0496)	(0.0452)	(0.0472)	(0.0512)	(0.0488)	(0.0499)	(0.0548)	(0.0430)	(0.0443)	(0.0475)	(0.0499)
Inc_ Employed	0.1904**	0.3982***	0.1008*	0.2342***	0.2898***	-0.0629	0.2717***	0.5016***	0.0008	0.0753	0.0656	0.3306***

	(0.0646)	(0.0533)	(0.0483)	(0.0504)	(0.0556)	(0.0527)	(0.0529)	(0.0607)	(0.0460)	(0.0477)	(0.0510)	(0.0533)
Inc_ Agriculture	0.1075	-0.074	-0.0996*	-0.1120*	0.0276	-0.3134***	-0.3780***	0.1318*	-0.2966***	-0.3791***	-0.4015***	-0.2662***
	(0.0623)	(0.0532)	(0.0495)	(0.0512)	(0.0542)	(0.0556)	(0.0534)	(0.0579)	(0.0475)	(0.0499)	(0.0530)	(0.0551)
Inc_Own Business	0.4433***	0.3840***	0.2377***	0.2212***	0.4467***	0.0208	0.1916**	0.4951***	-0.0056	-0.0362	-0.0528	0.1304*
	(0.0808)	(0.0600)	(0.0550)	(0.0563)	(0.0636)	(0.0568)	(0.0600)	(0.0681)	(0.0514)	(0.0522)	(0.0546)	(0.0593)
Inc_Rent/ Investment	0.2169	0.2504	0.3210*	0.25	0.5645**	0.1769	0.0186	0.5689**	0.0622	0.2051	0.3192**	0.1043
	(0.1947)	(0.1538)	(0.1474)	(0.1489)	(0.1894)	(0.1067)	(0.1524)	(0.2072)	(0.1194)	(0.1073)	(0.1092)	(0.1266)
Ln_HH Expenditure	0.2738***	0.1572***	0.1557***	0.2069***	0.1866***	0.2161***	0.1746***	0.1950***	0.2109***	0.2777***	0.2862***	0.1940***
	(0.0238)	(0.0226)	(0.0205)	(0.0216)	(0.0228)	(0.0246)	(0.0225)	(0.0243)	(0.0195)	(0.0220)	(0.0238)	(0.0231)
Own Mobile Phone	0.4403***	0.8296***	0.7543***	0.7399***	0.6311***	0.4220***	0.9829***	0.6776***	0.7400***	0.5814***	0.5270***	0.9193***
	(0.0645)	(0.0510)	(0.0471)	(0.0490)	(0.0529)	(0.0623)	(0.0502)	(0.0580)	(0.0467)	(0.0536)	(0.0586)	(0.0530)
Bank Product	1.0934***	1.0299***	1.5572***	1.0311***	1.5174***	0.6785***	1.6711***	0.8304***	0.9678***	0.7992***	0.9129***	0.8947***
	0.1103	0.0777	0.0767	0.0693	0.0988	0.056	0.0809	0.0925	0.0565	0.0517	0.0535	0.0667
SACCO Product	0.8187***	0.6015***	0.6331***	1.0911***	0.7098***	0.3632***	0.1992*	0.5281***	0.4521***	0.5026***	0.4708***	0.5589***
	(0.1440)	(0.1018)	(0.0917)	(0.1024)	(0.1192)	(0.0711)	(0.0931)	(0.1234)	(0.0750)	(0.0687)	(0.0703)	(0.0909)
MFI Product	0.8522**	0.5248**	0.6029**	0.3456*	0.8553***	0.0712	0.6146***	0.3804	0.0271	-0.1706	-0.1048	0.067
	(0.3080)	(0.1911)	(0.1834)	(0.1692)	(0.2343)	(0.1148)	(0.1851)	(0.2256)	(0.1308)	(0.1150)	(0.1147)	(0.1416)
_cons	-0.5477	-4.2686***	-1.6284***	-5.1231***	-4.8355***	-4.0869***	-5.1165***	-2.4536***	-2.6621***	-3.7995***	-5.6618***	-6.1460***
	(0.4053)	(0.3608)	(0.3368)	(0.3399)	(0.3566)	(0.3473)	(0.3693)	(0.3713)	(0.3087)	(0.3263)	(0.3552)	(0.3722)
N	12509	12509	12509	12509	12509	12509	12509	12509	12509	12509	12509	12509
Pseudo R²	0.1909	0.2999	0.24	0.289	0.2566	0.1216	0.3548	0.2229	0.2127	0.1778	0.205	0.3841

7.3 Appendix A3: OLS Model Results on the Financial Literacy Index

	Finlit Index1	Finlit Index1
Ln_Mobile agents	0.3482***	0.3165***
	(0.0348)	(0.0352)
HH female	-0.5191***	-0.5285***
	(0.0645)	(0.0645)
Rural HH	-0.6304***	-0.5789***
	(0.0666)	(0.0672)
Ln_Age	0.6563***	0.6923***
	(0.0371)	(0.0375)
Married	-0.5544***	-0.4368***
	(0.0853)	(0.0873)
No Formal Education	-2.7039***	-2.6895***
	(0.0760)	(0.0760)
Income_Transfers	0.2183***	0.2303***
	(0.0516)	(0.0516)
Employed	0.2942***	0.2952***
	(0.0561)	(0.0560)
Income_Agriculture	-0.3620***	-0.3521***
	(0.0571)	(0.0572)
Income_Business	0.2671***	0.2735***
	(0.0601)	(0.0600)
Income_Rent/Investment	0.2077	0.2094
	(0.1127)	(0.1126)
Ln_ HH Expenditure	0.3384***	0.3507***
	(0.0245)	(0.0246)
Own Mobile Phone	1.5394***	1.5384***
	(0.0674)	(0.0672)
Bank Product_Current	1.7676***	1.7295***
	(0.0631)	(0.0634)
SACCO Product_Current	0.8482***	0.8131***
	(0.0774)	(0.0776)
MFI Product_Current	0.2382	0.2808*
	(0.1245)	(0.1243)
Total Persons in HH		-0.0639***
		(0.0111)
_cons	-0.7083	-0.4664
	(0.3622)	(0.3650)
N	12509	12509
R^2	0.4585	0.4600

Standard errors in parentheses

* $p<0.1$, ** $p<0.05$, ***$p<0.01$

Appendix B

7.4 Appendix B1: IV Probit with First Stage

	(1)	(2)	(3)	First Stage IV Probit
Mobile Money Usage	0.7911*	1.2267***	1.5029***	
	(0.3983)	(0.3385)	(0.3301)	
Rural	-0.0124	-0.0065	-0.4155***	-0.0130
	(0.0325)	(0.0319)	(0.0553)	(0.0099)
Age	-0.0275**	-0.0333***	-0.0361***	0.0210***
	(0.0094)	(0.0082)	(0.0082)	(0.0013)
Age2	0.0002*	0.0003**	0.0003***	-0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0000)
Female	-0.0516	-0.1135***	-0.1069**	-0.0057
	(0.0304)	(0.0315)	(0.0334)	(0.0090)
Education_Primary	0.0747	0.0011	-0.2482***	0.0708***
	(0.0546)	(0.0521)	(0.0426)	(0.0121)
Education_Secondary	0.0237	-0.0484	-0.1845**	0.1114***
	(0.0686)	(0.0647)	(0.0583)	(0.0130)
No Education Female Head	-0.1309**	-0.0487	0.0518	-0.0645***
	(0.0502)	(0.0485)	(0.0465)	(0.0109)
Ln Income	0.0846**	0.0695*	0.1679***	0.0471***
	(0.0270)	(0.0282)	(0.0422)	(0.0039)

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Employed	0.0390	0.0903	-0.0684	0.0379[*]
	(0.0551)	(0.0565)	(0.0518)	(0.0155)
Self Employed	0.1004[*]	0.1151[**]	0.0425	0.0406[***]
	(0.0430)	(0.0445)	(0.0442)	(0.0113)
Married	0.0816[**]	0.0901[**]	0.0096	0.0040
	(0.0313)	(0.0312)	(0.0319)	(0.0094)
No. of Income Earners in Hhold	0.0742[***]	0.0687[**]	0.0305	0.0183[**]
	(0.0223)	(0.0230)	(0.0231)	(0.0058)
Savings as % of Income	0.1308[***]	0.0917[***]	0.0709[***]	0.0032
	(0.0212)	(0.0195)	(0.0167)	(0.0030)
2nd Poorest Quintile	0.0911	-0.0360	-0.0684	0.1584[***]
	(0.0879)	(0.0817)	(0.0889)	(0.0136)
Middle Quintile	0.0870	-0.1152	-0.0356	0.2165[***]
	(0.1116)	(0.1001)	(0.1180)	(0.0140)
2nd Wealthiest Quintile	0.0290	-0.1150	0.1451	0.2488[***]
	(0.1262)	(0.1164)	(0.1530)	(0.0152)
Wealthiest Quintile	0.0793	-0.0519	0.4070[*]	0.2348[***]
	(0.1267)	(0.1194)	(0.1751)	(0.0174)
Bank Product Current	-0.0371	-0.0209	0.0655	-0.2046[***]
	(0.0970)	(0.0962)	(0.0996)	(0.0109)
SACCO Product Current	-0.0655	-0.1000[*]	-0.1752[**]	-0.0182
	(0.0497)	(0.0505)	(0.0542)	(0.0144)

MFI Product Current	-0.0145	-0.0200	0.0501	-0.0546*
	(0.0845)	(0.0841)	(0.0807)	(0.0238)
MMAgent Time taken				-0.0223***
				(0.0028)
Constant	-0.5023	-0.3122	-1.3038***	
	(0.2564)	(0.2536)	(0.2774)	
athrho2_1				
Constant	-0.2333	-0.4579**	-0.6072**	
	(0.1665)	(0.1652)	(0.1874)	
lnsigma2				
Constant	-0.9479***	-0.9479***	-0.9479***	
	(0.0076)	(0.0076)	(0.0076)	
Wald test of Exogeneity	1.96	7.68**	10.50***	
N	8665	8665	8665	

Note: Dependent variables save for emergency, save regularly and access to emergency funds are dummy variables equal to 1 if respondents answered in the affirmative and 0 otherwise. The resulting coefficients are the log odds and with only one column for the first stage since the results were the same for all specification. The results in the text used for interpretation, however, report the average marginal effects. Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7.5 Appendix B2: Users of Bank Integrated Mobile Money Services

	(1)
Rural	0.0154
	(0.0079)
Age	0.0084***
	(0.0018)
Age2	-0.0001***
	(0.0000)
Female	-0.0516***
	(0.0071)
Education_Primary	-0.0377***
	(0.0102)
Education_Secondary	0.0307***
	(0.0093)
No Education Female HHold head	-0.0387***
	(0.0091)
Ln Income	0.0363***
	(0.0034)
Employed	0.0186
	(0.0098)
Self Employed	0.0359***
	(0.0084)
Married	-0.0217**
	(0.0080)
No. of Income Earners in Household	0.0145**
	(0.0048)
Savings as % of Income	0.0028
	(0.0018)
2nd Poorest Quintile	0.1084***
	(0.0210)
Middle Quintile	0.1548***
	(0.0201)
2nd Wealthiest Quintile	0.1914***
	(0.0199)
Wealthiest Quintile	0.2178***
	(0.0202)
N	8665
pr2	0.2120

Note: The dependent variable is a dummy variable for a household's use of a bank integrated mobile money service (M-Shwari, KCB M-PESA). The table displays results on the household characteristics that influence the use of bank integrated mobile money services. The coefficients reported are the average marginal effects. Standard errors in parentheses. $^{*} p < 0.10$, $^{**} p < 0.05$, $^{***} p < 0.01$

Appendix C

7.6   Appendix C1: Financial Literacy Index

The financial literacy index was constructed as a composite measure using principal component analysis. This measure constituted of nine variables drawn from responses to questions on questions on: awareness of financial terms related to savings and investments: "Interest", "savings account", "NSSF", "investment", "shares", "NSE", and "pension". The responses were binary in nature where 1 represented an affirmative response and 0 otherwise; Perception to finances was measured using responses to questions below pertaining to how respondents dealt with money in their day to day lives. The responses to each question were "Agree" or "Disagree" where the affirmative was coded 1 and the negative 0. A total of six questions were used. The third element was the respondents' propensity to save. To determine this, three questions on individuals' attitude toward old age, regular savings and emergency savings were used. The response here as well was binary in nature where 1 represented response "Agree" and 0 "Disagree". The resulting index was used as a measure for financial knowledge and awareness.

Questions relating to the respondents' attitude to finances

1. You have a plan for how to allocate money for things like food, clothing, bills and other needs from month to month.
2. You do not care about tomorrow, you live for today, tomorrow will take care of itself.
3. You often have trouble making your money last between the times when you get money.
4. Over the last year you had to sell some assets in order to repay a loan.
5. Over the last year you had to borrow another loan in order to repay a loan.
6. You can easily live your life without having a bank account.

Questions relating to the respondents' propensity to save

1. You are worried that you won't have enough money to live on in old age
2. In the last year you have been regularly putting money aside for a particular purpose in future
3. In the last year you have regularly kept money aside for emergencies or unexpected expenses.

To construct the index, components with eigenvalues of 1 and above were taken into consideration. Table C1 presents the eigenvalues for the principal component analysis.

Table C1: Principal Component Analysis Eigenvalues

Eigenvalues	Coef.	Std. Err.	z	P>z
Comp1	**4.2794**	**0.0653**	**65.56**	**0.000**
Comp2	**1.5936**	**0.0243**	**65.56**	**0.000**
Comp3	**1.3418**	**0.0205**	**65.56**	**0.000**
Comp4	**1.1766**	**0.0179**	**65.56**	**0.000**
Comp5	0.9364	0.0143	65.56	0.000
Comp6	0.8155	0.0124	65.56	0.000
Comp7	0.7986	0.0122	65.56	0.000
Comp8	0.7275	0.0111	65.56	0.000
Comp9	0.7225	0.0110	65.56	0.000
Comp10	0.6782	0.0103	65.56	0.000
Comp11	0.6059	0.0092	65.56	0.000
Comp12	0.5685	0.0087	65.56	0.000
Comp13	0.5492	0.0084	65.56	0.000
Comp14	0.4311	0.0066	65.56	0.000
Comp15	0.4066	0.0062	65.56	0.000
Comp16	0.3685	0.0056	65.56	0.000

Source: Author Computation

To determine the reliability of the emergent scale the Cronbach's alpha measure was taken and an analysis of the item-rest correlation was also considered. Table A2 presents these values.

7.7 Appendix C2: Financial Literacy Index Test of Reliability

Item	Obs.	Sign	item-test correlation	item-rest correlation	average Inter item correlation	alpha
FinLit_Interest	8665	+	0.6825	0.601	0.1544	0.7326
FinLit_Investment	8665	+	0.6769	0.5945	0.1548	0.7332
FinLitPension	8665	+	0.6337	0.5436	0.1579	0.7377
FinLit_SavingsAcc	8665	+	0.6864	0.6058	0.1541	0.7322
FinLit_Shares	8665	+	0.6836	0.6024	0.1543	0.7325
FinLit_NSE	8665	+	0.5142	0.4064	0.1665	0.7498
FinLit_NSSF	8665	+	0.6447	0.5564	0.1571	0.7366
Repay loan using loan	8665	+	0.3165	0.1902	0.1807	0.7679
Repay loan from assets sales	8665	+	0.2419	0.1118	0.186	0.7742
Old Age Worries	8665	+	0.2274	0.0968	0.1871	0.7754
No need for bank account	8665	-	0.2927	0.1649	0.1824	0.7699
No plan for tomorrow	8665	-	0.2191	0.0881	0.1876	0.776
Budget	8665	+	0.4546	0.3398	0.1708	0.7555
Make money last till end of the month	8665	+	0.285	0.1568	0.183	0.7706
Saving Regular	8595	+	0.5043	0.3947	0.1673	0.7509
Saving for Emergency	8665	+	0.4691	0.3558	0.1697	0.7541
Test scale					0.1696	0.7657
Average inter item covariance:			0.0362			
Scale reliability coefficient			0.7679			
Rho			0.4509			

Source: Author Computation

7.8   Appendix C3: IV Probit First Stage Regression Results

	(1)	(2)
SecSchl_Transport	0.0103	0.0050
	(0.0116)	(0.0102)
SecSchl_Time	-0.0532***	-0.0512***
	(0.0117)	(0.0120)
Constant	-0.7218***	-0.7186***
	(0.1616)	(0.1613)
athrho2_1		
_cons	-0.2993	0.0858
	(0.3559)	(0.3120)
lnsigma2		
_cons	0.3281***	0.3281***
	(0.0077)	(0.0077)
N	8412	8412
Wald test of Exogeneity	0.619	0.844

Note: The table reports the first stage of the IV probit regressions. The financial literacy index was instrumented using two exogenous variables (excluded variables) to determine the proximity of the individual to the nearest secondary school: approximate time taken, and transport required to get there. The two sets of regressions represent savings on a regular basis (1) and saving for old age (2). The dependent variable in this stage of the regression is the Financial Literacy Index. All controls of household demographics and socioeconomics characteristics: Location, gender, age, education, marital status, income source, wealth quintile and use of formal financial services were included. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7.9   Appendix C4: Financial Knowledge Statistics by Household Demographics

	Overall Number of Terms Known	Savings Account (%)	Investment (%)	Interest (%)	NSSF (%)	NSE (%)	Shares (%)	Pension (%)
Location								
Rural	4.82	69	45	58	72	26	57	53
Urban	6.92	85	69	78	89	43	75	70
Gender								
Female	5.17	72	49	62	75	28	61	55
Male	6.64	82	66	74	86	42	72	69
Marital Status								
Single	5.75	76	57	69	78	34	67	58
Married	5.74	76	55	65	80	34	64	62
Education								
No education	1.81	32	12	22	34	7	19	23
Primary	5.27	78	62	64	84	30	63	58
Secondary	7.60	93	83	90	94	45	88	77
Tertiary	9.98	98	96	96	99	70	96	94

Note: The overall number of terms is gauged against the total 12 terms for financial concepts and financial service providers not only the savings related terms. These terms in addition to the above savings and investment terms include: Collateral, Guarantor, Inflation, National Health Insurance Fund (NHIF), and Credit Reference Bureau (CRB).

7.10 Appendix C5: Effective Numeracy Statistics by Household Demographics

	Division %Correct	Interest %Correct	Overall %Correct
Location			
Rural	51	25	22
Urban	66	36	33
Gender			
Female	51	25	22
Male	69	38	35
Marital Status			
Single	59	33	30
Married	57	28	25
Education			
No education	27	11	10
Primary	51	21	17
Secondary	77	45	42
Tertiary	90	33	61
Age			
18-25	62	33	30
26-35	61	30	27
36-45	61	34	30
46-55	60	29	27
>55	35	16	14