UTILIZATION OF MOBILE MONEY SERVICES IN ENHANCING HOUSEHOLD'S FINANCIAL RESILIENCE AND PERFORMANCE OF MICRO AND SMALL ENTERPRISES IN KENYA

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DECLARATION

This thesis is my original work and has not been presented in any other university for an award of a degree or any other ward.

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To my wife and my daughter, my parents and all my siblings

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ABBREVIATIONS AND ACRONYMS

ATET	Average Treatment Effect on the Treated
ATEU	Average Treatment Effect on the untreated
CBK	Central Bank of Kenya
ESR	Endogenous Switching Regression
FIML	Full Information Maximum Likelihood
FSD	Financial Sector Deepening
GDP	Gross Domestic Product
IMR	Inverse Mills Ratio
KCB	Kenya Commercial Bank
KNBS	Kenya National Bureau of Statistics
MFI	Microfinance Institution
MSE	Micro and Small Enterprises
PEOU	Perceived Ease of Use
PSM	Propensity Score Matching
TAM	Technology Acceptance Model
VIF	Variance Inflation Factor

OPERATIONAL DEFINITION OF TERMS

e- float	Refers to the balance electronic money that an agent can immediately access to meet customer's demands either to send (cash out) or receive (cash in) money.
Household	Refers to group of persons bonded by kinship ties living together under single roof and shares common income for purposes of consumption.
Financial Inclusion	Refers to a situation where households, firms or individuals have access to affordable financial services.
Financial Shocks	Refers to unforeseen and unfavorable occurrences that can lead to sudden loss of household incomes and welfare in general
Household Financial Resilience	Refers to the ability of a household to bounce back after unexpected shock(s) with minimal or no welfare loss.
Microenterprise	Refers to a business enterprise that employs less than ten people
Mobile Money Service	Electronic financial services performed via mobile phone which includes payments and transfers of money
M-PESA	Is a money transmission platform that enables users to exchange cash for 'e-float' over their mobile phones and either to send the e-float to other phone users or to even transfer e-float back into cash
Performance of the enterprise	It is the gross amount of income in Kshs earned by a firm in a given month.
Remittances	Refers to money received during a period of time from friends or relatives not living in the same household.
Small enterprise	Refers to a business enterprise that employs 10 to 50 people
Utilization of Mobile Money	Refers to use of mobile money services by a household or a firm to receive payments to borrow and to save money

ABSTRACT

Developments in financial innovations in Kenya has seen financial access gap drastically reduced. Specifically, mobile money has offered huge potential in boosting financial access in Kenya. As a result, 83 percent of Kenyans have been formally included into the formal financial system. This was expected to positively impact households' resilience to financial shocks and performance of Micro and Small enterprises in Kenya in terms of ease of financial access and transactions costs. On the contrary, at least 36.2 percent of households in Kenya experienced financial shocks and were unable to recover. In terms of performance of micro and small enterprises, majority of them continue to face challenges related to high levels of financial services exclusion and other bottlenecks in attempt to access credit. The key question was therefore on whether utilization of mobile money services has any effects on household resilience to financial shocks and performance of Micro and Small Enterprises in Kenya. Past studies on the effects of utilization of mobile money services on household financial resilience had not focused on all facets of mobile money utilization which included receiving payments, borrowing and saving money. None of the reviewed studies analyzed the effects of utilization of mobile money services, as defined in this study and majority of the studies in Kenya mainly focused on major towns leaving out rural areas where mobile money is being heavily relied on. This study analyzed the effect of utilization of mobile money on household resilience and small and microenterprise performance in Kenya. Specifically, the study established the determinants of utilization of mobile money services by households and small and medium enterprises and analyzed the effects of utilization of mobile money services on household financial resilience to shocks and performance of micro and small enterprises' in Kenya. The study used 2016 Micro, Small and Medium Enterprises establishment data set by Kenya National Bureau of Statistics and 2019 FinAccess data set. Heteroskedastic probit models were estimated for determinants while endogenous switching regression model and propensity score matching estimation techniques were used to analyze the effects of utilization of mobile money services. The findings indicated that household size, level of dependency, age, average transport cost to the nearest mobile money agent, residence, group membership, marital status, education and mobile phone ownership determined utilization of mobile money services by households in Kenya. Households that utilized mobile money services were found to be more financially resilient than those who did not. In the case of the small and microenterprises, the results showed that group membership, sex, credit access, education, mobile phone ownership, radio ownership, registration of business, number of business units and total number of employees determined utilization of mobile money services. On average, the monthly firm income was shown to increase when an enterprise utilized mobile money services than when it does not. The study recommended the need for the government to design supportive policies that would scale up the utilization of mobile money services to more financially excluded households and MSEs in Kenya.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

A developed and efficient financial sector is a vital tool for economic development to be realized particularly through mobilization of capital funds for productive investment (Munyegera & Matsumoto, 2016). However, for financial sector to enhance financial development, financial services should be accessible and affordable particularly to those financially excluded and the vulnerable groups (Dupas & Robinson, 2013). Demirgüç-Kunt, Klapper, Singer, and Van Oudheusden (2017) argued that financial services access and their use can enhance the welfare of the poor, thus making households closer to achieving sustainable development. Enhancing access to affordable savings platforms and slackening constraints to credit access encountered by many poor households in developing countries can be central to poverty reduction by enhancing asset acquisition and productive investments (Jalilian & Kirkpatrick, 2005: Banerjee, Karlan, & Zinman, 2015). Furthermore, access to affordable credit and remittances boosts risk sharing mechanisms and may enhance consumption smoothing which may in turn subdue household vulnerability (Mbiti & Weil, 2011).

In many developing countries, barriers to financial access arise from either supply or the demand side factors. Supply side factors are those which narrow material access to financial institutions such as the geographical distance to the nearest financial institutions. This is because formal financial institutions such as commercial banks and microfinance institutions are more centralized in urban areas leaving rural areas with narrow or no coverage at all (Munyegera & Matsumoto, 2016). Accessing financial

services from institutions that are usually located in urban areas usually comes with heavy costs in terms of transport, time and convenience which may discourage those based in rural areas from using such services. The demand side factors are those that deter people from using the already available financial services such as higher costs of transacting them. This may discourage financial services utilization especially among rural residents where majority are low income earners. Other demand side factors may include socio-economic considerations such as sex, ethnicity and cultural beliefs (Munyegera & Matsumoto, 2016).

Poor access to the most essential financial services may make poor households to be more vulnerable to both peculiar and covariate shocks and specifically to their income sources (Dupas & Robinson, 2013). With formal insurance severely underdeveloped in majority of the developing countries, households who are constrained in attempting to access credit are usually exposed to shocks associated to slumps in income and consumption such as erratic weather conditions including floods and drought (Jack & Suri, 2014). Moreover, inadequate cheap and convenient remittances platforms may encourage households to engaging in other risk-sharing approaches which may be informal such as keeping their money under the mattress or burying them underground (Munyegera & Matsumoto, 2014).

Mobile money, a financial product which enables the users have access to financial services via a mobile handset, has tremendously changed the access to finance landscape for many people particularly those who had formerly been financially excluded especially in Sub-Saharan African region (Hughes & Lonie, 2007). Unlike formal

financial institutions with many requirements to be met such as establishing bank branches to cover wider areas, mobile money services are offered through a mobile phone. The robust penetration of mobile phones ownership to more than 60 percent of Africa's population has seen the surge in the uptake and utilization of mobile money services (World Bank, 2013). The upsurge in mobile money utilization has been an essential factor in widespread of mobile money agents particularly in rural areas which has made mobile financial transactions more affordable and convenient. By bringing financial service centers closer to users and the consequent reduction in costs associated with its access, mobile money services are expected to boost financial deepening by enhancing financial services uptake thereby reducing poverty and vulnerability (Mbiti & Weil, 2011). Furthermore, mobile money facilitates domestic remittances thereby effectively cushioning consumption expenditure against various types of shocks (Jack & Suri, 2014).

Mobile money services have been rapidly rising across Sub-Saharan Africa in terms of subscription and transactions. In 2017, the total number of mobile money services transacted rose by 14.4 percent while its value increased by 17.9 percent compared to previous year (Global System for Mobile Communications, 2017). Towards the end of 2017, 135 and 122 million active mobile money services and mobile money accounts across the region were registered. Across the continent, mobile money services have been fundamental in financial services coverage specifically to the people with constrained access to brick and mortar financial institutions, particularly among the women and the rural residents.

1.1.1 Utilization of Mobile Money Services in Kenya

The remarkable progress that has been made towards access to mobile phones has witnessed a steady progress in scope of financial innovations emanating from exploitation of these technologies. What has characterized this Mobile phone landscape is rapid uptake of key services associated with mobile phone-based products in Kenya (Njenga, 2009), made possible the noteworthy transformation in information and communications technology (ICT) (World Bank, 2013).

By the end of 1990s, hardly 3 percent of households owned a mobile phone in Kenya (Ansongu, 2013). In 2005, the Central Bank of Kenya was overseeing an underdeveloped financial sector that had suffered because of inefficiencies and poor legal and statutory framework to sustain digital financial services despite high potential demand (Muthiora, 2015). In 2007, Safaricom, which is the largest mobile phone-based service provider in Kenya, formalized a mobile financial procedure with the establishment of *M-PESA*. Table 1.1 shows the trends in mobile money utilization in Kenya from 2011 to 2019.

Table 1. 1: Trends in Mobile Money Services Utilization in Kenya Since 2011

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Mobile Money Transfer Agents	47,677	49,079	93,689	123,703	143,946	165,908	182,472	205,745	224,108
Mobile Money Transfer Service Subscribers ('000)	17,396	19,319	26,016	26,023	26,753	31,997	30,005	31,627	28,976
Total Transfers (KSh Billion)	1,169	1,544	1,902	2,372	2,816	3,356	3,638	3,984	4,346
Number of Total Transactions in Million	….	577.4	732.6	911.3	1,114.2	1,526.2	1,543.2	1,739.6	1,839
Total Transfers as % of GDP	31.4	36.2	40.1	43.9	44.8	47.8	44.7	44.7	44.6

Source of Data: Republic of Kenya, 2018

Table 1.1 shows a rising trend in the number of mobile money services users and mobile transfer agents in the given period. The witnessed growth of mobile money operations was ascribed to the growth in agent network since they provided ease to deposits and withdrawals. The agent network grew from 47,677 in 2011 to 224,108 in 2019. The increase in the agent network was also occasioned by rapid growth in the number of mobile money transfer services subscribers from 17 million in 2011 to 30 million in 2019. There was also a steady rising trend in the total number of transactions from 577.4 million in 2012 to 1.8 billion in 2019 which indicated growth in utilization of mobile money services. This growth in the number of transactions saw the total transfers going

up from 1.2 trillion in 2011 to 4.3 trillion in 2019. This was equivalent to 31.4 and 44.6 percent of the GDP in 2011 and 2019, respectively. The Table 1.1 shows that mobile phone-based financial services in Kenya grew from just a mere money transmission channel to a bank account and a payment platform. Suri and Jack (2016) documented that the service was being utilized by at least one member in 96 percent of households in Kenya.

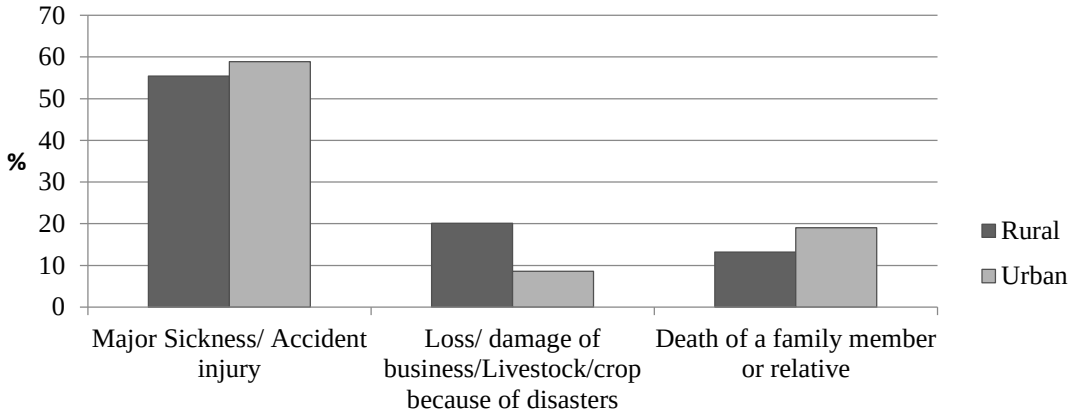
One notable impact of the mobile phone-based money service in the period was that majority of the businesses, government agencies and millions of individuals who had financially been excluded were able to generate history of transactions, borrow and repay money digitally via a mobile phone. About 90 percent of the 250 services transacted in the central government electronic platform (eCitizen) in Kenya which requires online payments, are done through mobile money services. Similarly, 85 percent of Nairobi City county services payments are also done through mobile money platforms. According to Republic of Kenya (2016a), the developments in the mobile money industry had seen 75.3 percent of Kenyans formally financially included.

1.1.2 Mobile Money Services and Household Financial Resilience in Kenya

Although households at all levels of income requires means to help them hedge against risks, the low income ones are asymmetrically affected by adverse events particularly across the developing world (David-West, Iheanachor & Umukoro, 2020). The incidence encompasses variety of shocks ranging from idiosyncratic shocks, such as theft and health emergencies, which may affect the income and expenditure of individuals and households. In a situation of aggregate shocks, not only are the poor

households adversely affected, but are also mostly unprepared to deal with it. Low-income households with no access to financial services are most frequently pushed to pursue negative coping strategies such as cutting food consumption, selling productive assets, reducing human capital investment, or even engaging in other income and welfare-reducing behaviors.

Owing to low rates of domestic savings, imperfect insurance and credit markets, and ineffective money transmittal technique, low-income households often face limitations on financial mechanisms to cushion them during a financial downfall. In 2017, households in least developed and middle-income countries were 27 percent less likely to be endowed financially in the event of an emergency compared to their counterpart in developed countries (Demirgüç-Kunt *et al*., 2017). In Kenya72 percent of Kenyans in 2015 regularly experienced financial shocks, but only 28 percent had a financial plan for the unexpected events (Ruh, 2017). The data from FinAccess (2019) showed that 62 percent of Kenyans were unable to meet their daily expenses in each income cycle. Approximately 36.2 percent of them had experienced financial shocks 12 months prior to the survey. Figure 1.1 shows shocks experienced according to area of residence in 2019.



Source of Data: FinAcess, 2019

Figure 1.1: Shocks Experienced by Area of Residence, 2018

From figure 1.1, the most common shock that financially impacted most Kenyans was health related (sickness), with no major differences between the wealth quintiles. However, the effect was felt more by the urban population by almost 60 percent of the households. The death of a family member impacted more on the finances of the urban households at 19 percent of the households than the rural ones which was at 14 percent. The loss of livelihoods was more felt among the rural population since such activities are domiciled in rural.

Even though the approaches for improving social outcomes vary and contingent upon the context and situation, bolstering the capacity to weather negative shocks is paramount. Enhanced financial services access can help households become more resilient during periods of negative shocks (Demirgüç-Kunt *et al*., 2017). Households that are resilient embrace risk-sharing approaches that can help slacken the catastrophic outcomes of shocks and hence can smooth consumption without necessarily resorting to

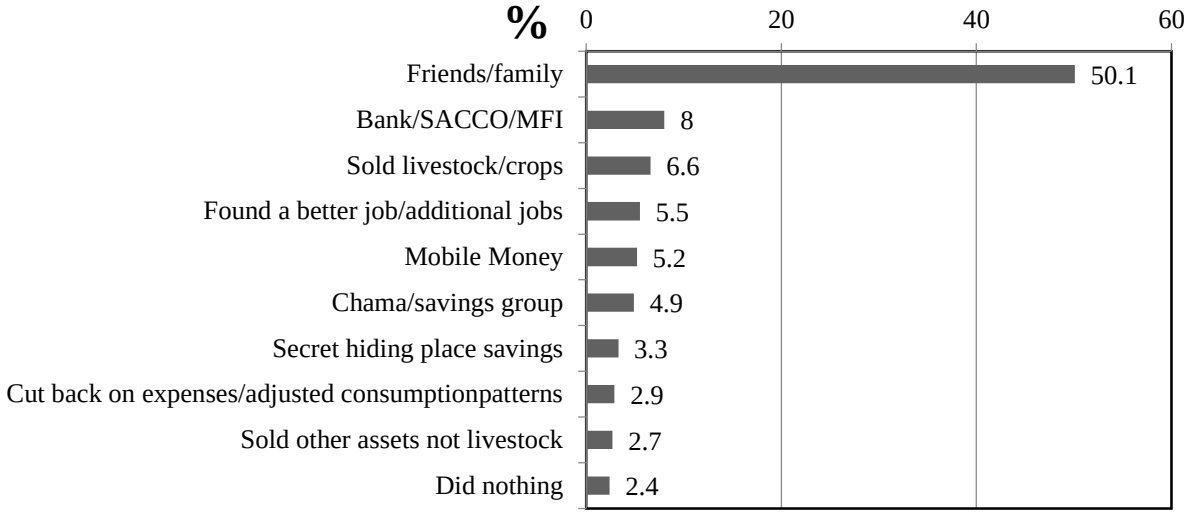
exorbitant procedures such as borrowing to unsustainable levels or disposing productive assets. Such measures includes, among others, purchasing insurance, cultivating social networks, and use of mobile financial services so as to ease reception of transfers. Utilization of mobile money services can encourage sharing of risks by bringing down the costs of transactions and broadening social networks. One way in which the services play an essential role is through remittances in terms of person-to-person transfers. Households are able to transact financially over a broad and more diversified network since they may not simultaneously experience similar shocks at the same time and might therefore share the risk. Jack and Suri (2014) observed that households holding accounts with mobile money had a higher chance of receiving bigger number and value of remittances particularly during the events of negative shock than the households without.

For small-scale and more recurring shocks, financial services can enhance households' ability to counter such shocks by establishing precautionary savings which would cushion and smooth their consumption during such periods of shocks El-Zoghbi, Chehade, McConaghy, & Soursourian, 2017). Designing accounts so as to enhance access and increased liquidity of funds can be crucial in boosting savings particularly for emergencies, since finances are secure prior to a shock and can be easily accessed when a shock hits. Therefore, access to the mechanisms of storing value and eradicating hindrances to formal savings accounts can increase the households' abilities to deal with shocks without resorting to negative coping mechanisms such as assets depletion (El-Zoghbi *et al*., 2017).

In Kenya, digital mobile loans such as KCB *M-Pesa*, *M-Shwari*, Equity *Eazzy*, *Branch*, *Timiza*, *Tala* and many others may also be useful tools in dealing with unexpected financial shock such as illness or loss of a job (Banerjee, Karlan, & Zinman, 2015). This is the case particularly for low-income households where social safety nets are limited and mostly unreliable and where the income fluctuations can be more severe. Immediate access to credit, lower transaction costs, and deeper markets access have made mobile money an attractive platform for banks to offer digital loans. Access to the short-term microloans enables some of the household's access credit that would not have been accessible otherwise since such loans do not require collaterals. This is because households that are eligible for digital credit are better prepared to respond to the shocks without adjusting other expenditures than those that are not eligible. According to Gubbins and Totolo (2018), the increase in number of digital lenders had seen more than 35 percent of mobile phone owners in Kenya approached at least one digital lender for borrowing.

The ability of household to effectively manage shocks is the key measure of resilience which includes the tendency to recover quickly when exposure to such shocks cannot be avoided. The coping strategies that the households may adopt can either be positive or negative. Positive strategies enable the households to withstand periodic shocks without adversely affecting livelihoods (Frankenberger *et al*., 2012). They may include the use of cash savings, consumption of reserve food stocks, borrowing or relying on formal and informal safety nets. Negative strategies such as disinvestment of productive assets, reduction in consumption or reliance on risky livelihood activities may have a

permanent and debilitating impact on a household's capacity to manage future risks. Figure 1.2 shows in percentages the strategies that the households used to deal with shocks in 2019.



Source of Data: FinAccess, 2019

Figure 1.2 1: Solutions households used to deal with shocks, 2018

Figure 1.2 shows that more than half (50.1 percent) of Kenyan households relied on social networks which entail borrowing from friends and relatives to mitigate against unexpected shocks and emergencies. Some of the households used other positive coping mechanisms as shown in Fig. 1.2. Utilization of mobile money services by households is instrumental in facilitating some of the coping strategies such as social networks (friends and family), savings group and mobile banking. A social network of family members, friends and relatives also involves the use of mobile money services particularly those

living far away from each other to cushion then against adverse effects of financial shocks.

In Kenya, the widely used mobile-based money transfer services have dramatically enhanced the efficiency of remittances particularly for households that experience financial shocks. The platform has been a vital tool particularly for the households that rely on social networks, borrowing and even using savings as coping mechanisms in the face of shocks. In many rural areas, social networks of family and friends are widely spread over long distances. This technology has drastically lowered transaction costs and has improved the efficiency which may, in turn, enable households to share risk and weather shocks. Despite this development, majority of households that experienced financial shocks adopted negative coping strategies such as adjusting consumption patterns as can be seen from figure 1.2.

1.1.3 Mobile Money Services and Performance of Micro and Small Enterprises in Kenya

Micro and Small Enterprises (MSEs) in Kenya play an essential part in employment and wealth creation in the economy (Republic of Kenya, 2016b). MSE sector is an important part of the economy since they produce a substantial value added besides providing most affordable goods and services thus increasing growth, innovation and prosperity (Republic of Kenya, 2016b). In Kenya, MSEs operations covers almost every spheres of the economy and they sustain a majority of the households (Republic of Kenya, 2016a). Besides increasing output of goods and services, the sector has also bolstered both forward and backward linkages among different sectors of the economy. This has greatly

enhanced participation of many Kenyans in various economic activities hence creating opportunities to cultivate and nurture both entrepreneurial and managerial skills (Republic of Kenya, 2016a).

The government of Kenya, via several policy documents has emphasized the importance of MSEs. This is domiciled in various sessional papers such as No. 1 of 1986 which underscored the importance of economic management for renewed growth of MSEs. It also acknowledged and highlighted the contribution of MSEs in strengthening the economic development in Kenya. It was acknowledged in the sessional paper that extraordinary attention needed to be given specifically to entrepreneurs in informal sector in the economy that included housing, construction, manufacturing, transport, and specific firms with possibility to obtain necessary finances so as to transform into large enterprises. Small Enterprises and *Jua Kali* Development contained in Sessional paper No.2 of 1992 was expected to entirely deal with challenges facing small enterprises where the government acknowledged the tight controls which negatively affected the sector. There was a call for sector support by all the stakeholders through a recommendation that the relevant ministries were to address the legal and regulatory challenges in order to create enabling environment for MSEs to thrive (Republic of Kenya, 2016b).

The MSEs' limited financial access is still a major obstacle that hinders establishment of new businesses and expansion of those already existing. Financial institutions consider MSEs as non-creditworthy due to their nature of small capital investments hence smaller business transactions which deny them the needed collateral to secure credit (Atieno,

2009). Further, the poor perception leveled against MSEs has negatively affected their ability to access financial services from the existing formal financial institutions (Ngaruiya, Bosire, & Kamau, 2014). Furthermore, their inability to financial access particularly from formal financial institutions is more aggravated since majority of them have poor returns from their investments, lack of proper financial records, small capital base, and more often do not have security to secure credit from banks.

Bångens and Söderberg (2011) noted that businesses and the society in general particularly in Sub-Saharan Africa have a robust cash-based tradition where cash is exclusively used for executing small-scale transactions. Cash is also fundamental in majority of business transactions and the success of any business can be dependent on how quickly the cash is mobilized from savings, credit from suppliers, or to ensure cash on delivery transactions. This implies that performance of the MSEs is a function of how cash receipts and payments are quickly made because any delay may affect the business operations.

The debut of mobile money transactions has completely changed the way in which businesses are conducted since offering banking products, particularly to those who cannot access formal financial institutions through mobile money services, has been fundamental in reaching the unbanked. Moreover, the services are accessible to both the rich and the poor and to almost all the business enterprises. Robust penetration of mobile financial services was seen as an avenue for uplifting the financial performance of MSEs because mobile phones are easily accessible and relatively affordable. Furthermore, mobile financial services have been adopted by majority of MSEs in Kenya and

approximately half of them use the platform for either payments, cash receipts or for borrowing through the digital credit platforms such as KCB- *Mpesa, M-Shwari*, Branch, and *Tala* (Republic of Kenya, 2016b). As a result of developments in financial innovations, entrepreneurs in Kenya have increasingly adopting mobile money services. However, majority of the MSEs continue to confront the problems associated with the high financial services exclusion and limited access to credit and as a result approximately 2.2 million establishments closed down in the period 2011-16 (Republic of Kenya, 2016b).

1.2 Statement of the problem

Development in mobile phone based financial innovations in Kenya has seen financial access gap drastically reduced. Specifically, mobile money has offered huge potential in boosting financial access in Kenya. This has seen 83 percent of Kenyans being formally included into the formal financial system (FinAcces, 2019). This was expected to positively impact on the households' resilience to financial shocks and performance of Micro and Small enterprises in Kenya (MSEs) in terms of ease of financial access and transactions costs. On the contrary, at least 36.2 percent of households in Kenya experienced financial shocks and were unable to recover indicating that these households were non-resilient to financial shocks (Republic of Kenya, 2019). With regard to MSEs performance, majority of them are still grappling with myriad of challenges related to high levels of financial services exclusion particularly from formal financial institutions and other bottlenecks in attempt to access credit (Republic of Kenya, 2012; 2016b). Approximately 2.2 million firms closed in the period 2011-2016

with more than 46 percent shutting business one year after starting their operations (Republic of Kenya, 2016b). The conflicting episodes raise questions on whether utilization of mobile money services has any effects on household resilience to financial shocks and performance of Micro and Small Enterprises in Kenya.

From the empirical literature on the effects of utilization of mobile money on household financial resilience, majority of studies (Jack & Suri, 2011; Jack & Suri, 2014; Bharadwaj, Jack & Suri, 2019) have not focused on all facets of utilization of mobile money services which encompasses receiving payments, borrowing through digital mobile platforms, mobile banking, and savings. Some studies focused only on aspect of borrowing to analyze its effects on household resilience (Jack & Suri, 2011; Jack & Suri, 2014; Bharadwaj *et al*., 2019). Furthermore, methodologies in the reviewed studies did not pay attention to self-selection and endogeneity problems. Addressing these econometric problems are necessary because mobile money services are being used by resilient and none-resilient households hence some may self-select into the services based on the information they have at their disposal. Ignoring endogeneity problem can render coefficient estimates from standard regressions causally non-interpretable as the estimates will be inconsistent since they do not converge to true coefficient values (Cantwell, 2020).

On the effects of utilization of mobile money on MSEs' performance, none of the reviewed studies analyzed the effects of utilization of money services as defined in this study and on the performance of MSEs in the entire country. Furthermore, studies on Kenya (Kalei, Wambugu, & Muturi, 2016; Kirui & Onyuma, 2015) only focused on

major urban centers where firms are usually well served by formal financial institutions like banks leaving out rural areas where mobile money is being heavily relied on because of the absence of formal financial institutions. With self-selection problem, the estimation may yield spurious results and hence the possibility of erroneous interpretation.

This study therefore analyzed utilization of mobile money services and its effects on household financial resilience and performance of micro and small enterprises in Kenya.

1.3 Research Questions

The study sought to answer the following research questions

i) What are the determinants of utilization of mobile money services by households in Kenya?
ii) What are the effects of utilization of mobile money services on households' resilience to financial shocks in Kenya?
iii) What are the determinants of utilization of mobile money services by MSEs in Kenya?
iv) What are the effects of utilization of mobile money services on financial performance of MSEs in Kenya?

1.4 Objectives of the study

The general objective of this study was to analyze the utilization of mobile money services and its effects on household financial resilience and performance of micro and small enterprise in Kenya. The specific objectives were to:

i. Establish the determinants of utilization of mobile money services by the households in Kenya
ii. Analyze effects of utilization of mobile money services on households' resilience to financial shocks in Kenya
iii. Establish the determinants of utilization of mobile money services by MSEs in Kenya
iv. Analyze the effects of utilization of mobile money services on financial performance of MSEs in Kenya

1.5 Significance of the Study

Knowledge of determinants of utilization of mobile money will be useful to mobile money service providers and regulatory authorities with vital entropy which might be insightful in creating financial products and incentives that would encourage absorption and uptake of mobile money services by households. Secondly, knowledge on the effects of utilization of mobile money services on MSEs performance is important for policy makers and the government in establishing importance of mobile money services in driving financial services access which are crucial to the growth and performance of MSEs. The findings of this study can therefore guide them in designing policies that will motivate and enhance MSEs access to financial services in Kenya.

1.6 Scope of the Study

The study examined the effects of utilization of mobile money services on household financial resilience and MSEs financial performance in Kenya. The study specifically examined; the determinants of utilization of mobile money services by both the

households and MSEs as well as the effects of utilization of mobile money services on households' resilience to financial shocks and performance on MSEs in Kenya. This study was done for the period 2018-2019. In the study period, there were enormous developments in financial access landscape through mobile money services which has tremendously reduced financial access gap to approximately 83 percent in Kenya. The study covered the entire country by using FinAccess (2019) that was nationally representative and MSMEs establishment data set from 2016 survey which was also nationwide.

1.7 Organization of the study

The study is organized as follows: chapter one presents the background of the study, statement of the research problem, research questions and objectives of the study, significance of the study, the scope and organization of the study. In chapter two, review of both the theoretical and empirical literature is presented with an overview of the reviewed literature at the end of the chapter summarizing the key dimensions from the theory and outputs from empirical research. In chapter three, description of the methodology used in the study is presented. The chapter begins by research design followed by theoretical framework, empirical specifications, variables definition and measurement, data types and sources. The chapter ends by description of procedures on data analysis. Empirical findings of the study and the discussions of the results are presented in chapter four. In chapter five, summary, conclusions and policy implications are presented.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the discussion of theoretical literature on understanding mobile money utilization, household utility maximization and other relevant theories. Relevant empirical literature was reviewed in section 2.3. The chapter ends with the overview and critique of the literature.

2.2 Theoretical Literature

2.2.1 Diffusion of Innovations Theory

One of the most influential works in the study of technology adoption emanates from the study by Rodgers (1962), who sought to elucidate how, why and at what rate technology and novel ideas spread out into societies and civilizations. The diffusion processes results in espousal or entrance of a new idea, conduct or physical invention (Rodgers, 1995).

The theory established that people who embrace an innovation early possess distinct attributes compared to the people who adopted it later. Five adopter categories to understand the target population was established in the theory. These include; innovators, early adopters, early majority, the late majority, and the laggards. Innovators comprises of individuals who desires to be in forefront in trying an innovation, are adventuresome and enthusiastic about contemporary concepts. The category consists of people who are ready to seize the risks and are in many instances the first to bring forth modern concepts. Early adopters according to this theory comprised of people who

embody opinion leaders, enjoy leadership responsibilities and embraced change opportunities. This category of adopters is already cognizant of the call to change and is comfortable with embracing new ideas. Early majority need to verify that innovation works before they adopted it. Strategies to appeal population in this category to adopt an innovation include an evidence of achievement stories and effectiveness of that innovation. The late majority adopter category consists of individuals who are dubious of change, and will exclusively embrace an innovation only after it has been tested by the majority. Some of the mechanisms to persuade the individuals in this category included knowledge on the number of other persons who have tried such an innovation and successfully embraced it. The last adopter category is the laggards which comprised of people who are bounded by tradition and are orthodox. They are very cynical to change and difficult people to persuade. Strategies to supplicate them include statistics, apprehension appeals and persuasion from individuals in other adopter categories.

The diffusion of an innovation, consistent with this theory takes place in a five-step process (Rodgers, 1995). These are; awareness, interest, evaluation, piloting and adoption. The theory was later reformulated to knowledge, decision, persuasion, implementation and confirmation. First, awareness entails an individual initially being acquainted to an innovation but there is information asymmetry about the same innovation. At this stage the person is motivated to look for more information concerning the innovation. The second stage entails an individual after developing interest in an innovation, actively seeking information regarding the innovation (Rodgers, 1995). The third stage consists of an evaluation where an individual

conceptualizes an innovation and considers the costs and benefits of its adoption and decides whether or not to adopt innovation. The fourth is piloting stage where an individual adopts the innovation to some degree. The individual at this stage ascertains the practicability of innovation and can look up for more information regarding it. The final stage is the adoption where the individual makes a final decision to fully adopt the innovation and utilize it.

Rodgers (1995) later defined five innovations attributes that determines the individual's discretion for adoption or otherwise of an innovation. They include; relative advantage, complexity, compatibility, trialability and observability. The first attribute (relative advantage) refers to the level where innovation is reckoned as being of absolute importance than the practice it supersedes. The key feature of this theory that was useful in the current study is that when users of mobile money perceive distinct merits conferred by mobile money institutions, they are most likely to utilize it. The second attribute is complexity which is the perceived point of difficulty in apprehending innovations and their ease of utilization. The theory posits that complexity hinders utilization of technology. There is a strong effect of perceived ease of use which is the opposite of complexity of new technology on its adoption (Lin, 2011). As mobile money services use becomes adaptive, users perceive them as being simple to use and therefore develops positive attitude towards them. The third attribute is compatibility which is the degree at which innovation will be termed as being in conformity with the likely end-users' present attributes, needs and preceding circumstances (Chen *et al*., 2009). According to Rodgers (2003) conformity of innovation with the user's characteristics

can accelerate the utilization rate. The fourth attributes is trialability which is the level at which innovations can be tried out with new technology before being finally adopted (Al-Jabri, 2016). Potential consumers of mobile money services who are experimenting with an innovation because of its perceived ease of use may induce them and hence may be more likely to utilize it. The fifth attribute is observability which is the limit to which the innovation outcome can be observable to the members belonging to community group and the benefits can be easily ascertained and conveyed (Rodgers, 2003). Regarding mobile money services utilization, observability is inferred as the users' ability to access the service at any time and from any location without any challenge.

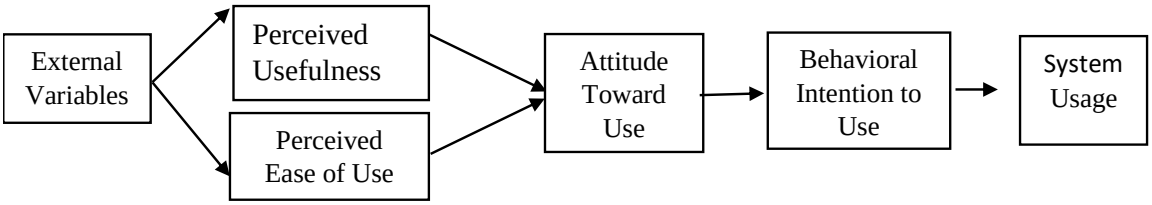
This study considered mobile money service as a technological innovation and therefore the category of adopter used to describe the determinants of utilization of mobile money was innovator category. The theory therefore was considered as the most appropriate in light of this study. Specifically the households' decision to utilize mobile money services can be derived from the diffusion process and innovation attributes explained earlier. This includes information to the individual about the mobile money service and how it operates, interest in the service as well as its usefulness.

2.2.2 Technology Acceptance Model (TAM)

The model was specifically oriented for modeling user adoption of information systems (Gardner & Amoroso, 2004). The core aim of TAM according to Wu & Wu (2005) was to present an account of the determinants of technology adoption that was general and able to explain user behaviors over a wide span of user technologies and across the populations (Davis, Bagozzi & Warshaw, 1989). TAM builds on the theory of reasoned

action (TRA) which posits that behavioral attitude is determined by the objective to execute which is subsequently influenced jointly by the persons' point of view and subjective norm (Azjen & Fishbein, 1980). Attitude refers to evaluative effect which is either positive or negative feelings for the said behavioral attitude while subjective norm is the perceived expectations of individuals (Lasserre, 2015). Therefore individual's behavior is their attitude outcome from the expected behavior and the social norm about the specific behavior (Straub, 2009).

TAM takes the concept of influencing behavior attitudes and proposes that perceived characteristics or beliefs about a technological innovation are extremely critical in the procedure of decision-making about the adoption or rejection. They include Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) of the innovations which is shown in Figure 2.1.



Source: Davis, 1989

Figure 2.1: The original Technology Acceptance Model

Perceived Usefulness according to the theory is the limit with which an individual believe that utilizing a certain system would increase his or her job performance (Lasserre, 2015). This has been linked to level of innovation as it may have the

possibility of influencing understanding a specific kind of technology for an individual in his or her circumstance (Straub, 2009). Perceived Ease of Use (PEOU) however considers the level to which one conceives that utilizing the system would call for a little or no effort (Davis, Bagozzi, & Warshaw, 1989). It is argued that PEOU influence attitudes and behavior through two mechanisms; instrumentality and self-efficacy (Davis *et al*., 1989). If the system is perceived as being effortless, it becomes more instrumental for the person because it will enable him or her to do more work with less effort. Likewise, increase in a person's perception of a system's easiness increases the sense of personal control and self-efficacy in using the innovation hence increasing the intrinsic need to the system's use.

Building up from this basic structure, various modifications have been made to TAM. King & He (2006) pointed out four types of modifications. The first being the inclusion of external precursors referred to as prior factors which include institutional involvement, prior usage and personal computer self-efficacy. The second modification was the suggestion that other factors be incorporated to increase the predictive power of TAM which include; task-technology fit, expectation, subjective norm, and trust. The third modification was the inclusion of the contextual factors that may have moderator effects such as culture, sex and technology characteristics. The fourth modification is the inclusion of the resultant steps such as attitude, perceptual usage and actual usage (King & He, 2006).

TAM along with its extension has been most influential in the study of technology adoption (Lin, 2011). But despite the extent of wide use of TAM and derived theories in

technology adoption literature, multiple criticisms have been laid against it. First, the concept that the perceived ease of use can directly be represented onto the idea of self-efficacy may be blemished. From the initial definition, perceived ease of use is discernment about abilities of a person (Shih & Venkatesh, 2002). Perceived self-efficacy in a distinct computer-based task may subsequently determine the perceived ease of use (Straub, 2009).

The model was useful in studying the determinants of utilization of mobile money services since it integrated the main determining variables of mobile money services utilization. With regard to perceived ease of use, individuals were considered to be more likely to use mobile money if the costs in terms of distances and the cost of transport to the nearest mobile money agents and the cost to the nearest commercial banks were lower.

2.2.3 Random Utility Theory

Li, Cheng, Wang, and Hiltz, (2001) proposed a modeling of individual choices as the outcomes of a procedure whereby a random variable is related with every option, and the option with the highest actualization in returns is picked out. According to McFadden (2001), when the deemed inputs are construed as utility levels, it can be considered as an epitome for economic choice where an individual's alternative yields the highest level of utility. Marschak (1974) explored the theoretical underpinnings of choice probabilities for the utility maximization that comprised of random components called Random Utility Models (RUM) which was later developed further according to Manski (1977) and McFadden (1974).

Neoclassical economic theory opines that one has a perfect discriminative ability and inexhaustible information-processing potential which enables an individual to rank preferences in a consistent and well-defined way. Anderson *et al*., (1991) observed that an individual therefore can ascertain his or her best alternative and will restate this alternative under similar scenarios. The connection with the probabilistic choice theory starts from an analyst's information asymmetry about the individual's true utility function. Manski (1977) argued that probabilistic choice is therefore introduced to reflect information asymmetry with regard to the features of the alternatives or of the individual on the part of the analyst. It is only that part of the utility which is observable to the analyst that makes up an alternative (Kjaer, 2005). This means that from the individual's perspective, the utility function is deterministic and therefore in line with the neoclassical theories.

The indirect utility is broken down into a utility function components; one that is contingent upon observable factors and the other component of the utility function that embodies determinants that affect the consumer's choice. That is, the utility function for alternative i is given as,

$$U_i = V_i + \varepsilon_i \tag{2.1}$$

For an individual, utility from alternative i becomes,

$$U_{in} = V_{in} + \varepsilon_{in} \tag{2.2}$$

Where U_i is latent utility for choice i, V_i is the observable systematic element of utility and ε_i is a latent random component. V_i is therefore an explainable component of the variation in choice and ε_i is non-explainable.

Under Random Utility Theory (RUT), it is assumed that an individual is rational and prefers an alternative that pays the highest possible utility level. Since the actual utility function of an individual cannot be observed, a utility function in a probabilistic form is used in analysis. Model of probabilistic choice is the most ideal to use depending on the presuppositions made about the random parameter. Assuming that an individual has two alternatives to choose from, that is, i and j, the probability that one chooses an prefers i over j is given as,

$$P_i = Prob(U_i > U_j) = Prob(V_i + \varepsilon_i > V_j + \varepsilon_j) = Prob(V_i - V_j > \varepsilon_i - \varepsilon_j) \forall\, i \neq j \quad (2.3)$$

Equation (2.3) means that when the probability for an alternative is higher, the observed difference in utility is also larger. The model's input is the observed choices, while its output to be estimated, is the difference in utility for the two choices, $(V_i - V_j)$, which is characterized by the utility of each dimension. Therefore, the probability of choice i increases with the increase in the difference in utilities between the two choices.

The theory may be used to model households' effects of utilization of mobile money service on its resilience to financial shocks. In the RUT, mobile money users choose the best alternative from among many but only achieve utility when they actually experience change in welfare. For any household, the total benefits of a change in welfare will

depend on the utility difference from use and from non-use of mobile money services. Therefore, the change in welfare is only beneficial when there is utilization of mobile money service.

2.2.4 Theory of a Firm

Among the neo-classical hypotheses that can be employed to characterize the behavior of a firm with reference to profit, production and cost is the theory of a firm. According to Demsetz (1988) the earliest cornerstone of the theory can be traced to the work of Knight (1921) and Coase (1937) who emphasized the idea that firm seeks to maximize profit. A firm employing a set of inputs and outputs has an objective of profit maximization such that

$$\pi(p, w) = py - wx \tag{2.4}$$

Where $\pi(p, w)$ represents the profit of a firm, p the output price, w the input price, y and x represents vector of outputs and inputs respectively.

Equation (2.4) is founded under the premise that the profit function is non-decreasing in output prices (p), non-increasing in input prices (w), homogenous of degree one both in output and output prices, convex and differentiable in both input and output prices (Jehle & Reny, 2011). Under profit maximization strategy, a production constraint is imposed upon so that a firm can use set of inputs (x) to produce vector of outputs (y) so that;

$$y = f(x) \tag{2.5}$$

Where $f\ (x)$ is presumed to be non-negative, both single and real-valued, and finite for all positive values of x. It is further presumed that $f(x)$ is twice differentiable everywhere inside the production set, continuous, and that inputs depicts diminishing returns.

The profit function may be rewritten so as to incorporate the production constraint as follows

$$\pi(p,w) = pf(x) - wx \tag{2.6}$$

To maximize profits of the firm, the necessary first order condition can be derived as

$$p\frac{df(x^*)}{dx} = w \tag{2.7}$$

Equation (2.7) means that a firm profit is maximized at the point where marginal revenue of the vector of inputs (x) and their costs (w) are equal. Accordingly, the optimal input demands in their reduced form that will maximize profit is generated as follows

$$x^* = x^*(p,w) \tag{2.8}$$

As production flourish, the constraints are relaxed thereby increasing the entire firm profitability. For a firm wishing to maximize profit given production constraints, it may opt for an optimal inputs level which depends on prices of both input and output together with other variables. Incorporating the optimal input demand functions in equations (2.5) and (2.8) yields the output supply function.

$$y^* = f(x^*(p, w)) \tag{2.9}$$

The input demand function in (2.9) and output supply in (2.10) depicts the parameters choices of profit maximization. The resultant indirect profit function is therefore stated as follows

$$\pi(p, w, m) = pf(x^*(p, w) - wx^*(p, w) \tag{2.10}$$

Equation (2.11) means that the firm's profit, input demand and output supply functions depends on both prices of inputs and outputs as well as utilization of mobile money services. This entails that, in order to influence profits, firms are also faced with the choice of utilization of mobile money services besides prices. Since utilization of mobile money services is a discrete variable, Obebo, Wawire, & Muniu (2018) noted that the first order conditions may not produce an interior solution to an optimum mobile money service utilization level.

The optimal option for utilization of mobile money services can only be drawn by comparison of the firm's profit for the two regimes of choosing to utilize the service or not. Firm will choose to utilize the service or choose not to by comparing the levels of profits from utilization and non-utilization. They will choose to utilize the service if the profits from utilizing (π_U) are higher than the profits from non-utilization of mobile money services (π_N) such that

$$\pi_U^*(p, w = 1) > \pi_N^*(p, w = 0) \tag{2.11}$$

In deciding to utilize mobile financial services or not, firms takes into account such factors as transaction costs, requirements for the service, and attributes of both the establishments and those of the owner. It is upon this comparison that the effect of utilization of mobile money services on MSEs performance was analyzed in this study.

2.3 Empirical Literature Review

2.3.1 Utilization of Mobile Money Services and Household Financial Resilience

Suri and Jack (2011) using 3000 randomly selected households across Kenya did a study to establish the effects of mobile money use on household financial resilience in Kenya using difference-in-difference estimation method. The dependent variable was spending on goods and services and the independent variables included mobile money use which was a treatment dummy and a host of vector of controls mainly household characteristics. The result of the study showed that those who did not use mobile money service experienced on average a 7-10 percent decline in expenditure on goods and services during the period household negative economic shock. However, those who used mobile money services experienced a much smaller and statistically insignificant drop in consumption when the negative events occurred. The study concluded that those who used the service were more likely to receive money and they received more than those who did not use. The study would have been more informative and insightful had it defined mobile money use in its entirety as in this study so as so reap the real effects on household financial resilience. Also the study only focused on one area of negative coping strategies in the event of a shock, that is, consumption spending. The current

study extended the nature of negative coping strategies which included sale of productive assets.

Kikulwe, Fischer, and Qaim (2013) investigated the impacts of mobile money use among smallholder farm households in Kenya. The study used panel survey data and random effects regression models for estimation. Dependent variables used were household income, household remittances, input use and banana sales and profit. The independent variables included land owned, household size, distance to banana market, distance to all-weather road and the treatment dummy which was mobile money. In the study the determinants of mobile money adoption were analyzed and the results showed that the coefficient of education, household size and wealth were significant and positively related to mobile money use. The coefficients of other variables which included land owned, distance to the banana market and distance to all-weather road had no significant influence on mobile money use. While the study provides useful insights, it only focused on farm-specific households which may be structurally different from others which were non-farmers. The current study analyzed the determinants of utilization of mobile money services on all the households, that is, both farm and non-farm households hence sufficiently capturing the determinants of utilization of mobile money services in Kenya.

Jack and Suri (2014) conducted a study to establish the effects of M-PESA services on risk sharing in Kenya using data from a household panel survey done between 2008 and 2010. The study specifically analyzed how the consumption of M-PESA users responded to shocks compared to non-users. The study used difference-in-differences

estimation method to analyze the effects of shocks on consumption changes across users and non-users of M-PESA. The dependent variable was annual per capita consumption while independent variables included dummies for shocks and users and non-users of M-PESA. Findings from the study revealed that households that encountered shocks experienced reduced per capita consumption of households who do not use M-PESA by 21 percent, but the households that used M-PESA were able to recover quickly from the shocks (resilient). The reviewed study only centered on one aspect of mobile money use, which is remittances only hence the study may have lost some crucial information on others uses of mobile money such as borrowing and saving via the platform which may work towards bolstering household resilience to financial shocks. The current study focused on all aspects of mobile money used alongside more superior estimation approach of endogenous switching regression that captured the real mobile money effects use on household resilience in Kenya.

Munyegera and Matsumoto (2016) used household data from 94 villages in Uganda to analyze the determinants of household mobile money adoption using a probit model. The dependent variable was mobile money use. On the explanatory variables, the coefficients of mobile phone ownership, value of total assets and household head years of schooling were statistically significant and positively influenced mobile money use. The coefficient of distance to the nearest mobile money agent was also statistically significant but negatively influenced mobile money use. The coefficient of the age and age squared of the household head, household size and sex of the household head were not statistically significant and hence did not have any influence on use of mobile money

services. The reviewed study focused mainly on the Ugandan households and the results may not be used to inform policy for the other countries like Kenya because of the dynamic and unique differences in economies and even different levels of nature of mobile money services uptake where Kenya has registered a huge services uptake compared to Uganda.

Abiona and Koppensteiner (2016) investigated the effect of mobile money adoption on consumption smoothing and poverty by households in Tanzania in 2016 using data from the World Bank. Instrumental variable method was used in the study to examine the effect of mobile money adoption on most vulnerable households' consumption smoothing and its effects on preventive health expenditure. Findings from the study demonstrated that household per capita consumption expenditure was smoothed during time of negative idiosyncratic shocks which implies resilience for mobile money adopter households than non-adopter ones in Tanzania. Also, at the individual level, reduction in preventive health expenditures triggered by negative household shock was neutralized for households that had adopted mobile money. This study used a binary variable as a measure of household resilience where a household was considered resilient if it would bounce back after a shock and non-resilient otherwise. The current study adopted a similar measure of household resilience. However, other variables besides utilization of mobile money services were incorporated as control variables.

Bharadwaj *et al*. (2019) did a study to analyze the digital loans impact on household financial resilience in Kenya. The study used administrative and survey data to study the impact of *M-Shwari* in Kenya using regression discontinuity estimation procedure. The

dependent variable was a latent variable of household financial resilience which was captured by some variables which included household's reduction in expenditure in certain budget categories, whether they withdrew the child from the school, whether they left a job or whether they sold any assets in response to negative shocks. The independent variables included mobile based digital loan, *M-shwari* which was a treatment variable and a host of other household characteristics as part of explanatory variables. Findings of the study demonstrated that households with individuals above the credit score cutoff were 6.3 percentage points less likely to report that any expenses were forgone in the face of negative shocks. Hence the study concluded that mobile based digital loans provide better protection (resilience) against household shocks. The reviewed study was valuable to this study in terms of the borrowing aspect of mobile money use. However, the study only focused on one aspect of mobile money use (borrowing) which may have not sufficiently captured full effects of mobile money services in household financial resilience. This study examined all the aspects of mobile money use which included receiving monies, saving and borrowing.

Alinaghi and Reed (2019) replicated a study by Jack and Suri (2014) on the effects of M-PESA on risk sharing in Kenya. The replicated study used pure replication, robustness checks and additional model specifications to re-examine using a panel of 2,282 Kenyan households' data the impact of transaction costs on the capability of households to manage risk using mobile a money innovation, M-PESA. The study also used propensity score matching estimation procedure. The dependent variables were per capita consumption of the household, illness consumption shock and remittances while

independent variable included dummies for a shock and mobile money use and a set of vector of household level characteristics. The study did not find significant effect of mobile money use in presence of a shock on household per capita consumption which was its measure of resilience. However, the results from the study on effects of mobile money use on remittances and consumption on health shocks were similar to those of Jack & Suri (2014). The current study explored more on other uses of mobile money which include borrowing, savings and receiving payments which sufficiently captured its effects on household response to shocks. The study also used more recent data since there have been tremendous changes regarding the uptake and utilization of mobile money services in Kenya.

2.3.2 Utilization of Mobile Money Services on Performance of MSEs

Frederick (2014) examined the effect of mobile money usage on the microenterprise profits in Zambia using instrumental variable strategy which consisted of two-stage least squares. A sample size of 204 micro entrepreneurs that was selected randomly from ten markets within Livingstone, Zambia was used. Profits were used to measure microenterprise performance and a dummy for mobile money use along with a vector of covariates which are thought to influence profits as explanatory variables. Study findings established that using mobile money services did not result in significant effects on net marginal profits for micro-entrepreneurs. On the basis of the estimation procedure used in the reviewed study, the problem of self-selection and endogeneity was ignored and this may have affected the validity of the study results. Ignoring endogeneity problem can render coefficient estimates from standard regressions causally not

interpretable as the estimates will be inconsistent since they do not converge to true coefficient values (Cantwell, 2020). The current study used endogenous switching regression and propensity score matching both of which are treatment affects models as a solution to potential self-selection and endogeneity problems, respectively.

Kirui and Onyuma (2015) analyzed mobile money services transactions effects on MSEs' performance in Kenya by using cross-sectional survey data of 21,139 MSEs amongst Sub-Counties in Nakuru County. A sample of 246 MSEs was selected using stratified sampling technique. Ordinary Least Squares regression was utilized to find out the effect of mobile money services on MSEs performance in Nakuru County in Kenya. Dependent variable used was sales turnover while explanatory variables included mobile banking, mobile money and mobile payments transactions. Results from the study showed that a unit increase in mobile money usage led to 0.161 unit rise in sales. This suggested that mobile money positively affected MSEs performance. The effect of mobile banking use on performance of MSEs was also positive and significant whereby a unit increment in mobile banking use led to 00.154 increases in sales. On mobile payments effect on performance of MSEs, the result was positive and significant. The reviewed study only focused on a small area of Nakuru County in Kenya. However, unlike the reviewed study, this study was nationwide and therefore captured the entire effects of utilization of mobile money services on performance of MSEs in Kenya. Furthermore, a different methodology which addressed problem of endogeneity and self-selection that the reviewed study ignored was used in the current study. This is because with self-selection problem, the estimation may have yielded spurious results and hence

the possibility of erroneous interpretation. As a solution to these problems, the current study used endogenous switching regression and propensity score marching estimation techniques.

Kalei *et al*, (2016) investigated factors influencing M-PESA services acceptance and their effect on small and micro-business in Kenya. A sample of 1230 small and micro-business operators in Limuru town in Kenya was used. For estimation, ordinary least square regression was utilized. The dependent variable was annual sales while the explanatory variables included acceptance of M-Pesa, nature of capital investment, business, owner's education, business location, years of experience in business, and promotional expenditure. All the variables significantly and positively influenced small and micro-business performance. The variable of interest, acceptance of M-Pesa services, increased the SMEs' performance by 0.198 percentage points. However, the study only focused on small area of Limuru town, yet M-Pesa services are nationally distributed. The current study used nationwide data to capture the effects of mobile money services effects of the performance of MSEs in Kenya. The study also used propensity score matching estimation technique which addressed the problem of self-selection that may have been encountered.

Salia (2016) investigated the effect of microcredit obtained from various sources including mobile digital credit on the performance of microenterprises owned by women in Morogoro, Tanzania. Ideally, the study sought to examine the performance of women owned microenterprises in terms of sales revenues, net profits and business net worth. The study used ordinary least square estimations using data from 400 respondents where

217 were borrowers and 183 non-borrowers. The study results showed that the business borrowers performed significantly better than those of non-borrowers. Among the explanatory variables that positively and significantly influenced business performance (total sales) included size of credit and borrowing experience while only the size of credit had statistically significant positive effect on net profit. Further, size of credit and repayment period had significant positive effects on business net worth. It was concluded that women's participation in microcredit schemes improves performance of their businesses. However, the reviewed study was biased towards women owned enterprises and that the estimation strategy ignored the self-selection bias since microcredit was being used by majority of micro and small businesses in Tanzania. The current study used data that was collected nationwide and estimation procedure involved propensity score matching as a solution to self-selection problem.

Mdoe, Kinyanjui, and McMillan (2018) analyzed the effect of mobile telephony and social networks (networks of family, friends and relatives) on the possibility of credit access by Micro, Small and Medium enterprises in Kenya. The study used 2016 FinAccess Household survey cross-sectional data. The study also used latent variable modeling for analysis. The dependent variable was observable credit access which was the outcome while the explanatory variables included a vector of firm characteristics, mobile telephony variables and social networks variables. Analysis of the results revealed that micro, small and medium-sized enterprises that used mobile money, mobile banking and group participation, had 6.05, 8.8, and 1.97 percentage points, respectively, more likely to receive formal credit. The reviewed study only focused on

one aspect of utilization of mobile money which is access to credit for borrowing. The current study focused on the entire mobile money utilization, that is, for borrowing, for saving, for receiving money and for making payments which captured, in its entirety, the effects of utilization of mobile money on performance of MSEs in Kenya.

2.4 Overview of literature

Reviewed theoretical literature revealed that successful utilization of a technology can be explained by Diffusion of Innovations Theory and Technology Acceptance Model (TAM). From the former, determinants of utilization mobile money services were derived from the mentioned attributes which included awareness, interest and benefits. Technology Acceptance Models mobile money utilization behavior through the relationships that exist between different variables such as the need to adopt the technology through perceived ease of use in which individuals will use mobile money if there is no much costs and effort required. According to random utility theory, a firm or a household's choice to either utilize the service or not depends on the difference in derived utility from utilizing the service and non-utilization.

Majority of the earlier studies did not focus on all aspects of utilization of mobile money services notwithstanding that utilization of mobile money encompasses receiving payments, borrowing through digital mobile platforms, mobile banking, and savings. Some studies only focused on borrowing to analyze its effects on household resilience (Jack & Suri, 2011; Jack & Suri, 2014; Bharadwaj *et al*., 2019). Furthermore, majority of these studies did not pay attention to the self-selection and endogeneity problem yet mobile money services are being used by resilient and none-resilient households hence

some may self-select into the service based on the information they have at their possession. This problem may have affected the validity of the results. This study endeavored to address this problem using endogenous switching regression and propensity score matching procedure. The two procedures were more robust in solving self-selection and endogenity problems in utilization of mobile money services.

On the effects of utilization of mobile money on MSEs' performance, majority of the studies in Kenya only focused on major towns where firms are usually well served by formal financial institutions like banks leaving out rural areas where mobile money is being heavily relied on because if the absence of formal financial institutions (Kalei *et al*, 2016; Kirui & Onyuma, 2015). This study used data collected across the whole country to analyze the effects of utilization of mobile money services in Kenya.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The chapter describes the methodology that was used in the study. The chapter begins by presenting the research design, theoretical framework, models specifications, variables description and their measurements, sources of data and data analysis.

3.2 Research Design

This study used cross-sectional non-experimental research design. The non-experimental design was to be more suitable since concerned variables could not be manipulated as in the case with attributes that exist naturally or even where random assignment of individuals to a given treatment condition would be unethical. In this design, groups based on different traits or on self-selection, such as being mobile money user or non-user, may differ for some reasons other than the variable under investigation.

3.3 Theoretical Framework

3.3.1 Determinants of Household Utilization of Mobile Money Services

The household's decision to utilize mobile money services was derived from diffusion of innovations theory where the categories of adopters are innovators. Innovators comprised of individuals who would always desire to be the first to try out an innovation, are adventuresome and are always enthusiastic about new ideas. The adoption decision depends on several attributes as observed in Rodgers (1995) which include; relative advantage, complexity, compatibility, trialability and observability. In

terms of relative advantage, households may decide to utilize mobile money services when they perceive distinct merits conferred by mobile money institutions. Complexity entails the ease and benefits of technology use with regard to other traditional financial institutions like commercial banks. Therefore, as mobile money services become user friendly, households perceive them as being friendly to use and therefore develops positive attitude to them. In terms of triability, potential users of mobile money services who are experimenting with an innovation because of its perceived ease of use may induce them and hence may be more likely to utilize it. Observability attribute can be achieved since mobile money services are closer to users even those in the remotest places unlike traditional banking facilities which are only located in urban areas. This is so because the users are only required to locate the mobile money agents hence distance is the key determining variable among others.

Besides Diffusion of Innovations theory that provides institutional variables determining utilization of mobile money which included transport cost to the nearest bank, there are other demographic variables which may influence decision of the household to utilize mobile money services. This perhaps can be derived from a random utility framework (Becerril & Abdulai, 2010; Khonje, Mkandawire, Manda, & Alene, 2015). The household chooses to use the service if the utility derived from using it is higher than from not using it. Since the utilities cannot be observed, they can be represented as a function of observable elements in a binary variable model (Kassie, Jaleta, Shiferaw, Mmbando, and De Groote, 2012). Let M_i^* represent the difference in utility for i^{th} from mobile money use (U_{i1}), and from non-use (U_{i2}) so that,

$$M_i^* = U_{i1} - U_{i2} \quad (3.1)$$

and

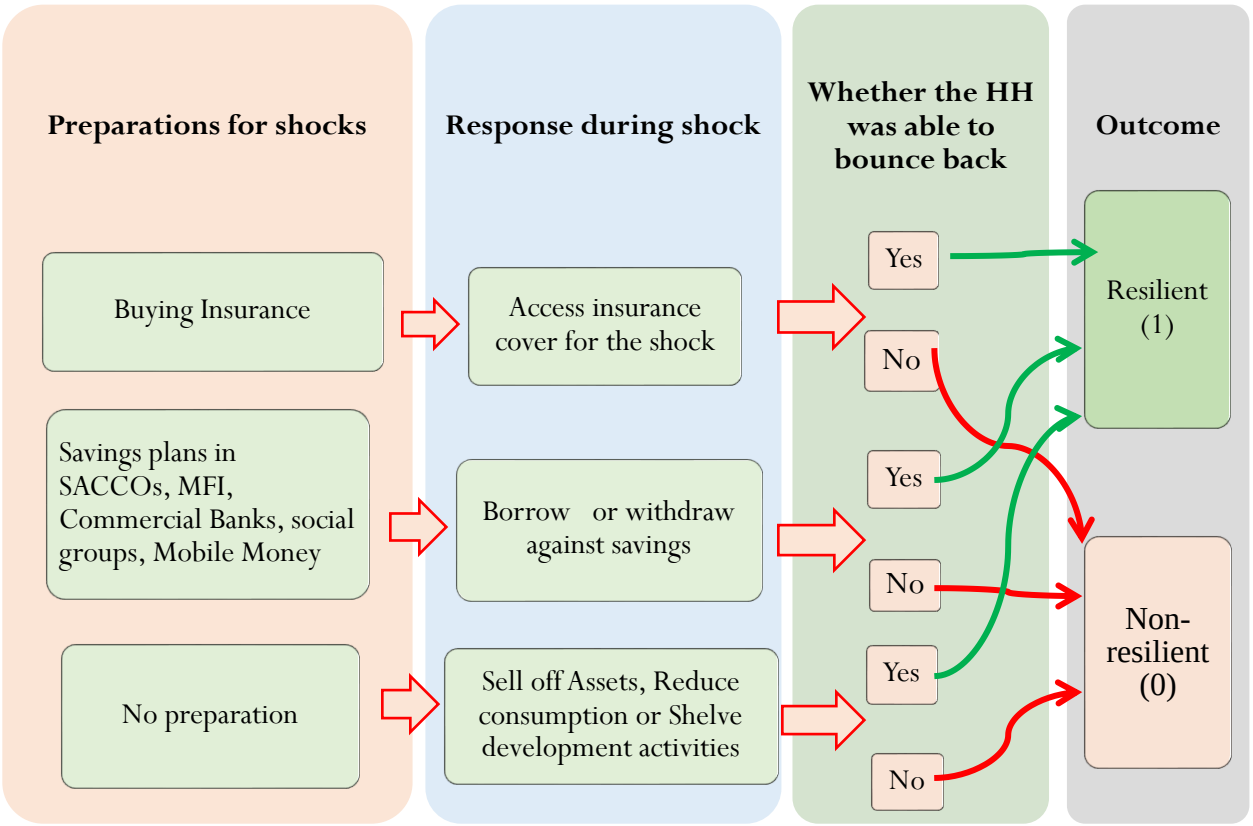
$$M_i^* = X_i'\beta + \varepsilon_i \text{ With } M_i = \begin{cases} 1 \; if & M^*{}_i > 0 \\ 0 & otherwise \end{cases} \quad (3.2)$$

Where M_i^* represents utility threshold of technology adoption which is unobservable and M_i is the dependent variable which is the observable part (utilization of mobile money) of technology adoption and equals 1 if a household utilizes mobile money services and zero otherwise, β is a vector of unknown coefficients, X_i is a non-stochastic vector of household, institutional and socio-economic, characteristics that are deemed to influence household's decision to use mobile money services and ε_i is the random error term.

3.3.2 Effect of Utilization of Mobile Money Services on Household Financial Resilience

Low-income households are most vulnerable to financial shocks particularly when they are least prepared for it. Households must make adequate preparations that would enable them to mitigate, deal, and bounce back after shocks without adversely affecting their welfare. Well-designed and established financial services and products can play a greater role in this regard. If the objective of the household is to be resilient, it would choose among existing financial products and other coping strategies to weather financial shocks or increase ability to recover from such shocks. Some common copying strategies include purchase of insurance, saving plans with SACCOs, commercial banks, MFIs, social groupings and mobile money. If a household has no defined preparations to deal with shocks then it will be forced to sell off assets, reduce consumption or shelve

immediate development activities which often lead to adverse effects on welfare. Figure 3.1 presents a summary of the framework for understanding household resilience in the face of financial shocks



Source: Author

Figure 3.1: Relationship between Household Resilience and Financial Shocks

The household's ability to effectively manage shocks is an indicator of resilience. From figure 3.1, resilience was established from the households' ability to bounce back after the shock. Those reporting that the strategy was able to get them back to their original financial status, then they are said to be resilient, otherwise they are not.

Mobile money services can be a vital tool particularly for the households that rely on social networks, borrowing and even using savings as copying mechanisms in the event of shocks. In many rural areas, networks of friends and families are widely dispersed over long distances. This technology can lower transaction costs which may, in turn, enable households to share risk and weather shocks. The effect of utilization of mobile money services on household financial resilience was evaluated by establishing whether mobile money users have a higher probability of recovering from a shock than non-users.

In terms of utilization of mobile money services, households themselves decide to use the service based on the information at their possession and therefore users and non-users may not be distributed randomly between the two groups since they could be different systematically as argued by Amare, Asfaw, and Shiferaw (2012). In the circumstance therefore, the mean outcome for the two groups are different even without treatment. Hence this bias had to be resolved. To resolve this, Endogenous Switching Regression Technique (ESR) was used (Khonje *et al*., 2015).

The ESR framework comprises two stages. The first stage consists of selection equation which is the decision to utilize the mobile money service. Consistent with Kassie *et al*, (2012), the selection equation for mobile money services use was given as;

$$M_i^* = X_i'\beta + \mu_i \quad \text{Where } M_i = \begin{cases} 1 & if\ M_i^* > 0 \\ 0 & otherwise \end{cases} \tag{3.3}$$

Where M_i^*, M_i, X_i and β are as previously defined in (3.1) and (3.2) μ_i is random error term that is assumed to be independent and identically distributed with zero mean and a

constant variance. The two resilience equations faced by households, that is, to utilize (regime 1) and not to utilize (regime 2) conditional on decision to use can be expressed as;

$$Regime\ 1\ (users): R_{1i} = D_{1i}'\alpha_1 + e_{1i} \ \ if\ M_i = 1 \tag{3.4}$$

$$Regime\ 2\ (non-users): R_{2i} = \alpha_2 D_{2i} + e_{2i} \ \ if\ M_i = 0 \tag{3.5}$$

Where R_{ji} is the outcome variable of household financial resilience in each regime. Household resilience is a binary variable that equals one if the household was able to bounce back financially after the shock and zero otherwise (using other strategies that impacted negatively on their welfare). D_{ji} is a vector of explanatory variables that may affect the household resilience (outcome variable) and e_i are independent and identically distributed random errors.

The error terms in (3.3), (3.4) and (3.5) were presumed to be having a trivariate normal distribution, with a mean of zero and non-singular covariance matrixes. Khonje *et al*., (2015) observed that the significance of the structure of the error is that since the error terms of selection equation is correlated with the error terms of the outcome equations (3.4) and (3.5), the expected values of e_{1i} and e_{2i} are non-zero conditional on the sample selection.

$$E[e_{1i}|M_i = 1] = \delta_{e1u}\frac{\phi(\beta X_i')}{\Phi(\beta X_i')} = \delta_{e1u}\hat{\lambda}_{1i} \tag{3.6}$$

$$E[e_{2i}|M_i = 0] = \delta_{e2u}\frac{\phi(\beta X_i')}{1-\Phi(\beta X_i')} = \delta_{e2u}\hat{\lambda}_{2i} \tag{3.7}$$

Where $\phi(.)$ is the standard normal probability density function, $\Phi(.)$ is the standard cumulative density function, δ_{e1u} and δ_{e2u} are the variances of the error terms in the two outcome equations and $\hat{\lambda}_{1i} = \frac{\phi(\beta X_i)}{\Phi(\beta X_i)}$ and $\hat{\lambda}_{2i} = \frac{\phi(\beta X_i)}{1-\Phi(\beta X_i)}$ are inverse mills ratios (IMR) computed from selection equation (Hadush, 2018). They were included in equation (3.4) and (3.5) to adjust for sample selection bias in two-step process.

If the estimated covariance between $\delta_{e1\mu}$ and $\delta_{e2\mu}$ are statistically significant (Di Falco & Veronesi, 2018), then the decision to use mobile money and household financial resilience are correlated, that is, existence of endogenous switching hence the null hypothesis of no sample selectivity bias is rejected (Asfaw, Shiferaw, Simtowe, & Lipper, 2012).

The expected values of the outcomes of users and non-users in factual and counterfactual cases according to Di Falco *et al*., (2018), are computed as follows:

$$E[R_{i1}|X, M_i = 1] = X'_{i1}\beta_1 + \delta_{\varepsilon 1\mu}\hat{\lambda}_{i1} \text{ (Users)} \quad (3.8)$$

$$E[R_{i2}|X, M_i = 0] = X'_{i2}\beta_2 + \delta_{\varepsilon 2\mu}\hat{\lambda}_{i2} \text{ (Non-Users)} \quad (3.9)$$

$$E[R_{i2}|X, M_i = 1] = X'_{i1}\beta_2 + \delta_{\varepsilon 2\mu}\hat{\lambda}_{i1} \text{ (Users had they decided not to use)} \quad (3.10)$$

$$E[R_{i1}|X, M_i = 0] = X'_{i2}\beta_1 + \delta_{\varepsilon 1\mu}\hat{\lambda}_{i2} \text{ (Non-Users had they decided to use)} \quad (3.11)$$

Equation (3.8) and (3.9) represents real expectations observed from the sample while equation (3.10) and (3.11) represents the counterfactual or hypothetical cases. The average treatment effects of the treated (ATET) and of the untreated (ATEU) were obtained from the ESR technique by juxtaposing the expected values of the outcomes of

the users and non-users in the actual and counterfactual frameworks. The average treatment effect on the treated (users) (ATET) is the difference between (3.8) and (3.10) Heckman *et al*., (2001), such that;

$$\text{ATET} = \text{E}(R_{1i}|\text{X}, M_i = 1) - \text{E}(R_{2i}|\text{X}, M_i = 1) = X'_{i1}(\beta_1 - \beta_2) + \hat{\lambda}_{1i}(\delta_{\varepsilon 1\mu} - \delta_{\varepsilon 2\mu}) \qquad (3.12)$$

Likewise, the average treatment effect on the untreated (ATEU) for the households that did not utilize mobile money is calculated as the difference between (3.9) and (3.11) as follows;

$$\text{ATEU} = \text{E}(R_{1i}|\text{X}, \text{M} = 0) - \text{E}(R_{2i}|\text{X}, M_i = 0) = X'_{i2}(\beta_1 - \beta_2) + \hat{\lambda}_{2i}(\delta_{\varepsilon 1\mu} - \delta_{\varepsilon 2\mu}) \qquad (3.13)$$

The effect of base heterogeneity (BH_i), according to Carter and Milon (2005) is defined for households adopting mobile money as shown in Table 3.1.

Table 3. 1: Conditional Expectations, Treatments and Heterogeneity Effects

	Decision Stage		
Sub-Samples	**To Utilize**	**Not to Utilize**	**Treatment Effects**
Households that Utilized	(a) $\text{E}(R_{1i}/M_i = 1)$	(c) $\text{E}(R_{2i}/M_i = 1)$	ATET
Households that did not utilize	(d) $\text{E}(R_{1i}/M_i = 0)$	(b) $\text{E}(R_{2i}/M_i = 0)$	ATEU
Heterogeneity Effects	BH_1	BH_2	TH

Source: Adapted from Di Falco *et al*., (2011).

Notes: $BH_i$is the effect of base heterogeneity for households that utilized ($\text{i} = 1$) and those that did not ($\text{i} = 0$). $\text{TH} = (\text{ATET} - \text{ATEU})$ Where TH is the transitional heterogeneity. All other notations are as earlier explained.

3.3.3 Effects of Utilization of Mobile Money Services on Performance of MSEs

The firms' decision to utilize mobile money services was derived from the theory of Technology Acceptance Model (TAM). The theory posits that behavioral attitudes and perceived characteristics about a technological innovation are crucial in the process of decision making. From the theory, perceived usefulness of a technology is the degree to which a firm would perceive that using mobile money services would increase the firm's performance. The usefulness of the technology to the MSEs may be realized through technology characteristics such as ease of use which may depend on distance to the nearest mobile money agents and location of the business.

The nexus between mobile money services utilization and MSEs performance was modeled using the theory of a firm which portends that a firm using multiple inputs and outputs is presumed to maximize profits given the production constraint. It is also presumed that MSEs which are barred from accessing formal financial institutions and hence undercapitalized can rely on utilization of mobile money and hence increase their incomes (Obebo *et al*., 2018). Therefore the optimal input demand and output supply functions in their reduced form can be integrated into utilization of mobile money services.

A profit function of the firm using variety of inputs and outputs can thus be augmented to include utilization of mobile money services as part of the inputs that affect the performance of MSE as shown in (3.14), See (Jehle & Reny, 2011).

$$\pi(p, w, u, F^k) = pf(x^*(p, w, u) - wx^*(p, w, u) \quad (3.14)$$

Where $\pi(p, w, u, F^k)$ represents firm profit, w and p are the input price and output price, F^k represents a set of firm characteristics that are thought to influence firm productivity, x represents a vector of inputs, u is the decision to utilize mobile money services where the $u = 1$ if a firm decides to utilize and $u = 0$ otherwise.

Firms will choose to utilize mobile money services ($u = 1$) or not to ($u = 0$) if there is a difference in compared levels of profits from the two options. They will choose to utilize if the profit from utilizing (π_U) is higher than the profits from non-utilization (π_N) such that;

$$\pi_U(p, w, u, F^k|u) = 1 > \pi_N(p, w, F^k|u = 0) \quad (3.15)$$

Equation (3.15) presents a strategy for establishing determinants of utilization of mobile money services by MSEs besides the effects of utilization on their performance. In modeling the MSE utilization of mobile money, the optimal decision of the firm that would maximize its profit was derived from discrete matching of the expected difference in profits from both decisions.

Firms choosing to either utilize or not, have an observable profit threshold that would enable them to make a decision. This threshold level is given as:

$$\pi^* = \pi_U - \pi_N \quad (3.16)$$

However, because the decision cannot be observed, it is modeled in a latent variable form (F_i) as follows:

$$F_i = 1 \; if \; \pi^* > 0 \text{ and } F_i = 0 \; if \; \pi^* \leq 0 \quad (3.17)$$

Equation (3.17) implies that firm will utilize mobile money services ($F_i = 1$), if the threshold profit is strictly positive otherwise they will choose not to utilize ($F_i = 0$).

In establishing the determinants of MSEs utilization of mobile money services, its framework was give as:

$$\Pr(F_i = 1) = \varpi(Z_i'\beta) \tag{3.18}$$

Where F_i is the decision to utilize mobile money, Z_i is an observed vector of firm and institutional characteristics that are thought to influence the performance of MSEs, β is a vector of unknown parameters and ϖ is the variable's cumulative distribution function of a standard normal.

To address the possible endogeneity problem that may arise due to unobserved variables, Propensity Score Matching (PSM) procedure was used following Rosebaum & Rubin (1983). The PSM method matches observations of those who utilized the service and those who did not utilize it in accordance with the predicted propensities of a treatment variable to create a counterfactual that will be used as a control group. According to Rosebaum & Rubin (1983) propensity score is defined as:

$$p(Z) = \Pr(F_i = 1|Z) \tag{3.19}$$

Where $p(Z)$ represents the value of propensity score and $\Pr(F_i = 1|Z)$ is the conditional probability to utilize mobile money services. Z is a vector of observed characteristics that are thought to affect utilization of mobile money services and they include; sex of the firm owner, education level of the firm owner, location of the firm, registration status of a firm, group membership of the firm owner, credit access, ownership structure,

mobile phone ownership, ownership of radio, number of employees and number of business units. Two assumptions were fulfilled for matching with propensity scores which included the assumption of conditional independence and the common support condition. The latter needs substantial overlaps in covariates between the firms that decided to utilize mobile money services and those that decided not to. This is because firms that were being compared had a common probability of being both users and non-users, such that, $0 < p(Z) < 1$. When these two assumptions are satisfied, Khonje *et al*.,(2015) argued that the PSM estimator for average treatment effects on the treated can be expressed as the mean difference of user firms matched with non-users. Nearest Neighbor matching algorithm was used in which from a control group, a unit was picked as a matching partner for unit treated that is close to it in propensity score.

According to Obebo *et al*., (2018), the propensity scores should be compared between the treated and non-treated observations so that Average Treatment Effect on the Treated (ATET), which is the difference in income of the firm, as the outcome variable, could be ascribed to the utilization of mobile services. ATET can be computed as:

$$ATET^{PSM} = E(\pi_U|F = 1) - E(\pi_N|F = 0) \quad (3.20)$$

Where $E(\pi_U|F = 1)$ is the outcome from the treated firms (expected) on condition of utilization of mobile money services and $E(\pi_N|F = 0)$ is the expected outcome for non-treated firms conditional on utilization of mobile money services (Riley, 2018). This formed the basis for estimation of the effects of utilization of mobile money services on performance of MSEs.

3.4 Empirical Specifications

3.4.1 Determinants of Household Utilization of Mobile Money Services

To establish the determinants of utilization of mobile money services by households, the model specified as in (3.21) according to Shiferaw, Kassie, Jaleta, and Yirga, (2014) was estimated

$$M_i = X_i'\beta + \varepsilon_i \tag{3.21}$$

Where M_i is a decision to use mobile money service. X_i is a vector of household and background characteristics that may influence household decision to use mobile money and they include: household size, age of the household head, marital status of the household head, household level of dependency, vulnerability level of the household, residence of the household, education level of the household head, average cost to the mobile money agent, mobile phone ownership, average cost to the nearest bank, group membership, and wealth quintile level. β is a vector of unknown coefficients and ε_i is a standard normally distributed random error term.

The priori expectations for the variables used in the study are presented in parentheses as follows: household size (+), age of the household head (+), marital status of the household head (+), household level of dependency (+), vulnerability level of the household (+), residence of the household (+), education level of the household head (+), average cost to the mobile money agent (-), mobile phone ownership (+), average cost to the nearest bank (+), group membership, and wealth quintile level (+).

3.4.2 Effect of Utilization of Mobile Money Services on Household Financial Resilience

To analyze the effects of utilization of mobile money service on household resilience, the model was specified as in (3.22) following Khonje *et al*., (2015).

$$R_i = X_i'\beta + \varepsilon_i \quad (3.22)$$

Where R_i represents the household financial resilience to shocks, X_i is a vector of household and background characteristics that may influence household resilience to financial shocks and they include the characteristics mentioned in (3.21). To estimate equation (3.22), Endogenous Switching Regression model was employed to find the treatment effects and was explicitly specified according to Asfaw *et al*., (2012) as in (3.23) to (3.25).

$$M_i = X_i'\beta + \mu_i \quad (3.23)$$

$$\text{Regime 1}: R_{1i} = \alpha_1 G_{1i} + \delta_{e1u}\hat{\lambda}_{1i} + e_{1i} \; if \; M_i = 1 \quad (3.24)$$

$$\text{Regime 2}: R_{2i} = \alpha_2 G_{2i} + \delta_{e2\mu}\hat{\lambda}_{2i} + e_{2i} \; if \; M_i = 0 \quad (3.25)$$

Where M_i is a latent variable that represents the i^{th} household decision to or not to use mobile money service. X_i is a vector of explanatory variables that determines the household's decision to use mobile money services which include; household size, age of the household head, marital status of the household head, education level of the household head, household level of dependency, vulnerability index of the household, residence of the household, average cost to the mobile money agent, mobile phone ownership, average cost to the nearest bank, group membership, and wealth quintile level. R_i is the households' resilience which was measured by a dummy indicating

whether a household was able to bounce back after a shock or otherwise. α_{ji}, and δ are parameters to be estimated. G_{ji} is a vector of household's characteristics that are thought to influence the households resilience in the event of a shock which include: household size, age of the household head, marital status of the household head, education level of the household head, household level of dependency, vulnerability index of the household, residence of the household, mobile phone ownership, and wealth quintile level of the household. $\lambda_i s$ are the inverse mill ratios obtained from selection equation. e_{1i} and e_{2i} are independently and identically distributed error terms (Khonje *et al*., 2015).

Full Information Maximum Likelihood (FIML) being an efficient method was used to estimate ESR models (Lokshin & Sajaia, 2004). The method takes into account complete systems of equations and all the coefficients are estimated jointly. Estimators found through FIML enjoy all the attributes of maximum likelihood estimators (Awotide, Abdoulaye, Alene, & Manyong, 2015). The FIML estimates the probit criterion or selection equation (equation 3.3) and the outcome equations (equations 3.4 and 3.5) simultaneously so as to produce consistent standard errors, therefore enabling $\hat{\lambda}_{1i}$ and $\hat{\lambda}_{2i}$ in the second stage equations homoscedastic. The logarithmic likelihood function based on the assumption about the distribution of the error term is given as:

$$Ln\ L_i = \sum_{i=1}^{N} M_i \left[ln\phi\left(\frac{e_{1i}}{\delta_{e1}}\right) - ln\delta_{e1} + ln\Phi(\varphi_{1i}) \right] + (1 - M_i) \left[ln\phi\left(\frac{e_{2i}}{\delta_{e2}}\right) - ln\delta_{e2} + \ln(1 - \Phi(\varphi_{2i})) \right] \quad (3.26)$$

Where $\varphi_{ji} = \frac{\left(X_i\beta + \frac{\rho_j e_{ji}}{\sigma_j}\right)}{\sqrt{1-\rho_j^2}}$, $j = 1, 2$, with ρ_j indicating the correlation coefficient between the error terms μ_i of probit criterion equation (3.3) and that of e_{ji} of equations (3.4) and (3.5), respectively.

3.4.3 Determinants of MSEs' Utilization of Mobile Money Services

To analyze the determinants of MSEs utilization of mobile money services, a probit model was used as specified in (3.27) following Asfaw *et al*, (2012).

$$F_i = Z_i'\beta + \mu \tag{3.27}$$

Where F_i is the decision of the i^{th} firm to either utilize mobile money services or not, that is, $F_i = 1$ is the decision to utilize and $F_i = 0$ otherwise, Z_i is a vector of the i^{th} firm characteristics, firm-owner and institutional variables and they include the following together with their priori expectations in parentheses; sex of the firm owner (+/-), education level of the firm owner (+), location of the firm(+/-), registration status of a firm (+), group membership of the firm owner (+), credit access (+), ownership structure (+/-), mobile phone ownership (+), ownership of radio (+), number of employees (+) and number of business units (+). β is a vector of coefficients and μ is the random error term.

3.4.4 Effects of Utilization of Mobile Money Services on MSEs Performance

To analyze the effects of utilization of mobile money services on MSEs performance, the study used PSM framework and was specified as in (3.28).

$$ATET = E(I_U|F = 1) - E(I_N|F = 0) \tag{3.28}$$

Where I_U and I_N represents the firm income from utilization and non-utilization of mobile money services, respectively. $F = 1$ and $F = 0$ represents the decision to and not to utilize mobile money services, respectively. $E(I_U|F = 1)$ is the treated firms' expected annual firm income conditional on utilization of mobile money services and $E(I_N|F = 0)$ is non-treated firms' expected outcomes conditional on utilization of mobile money services. Estimation of $E(I_N|F = 0)$, that is, how non-utilizing firms' income would have been had they utilized mobile money services, will be simulated.

3.5 Definition and Measurement of Variables

Variables used to analyze determinants and effects of utilization of mobile money services on household resilience are presented in Table 3.2

Table 3. 2: Study Variables for Analysis of Utilization of Mobile Money Services and Household Financial Resilience

Variable	Definition	Measurement
Utilization of Mobile Money Service	Is the use of mobile money services by a household to receive payments to borrow and to save money	Represented by a dummy variable, where 1= HH Utilized, 0 = otherwise
Household Financial Resilience	Refers to whether the household was able to bounce back after the shock	Represented by a dummy where 1= Bounced back, 0=Otherwise
Wealth Quintile Level	Refers to the level of the household wealth in terms of total value of its holdings which includes total value of assets, land size and its living conditions	Represented by a dummy where 1= Highest, 2 = Middle, 3 = Lowest
Household Size	Refers to the total number of members of a household in the past one year	Represented by total number of persons in a household
Household level of dependency	Refers to the level of burden of dependency in a household	Represented by the number of school going children in the past one year
Age of the household Head	Refers to the age of the head of the household in years	Represented by the total number of years
Education level of the household head	It is the level of education level attained by the HH head	Represented by a dummy variable where 1= No education, 2 = Primary, 3 = Secondary and 4 = Tertiary, 5 = Others
Marital status of the household head	Refers to whether the head household head is married or not in the past one year,	Represented by a dummy variable where 1 = Married and 0 = otherwise
Mobile Phone ownership	Refers to whether any member of the household possess mobile phone or not,	Represented by a dummy variable where 1 = own a phone and 0 = otherwise
Cost of transport to nearest to the nearest bank	Refers to the average transport cost to the nearest commercial bank.	Measured by the average total cost in Kenyan shillings
Group Membership	Refers to whether the household member(s) belong to any group for purpose of sharing financial ideas	Represented by a dummy variable where 1 = Belong to a group, 0 = otherwise
Cost of transport to nearest mobile money agent	Refers to the average transport cost to the nearest mobile money agent.	Measured by the total cost in Kenyan shillings
Household Level of Vulnerability	Refers to whether a household lived without enough food in the past one year.	Represented by a dummy where, 1= Vulnerable (Without food), 0= Not Vulnerable (With food)

Table 3. 3: Study Variables for Utilization of Mobile Money Services on MSEs Performance

Variables used to analyze determinants and effects of utilization of mobile money services on household resilience is presented in Table 3.2

Variable	Definition	Measurement
MSE Utilization of Mobile Money Service	Refers to use of mobile money services by a firm to receive payments ,to borrow, and to save money	Represented by a dummy where 1= Firm Utilized, 0 = otherwise
Sex of the firm owner	Refers to whether the firm owner is a male of female	Represented by a dummy where, 1 = male and 0 = female
Firm owner education level	Refers to the level of education attained by owner of the firm	Represented by a dummy where 1 = No Education 2 = Primary, 3 = secondary and 4 = Tertiary
Monthly Net Income of the Firm	Refers to the gross monthly income earned by the establishment in the past year	Measured in Kenyan Shillings
Number of firm employees	Refers to the number of firm employees (casual or permanent) in the past year	Measured by the total number of employees
Number of business Units	Refers to the number of independent businesses ran within the firm	Measured by the total number of business units
Location type of the firm	Refers to the nature location of the area of operation of the firm, whether fixed or not in the past year	Represented by a dummy where 1= Fixed and 0 = Not Fixed
Business Ownership Structure	Refers to whether formal registration of the firm was either sole proprietorship, partnership or as a company in the past year	Represented by a dummy where 1= Sole Proprietor, 2= Partnership, 3= Company
Registration of business	Refers to whether a firm has a valid business permit over the past year where	Represented by a dummy where 1= Yes (Has a Permit)and 0 = No (No permit)
Radio Ownership	Refers to whether the firm owner owns a radio in the past one year	Represented by a dummy where 1= Owned, 0= Not owned
Mobile Phone Ownership	Refers to whether the firm owner owns a mobile phone in the past one year	Represented by a dummy where 1= Owned, 0= Not owned
Access to Credit	Refers to whether the firm accessed credit in the past one year	Represented by a dummy where 1 = Accessed Credit, 0 = Otherwise

3.6 Data Type and Source

The study used the 2019 FinAccess dataset for analysis on household utilization of mobile money services. The data was collected jointly by Kenya National Bureau of Statistics (KNBS), Central Bank of Kenya and Financial Sector Deepening (FSD) Kenya. The 2016 MSMEs establishment data collected by Kenya National Bureau of Statistics was used for the analysis of utilization of mobile money services by MSEs. The data was cross-sectional in nature and nationally representative.

3.7 Target Population

The study used data from FinAccess survey that targeted respondents who were 16 years and above. The data which comprised of 8,669 households in Kenya was collected in 2018. From this data, households were systematically selected which was envisaged to offer estimates both at the national and regional level and by extension, on the area of residence (urban and rural areas). Households that experienced financial shocks and were found to have utilized mobile money services were selected. A different set of data for business establishments in Kenya collected by KNBS in 2016 was also used in the analysis. A total of 24, 164 samples from the establishment's data were picked. The firms that used mobile money services were selected and their financial performance analyzed against mobile money services use and non-use.

3.8 Diagnostic Tests

To ensure that the estimated models were reliable and valid, a number of diagnostic tests were conducted. These includes Multicollinearity Test which was done using Variance Inflation Factor (VIF), specification test done using link test, goodness of fit using

Hosmer-Lemeshow (H-L) test, heteroskedasticity test which was carried out using Breusch-Pagan/Cook-Weisberg test, and the balancing test for PSM model using Kernel Based Matching (KBM) method.

3.9 Model Estimation and Data Analysis

Before the data was estimated to address the study objectives, it was first cleaned to get rid of inconsistencies, missing observations, outliers and other errors. Descriptive summary of the data on the study variables which included mean, range, standard deviation and proportions was then done. Furthermore, t-tests and z-tests were carried out between those that utilized mobile money services and those who did not.

Heteroskedastic probit model was estimated to establish the determinants of utilization of mobile money services by households (first objective) and firms (third objective). The model was estimated using maximum likelihood estimation approach. The estimated equations for the first and third objective were (3.21) and (3.27), respectively. This model was preferred as a solution for estimating a model where heteroskedasticity was present in the data. After estimating heteroskedastic model, marginal effects of coefficients were estimated and interpreted accordingly.

The second objective was to analyze the effects of utilization of mobile money services on household financial resilience. This was achieved by estimating endogenous switching regression model which was estimated using Full Information Maximum Likelihood (FIML) (equations 3.23 to 3.25). This method estimates selection equation in form of probit to generate inverse mills ratios (IMR). The IMR values which were

predicted were then added back to outcome equations (users and non-users of mobile money services) as explanatory variables and the equations re-estimated simultaneously. Average treatment effects on the treated were obtained by the expected difference between users and non-users, and the average treatments effects on the untreated on users had they not used and non-users had they used were then computed and checked for statistical significance.

The fourth objective on the effect of utilization of mobile money services on MSEs performance was achieved by estimating a propensity score matching (PSM) model specified in equation. (3.28). Under the PSM technique, a probit model was first estimated to get the propensity scores whereby the dependent variable was 1 if firm utilized mobile money service and 0 otherwise. In the second step, balancing properties and overlap condition of propensity scores were then checked to ascertain that the scores were appropriate to ensure quality matches. In the third step, matching process of score was done using the Nearest Neighborhood Matching (NNM) algorithm. From the PSM, ATET were obtained and statistical significance checked and interpreted accordingly.

CHAPTER FOUR

EMPIRICAL FINDINGS

4.1 Introduction

In this chapter, the findings of the study and their discussions are presented. The chapter begins with presentation and the discussion of the results of descriptive statistics of all the variables that were used in the analysis. The subsequent section presents the relevant diagnostic tests, analysis and the discussion of the results for each objective of the study.

4.2 Descriptive Statistics of Data on Variables Used on Household Financial Resilience

Descriptive statistics on the variables used in the analysis of household's utilization of mobile money services and its effects on household's financial resilience were based on data obtained from FinAccess (2019) dataset. The descriptive statistics used included range, mean and the standard deviation of the variables used in the study. To establish whether statistical differences in means exist between utilization and non-utilization of mobile money services, t-test was used. The differences in means and frequencies of the users and non-users of mobile money services are shown in Table 4.1 in differences column. The descriptive statistics for both count and continuous variables are also shown in Table 4.1.

Table 4. 1: Descriptive Statistics for Discrete and Continuous Variables

Variable	Range		Total Sample N=8,669	Those who utilized Mobile Money (1) N= 6,471(74.65%)	Those who did not utilize mobile money (0) N= 2,198(25.35%)	Difference in Means	P-value
	Maximum	Minimum	Mean (S.D)	Mean (S.D)	Mean (S.D)		
Household Size	21	1	3.974276 (2.321904)	3.86524 (2.264315)	4.295268 (2.456297)	-0.43002***	0.0000
Household level of dependency	10	0	1.752221 (1.823796)	1.69541 (1.732348)	1.919472 (2.061056)	-0.22406***	0.0000
Average Cost of transport to the nearest bank	500	50	110.2 (108.0489)	100.6 (96.52933)	139.1 (132.8609)	-38.4667***	0.0000
Age	95	16	39.29369 (17.10364)	39.0306 (14.95203)	40.06824 (22.24811)	-1.03764***	0.0140
Average Cost of transport to nearest mobile money agent	500	0	33.4 (91.47891)	22.5 (67.96693)	65.4 (134.3)	42.92316***	0.0000

Note: N= Total number of observations, S.D= Standard Deviation (in Parentheses), Asterisks (**) and (***) represents statistical significance level at 1% and 5%, respectively. P represents the probability value of the difference in the mean between those who utilized mobile money services and those who did not.

Source: **Author's Computation Based on FinAccess Database (2019)**

The descriptive statistics on the household size showed that a household had a minimum size of one person while the maximum was 21 persons. The average mean for the total sample was approximately 4 persons per household. This conformed to the report of 3.9 persons per household by Kenya Demographic Health Survey (KDHS) in 2014 (Republic of Kenya, 2014). On the utilization of mobile money, the difference in means between those who utilized the service and those who did not was significant at 1 percent level. On average, there were more persons per household at 4.2 for those who did not utilize mobile money services. Those who utilized mobile money had 3.8 persons per household. The result suggests bigger households have low rate of utilization of mobile money services. This is contrary to the idea that bigger households would require more resources for the expanded budget and hence may necessitate pooling of more resources.

The household level of dependency was obtained from the household's total number of school going children. The data revealed that the households that did not utilize mobile money services had a higher dependency level (1.9) than the households that utilized (1.6). The difference in means between the two groups was significant at 1 percent level. This is consistent with the belief that households that lack access to financial services may experience low welfare levels therefore resulting to increased levels of dependency (Dupas & Robinson, 2013).

The minimum age of the household head was 16 years while the maximum was 95 years with the average age being 39 years. The average age for those who utilized mobile money services was 39 years while for those who did not utilize was 40 years. The

difference in means was statistically significant at 5 percent level. This shows that majority of those who utilize mobile money services are younger than those who do not.

Regarding the average cost of transport to the nearest commercial bank, the minimum cost was Ksh 0 while maximum was Ksh 500 and the average cost for the total sample was Khs 110. Households that did not utilize mobile money services incurred an average cost at Ksh 139 while those who utilized the service spent Ksh 100 on transport to the nearest commercial bank. The difference in means between the two groups of mobile money users was also statistically significant at one percent. This may imply that those who utilize the service spent lower amount in terms of transport when seeking financial services since mobile money services are easily available because they are provided through mobile phone. For those that do not utilize, they have to seek for other alternative means of accessing financial services such as from commercial banks which in most instances have proximity challenges to the users.

On the average cost to the nearest mobile money agent, the minimum and maximum cost was Ksh 50 and Ksh 500, respectively, while the average cost for the entire sample was Ksh 33.4. For those who utilized mobile money services, the average cost to the nearest mobile money agent was Ksh 22.5 while those who did not utilize had their average cost being Ksh 65.4. The difference in means of those who utilized and those who did not was statistically significant at one percent level. Users of mobile money services experience lower transport cost than non-users because of proximity and widespread distribution of mobile money agents.

To describe the categorical variables that were used for analyzing determinants and effects of utilization of mobile money services on household financial resilience, frequencies of the variables for those who utilize and those who did not together with the differences in their proportions are presented in Table 4.2.

Table 4. 2: Descriptive Statistics for Categorical Variables

Variable	Total Sample			Utilized Mobile Money (1) N= 6,471(74.65%)		Did not utilize mobile money (0) N= 2,198(25.35%)	
	Measurement	**N**	**%**	**N**	**%**	**N**	**%**
Utilization of Mobile Money Services	Yes	6,471	74.65				
	No	2,198	25.35				
Household Resilience	Resilient	1,276	14.72	1,000	15.45	276	12.56
	Non-Resilient	7,393	85.28	5,471	84.55	1,922	87.44
Education level of the Household Head	None	1,305	15.05	684	10.57	621	28.25
	Primary	3,726	42.98	2,749	42.48	977	44.45
	Secondary	2,582	29.78	2,022	31.25	560	25.48
	Tertiary	1,041	12.01	1,003	15.50	38	1.73
	Other	15	0.17	13	0.20	2	0.09
Residence of the household	Rural	5,058	58.35	3,471	53.64	1,587	72.20
	Urban	3,611	41.65	3,000	46.36	611	27.80
Marital Status of Household Head	Married	5,050	58.31	4,139	64.04	911	41.47
	Not Married	3,610	41.69	2,324	35.96	1,286	58.53
Household Level of Vulnerability	Vulnerable	3,143	36.26	2,050	31.68	1,093	49.73
	Not Vulnerable	5,526	63.74	4,421	68.32	1,105	50.27
Mobile Phone ownership	Owned	6,885	79.42	6,316	97.60	569	25.89
	Not Owned	1,784	20.58	155	2.40	1,629	74.11
Group Membership	Group Member	2,409	27.79	2,157	33.33	252	11.46
	Not a Group member	6,260	72.21	4,314	66.67	1,946	88.54
Wealth Quintile Level of Household	Highest	2,935	33.86	2,566	39.65	369	16.79
	Middle	1,617	18.65	1,342	20.74	275	12.51
	Lowest	4,117	47.49	2,563	39.61	1,554	70.70

Notes: N= Total number of observations, S.D= Standard Deviation (in Parentheses).

Source: Author's Computation **Based on FinAccess Database (2019)**

From Table 4.2, the proportion of households that utilized mobile money was 74.6 percent of the total numbers of households while those that did not utilize was 25.4 percent. The high level of those who utilized mobile money services was an indication of increased uptake of these services owing to its affordability and availability to majority of the households in Kenya. The high utilization rate was attributed to rapid growth in mobile money agents which are widespread across both the urban and the rural areas unlike commercial banks which are mostly concentrated in urban areas.

From the entire sample, 14.7 percent and 85.3 percent of the households were resilient and non-resilient, respectively, to financial shocks. For those who utilized mobile money services, 15.4 percent were resilient to financial shocks while 84.6 percent were non-resilient. For non-users, 12.6 percent were resilient to financial shocks while 87.4 percent were non-resilient. The higher proportions of non-resilient households for both categories of users and non-users points out the problems majority of the households still face when financial shock(s) strike.

On education level of the household head, the data from the sample showed that household heads with primary level of education were the most at 42.9 percent, followed by those with secondary at 29.8 percent and tertiary education holders were 12 percent. Those who had no education were 15 percent. For those who utilized mobile money services, household heads with primary level of education were 43.5 percent and 31.3 percent had secondary education. Household heads with tertiary education were 15.5 percent while those with no education were 10.6 percent. For the households that did not utilize mobile money services, 44.5 percent of the household heads had primary

education while 25.5 percent had secondary education. Household heads with tertiary education were 1.7 percent while those with no education were 28.2 percent. The high percentage of those with primary education was consistent with the view that literacy may enhance the households' decision to utilize mobile money services.

In terms of residence of the household, at least a half of the households from the sample resided in rural areas at 58.4 percent whereas 41.6 percent resided in urban areas. Majority of those who utilized mobile money services resided in rural areas which were at 53.6 percent while 46.4 percent resided in urban areas. This was consistent with the idea that majority of those in rural areas utilized mobile money services because they could not access formal financial institutions which are mostly located in urban areas. They would therefore resort to using mobile money services as a means of financial access. For those that did not use mobile money services, 72.2 percent of them live in rural areas while 27.8 percent live in urban areas. The difference in proportions in residence between those who utilized mobile money and those who did not may suggest that a rural household is more likely not to utilize mobile money services compared to an urban household.

Considering the marital status of the household head in the entire sample, majority of them (58) were married and 42 percent not married. For those who utilized mobile money services, 64.04 percent of heads of the household were married while those who did not utilize mobile money services, 41.47 percent of the household whose heads were married, the others being unmarried. This points to the view that a household head whose is married may have his/her household size being bigger than the one who is not

married. Bigger household size prompts for more resources so as to ensure smooth consumption. More resources means more household expenditure and therefore households have to explore various means to get more resources including using mobile money services to access financial resources.

Data from the study sample demonstrated that 36.3 percent of the households were vulnerable while 63.7 percent were not. Those who utilized mobile money services and were vulnerable were 31.7 percent while 68.3 percent were not vulnerable. Those who did not use the service and were vulnerable were 49.7 percent while those not vulnerable were 50.3 percent. From the statistics, the difference in proportions between the two groups revealed that households that utilized mobile money services were less vulnerable than those that did not utilize. This may imply that mobile money services decreases household's vulnerability.

In terms of mobile phone ownership, 79 percent of the households in the sample owned a mobile phone while 21 percent did not. For those that utilized mobile money services, 97.6 percent of them owned a mobile phone while 2.4 percent did not. For those who did not use mobile money, 25.9 percent of them owned a mobile phone while 74.1 percent did not own. This observation was in conformity with the view that majority of those who owned a mobile phone use the same phone to access mobile financial services including mobile money. This suggests that mobile phone ownership influences a household individual to register for mobile money services.

On whether households belong to a group such as *chama,* 27.8 percent of the total sample belonged to a group while 72.2 percent were not members of any group. For the

households that utilized mobile money services, 33.5 percent of them were members of a group while 66.7 percent were not. For those that did not use mobile money services, 11.5 percent were members of a group while 88.5 percent were not. The difference in proportion between the two groups indicates that mobile money users who are members of a group are more than non-users. Further it suggests that members in a group were most likely to adopt use of mobile money services than those who were non-members.

With regard to the wealth quintile levels of the households, 33.9 percent belonged to the highest wealth quintile. 18.7 percent of the households were in the middle wealth quintile level while 47.5 percent of the sample was in the lowest wealth quintile. Users of mobile money services had 39.7 percent of the households in highest wealth quintile, 20.7 percent in the middle while 39.6 percent were in the lowest wealth quintile. Households that were non-users of mobile money services on the other hand had 16 percent in highest wealth quintile level with 12.5 and 72.2 percent of its members being in middle and lowest wealth quintiles, respectively. Comparison between users and non-users of mobile money services shows that users at the highest and middle level of wealth quintile were more than non-users. The difference in proportions between the two groups was in tandem with the idea that wealthier households have more resources and bigger expenditures and hence are more likely to utilize mobile money services than those in lower wealth quintile.

The unconditional summary statistics of the variables that have been discussed showed that the variables may explain the difference in utilization of mobile money services by households in Kenya. However, given that the decision to utilize mobile money is

endogenous, a simple comparison of the variables on the decision to use mobile money has no causal interpretation. This is because there might be other confounding factors which may affect the household's decision to utilize mobile money services and its subsequent effect on household resilience. In the subsequent chapter, a rigorous multivariate analysis was conducted that unmasked the individual differences that arose.

4.3 Determinants of Households Utilization of Mobile Money Services

The study analyzed the determinants of utilization of mobile money services at the household level in Kenya using a binary probit model which was fitted by Maximum Likelihood Estimation (MLE). The output of the estimation from the model is presented in Table A1 in the Appendix. However, the marginal effects are presented in Table 4.3 in section 4.3.2. Relevant diagnostic tests were conducted to ascertain the validity of the results. The results of relevant diagnostic tests are presented and discussed in section 4.3.1.

4.3.1 Diagnostic Tests Results

To test presence of multicollinearity in the estimated model, Variance Inflation Factor (VIF) was used. VIF which ranges between 1 and 10 identifies the correlation between regressors and also the strength of that correlation. As a rule of thumb, Multicollinearity is considered to be present if a variable has a VIF in excess of 10. The result of the test is presented in Table A2 in the Appendix showed the absence of multicollinearity since VIF of all the variables was less than 10. A mean value of 1.73 of VIF was a further confirmation of the absence of multicollinearity in the model.

Model misspecification may happen if one or more variables are omitted from the model or if irrelevant variables are incorporated into the model. Whenever relevant variables are erroneously omitted, the standard variance shared with the variables included may be incorrectly ascribed to those variables hence inflating error term. Generally, model misspecification can substantially affect the estimates of the regression coefficients. To establish whether the model was correctly specified, Link test was conducted. The test is based on the view that if a model is correctly specified, any additional explanatory variables cannot be found unless inadvertently. The test creates two new variables, the prediction variable (*hat*) and squared prediction variable $(hatsq)$. For a correctly specified model, the prediction variable (*hat*) should be significant while *hatsq* should not. The results of the test are reported in Table A3 in the Appendix and it showed that the prediction variable (*hat*) was statistically significant since its p-value was 0.000 while *hatsq* was not since it p-value was 0.806. Therefore the model was correctly specified.

Hosmer-Lemeshow (H-L) test was carried out to establish the goodness of fit of the model. The tests determine whether observed binary responses, conditional on vector of covariates (confounding factors), are consistent with predictions, that is, if the number of outcomes in the regression indicates the number of outcomes observed in the data. When the predictions in the data fit data model appropriately, then the probability value of H-L is not statistically significant. Table A4 in the Appendix showed that the p-value of the test was insignificant (p-value was 0.8990) and hence concluding that the data appropriately fitted well in the model.

Heteroskedasticity was established using the Breusch-Pagan/Cook-Weisberg test after running a probit model. The null hypothesis in the test is that the variance of the error is a constant (homoscedasticity) against the alternative that the error variance is an increasing function of one or more variables (heteroscedasticity). The probability value of Breusch-Pagan/Cook-Weisberg test statistic from Table A5 in the Appendix was 0.000. As a result, the null hypothesis of homoscedasticity was rejected and concluded that heteroskedasticity was present in the data. This problem was addressed by using heteroskedastic probit (Alvarez & Brehm, 1995). The heteroskedastic model has been widely used to analyze heterogeneous choices and behaviors (Alvarez & Brehm, 1997; Busch & Reinhardt, 1999). This model specifies the probit model by extending a standard normal cumulative distribution function (CDF) of a random variable to a normal cumulative distribution function with a variance not fixed at one but which varies as a function of independent variables (Obebo *et al*., 2018). The model addresses the disparities in variances of binary outcomes by producing heteroskedastic-robust standard errors.

4.3.2. Results of Determinants of Households Utilization of Mobile Money Services

To establish the determinants of utilization of mobile money services by households, heteroskedastic probit model was therefore estimated and its output is presented in Table A6 in the Appendix. Heteroskedastic probit (hetprob) model was then used to compute marginal effects on the determinants of household utilization of mobile money services. The results are presented in Table 4.3

Table 4. 3: Marginal Effects of Determinants of Household Utilization of Mobile Money Services

Model	Heteroskedastic Probit		
Dependent Variable: 1 if a Household Utilized Mobile Money Services, 0 otherwise			
Independent Variables	Marginal Effects (dy/dx)	Robust Std. Errors	P-Value
Marital Status of the Household Head (Married)	0.0544***	0.0077	0.000
Household Size	-0.0048**	0.0023	0.038
Household Level of Dependency	0.0056**	0.0026	0.035
Age	0.0009***	0.0002	0.001
Residence of the Household (Urban)	0.0217***	0.0076	0.004
Group Membership (Group Member)	0.0131**	0.0068	0.054
Average Cost to the Nearest Mobile Money Agent	-0.0001**	0.0000	0.013
Mobile Phone Ownership (Yes)	0.7807***	0.0152	0.000
Average Cost to the Nearest Bank	0.0000	0.0000	0.759
Wealth Quintile Level (Highest)	-0.0152	0.0096	0.113
Wealth Quintile Level (Middle)	0.0203**	0 .0091	0.027
Wealth Quintile (Low)	0.0091	0.0088	0.303
Vulnerability Index (Vulnerable)	0.0009	0.0072	0.895
Education (Primary)	0.0755***	0.0163	0.000
Education (Secondary)	0.0815***	0.0177	0.000
Education (Tertiary)	0.1498***	0.0199	0.000
Education (Other)	0.1570***	0.0288	0.000
Number of obs. = 6,895.Wald chi2 (15) = 283.35, Prob > chi2 = 0.0000.			

Asterisks **, *** denotes statistical significance at 10 percent, 5 percent and one percent levels, respectively. No education and lowest wealth quintile were the reference categories.

Source: Author's Computation Based on FinAccess Database (2019)

The results Table 4.3 shows that household size, household level of dependency, age of the household head, average cost to the nearest mobile money agent, marital status of the household head, residence of the household, group membership of the household, education level of the household head and mobile phone ownership determined utilization of mobile money services at the household level in Kenya. This was because

the marginal effects were all statistically significant at 10 and 5 percent significance levels. The marginal effects of average cost to the nearest bank, wealth quintile level of the household and vulnerability level of the household were found not to be statistically significant and hence were not important in determining utilization of mobile money services by households in Kenya.

The marginal effect of marital status of the household head was positive and statistically significant at one percent level. Its value showed that there was a probability of 0.054 that household whose head was married was more likely to utilize mobile money services than the households whose head were not married, all other factors held constant. Findings of the study may imply that household whose heads were married may have experienced increased liquidity needs to cater for expanding household budget and hence utilizing mobile money services may be one of the approaches of accessing financial resources. This was consistent with the findings of a study by Munyegera and Matsumoto (2016) on determinants of mobile money adoption by households in Uganda.

On the household size, the marginal effect was negative and statistically significant at 5 percent level. The marginal effect of -0.00489 showed that an increase in household size by one person decreases the probability of using mobile money services by 0.005 percentage points. This result was inconsistent with the expectation and some studies such as that of Kikulwe *et al*. (2013) which showed that increase in household size may increase adoption of mobile money services. With a bigger household size, there will be increased liquidity needs of a household and hence the need for more resources to gather for expanding household budget.

The marginal effect of the household level of dependency was positive and statistically significant at 5 percent level. Holding other factors constant, an increase in a household's level of dependency by one unit, increased the probability of utilization of mobile money services by 0.05 percentage points. The result was consistent with the view that higher burden of dependency triggers greater use of mobile money services as a mean of accessing financial resources to deal with more emerging needs of a household burdened by a higher dependency ratio. This finding was also consistent with that of Dupas & Robinson (2013) who found that dependency level of the household influences adoption of mobile money services. The burden of dependency of households may also call for household reliance on other individuals such as friends and network of family members in meeting some of their needs. Some of the friends and network of family members may be widely spread and will therefore warrant the use of mobile money services.

On the age of the household head, its marginal effect was positive and statistically significant at one percent level. As age of the household head increases by one year, the probability of using mobile money services increases by 0.098 percentage points, other factors kept constant. This may suggest that as the household head gets older, the burden of dependency may set in since the household head may have retired or become unproductive. This necessitates the need for more resources to cater for the family needs and use of mobile money services may be one of the channels for accessing financial resources hence may lead to increased demand for mobile money services. Sekabira &

Qaim (2017) in establishing the determinants of mobile money adoption in Uganda also found similar findings.

Regarding the residence of the household, there was a probability of 0.023 that a household that resides in urban area was more likely to utilize mobile money service than a household that lives in rural areas, other factors being constant. The result was statistically significant at 5 percent level. The result of this findings indicated that majority of the households in urban areas have got an advantage in terms of access to diverse financial services, mobile money included. Utilization of mobile money services may also be influenced by higher levels of income since majority of them are in jobs with regular incomes compared to those in rural areas who, more often, depends on seasonal agricultural incomes. Further, majority of urban residents may increase saving or borrowing with mobile services. However, for those in rural areas, myriad of challenges ranging from low incomes to barriers in access to financial services may limit their chance of utilizing mobile money services. It was also found by Kirui and Nyikal (2012) that urban residents were more likely to adopt mobile money services than rural residents in Kenya.

Concerning group membership, the marginal effect was positive and statistically significant at 10 percent level. There was a probability of 0.013 that a household that was a member of a group such as *chama,* was more likely to utilize mobile money services than a non-member household, all other factors being constant. With the advent of mobile money services, group membership has become more efficient since members can make contributions or even borrow from the group without necessarily having to

convene a meeting. This could suggest that groups encourage the use of such services among their members. This finding was consistent with that found in a study by munyegera and Matsumoto (2016) which showed that group membership increases the possibility of adoption of mobile money services. Group membership may also be crucial in times of shocks such as emergencies like illness or sudden loss of income. This is so because such groups can provide immediate financial access as members borrow with no collateral requirement.

The marginal effect of average cost of transport to the nearest mobile money agent was negative and statistically significant at 5 percent level. Holding other factors constant, a shilling increase in the cost of transport to the nearest agent reduces the probability of using mobile money by 0.01 percentage points implying that households choose to subscribe to mobile money services if the cost of transport is relatively cheap. Cheap transport cost is associated with the shorter distance to the nearest mobile money agent. It should be borne in mind that mobile money booths and agents are essential factors in easing mobile money transactions in terms of deposits and withdrawals and their geographical distance to household matters very much to the rate of mobile money services utilization. Munyegera and Matsumoto (2016) study also found a negative and statistically coefficient of the cost of transport to the nearest mobile money agent.

In terms of mobile phone ownership, its marginal effect was positive and significant at one percent level. Household that owned a mobile phone had a probability of 0.78 percentage points of utilizing mobile money services than those that did not own it. This implies that mobile phone ownership positively influences utilization of mobile money

services. The reason might be that mobile money services are offered through a mobile phone handset. From the descriptive statistics in Table 4.4, a large percentage (79 percent) of households owned mobile phones. This is an indication that majority of those who own a mobile phone are likely to be familiar with mobile phone applications which are essential in enhancing use of mobile money services. Such applications may include *M-Pesa, M-Shwari,* KCB-*Mpesa, Branch, Tala,* and *Okash*. This finding was consistent with findings in the study by Sekabira & Quaim (2017) and Kikulwe *et al.* (2013).

With regard to wealth quintile level of the household, the marginal effect of a household on middle wealth quintile was positive and statistically significant at 5 percent level. There was a probability of 0.027 that a household on middle level of wealth quintile was more likely to utilize mobile money services than the one on either low or highest wealth quintile level. This implies that a household with average level of wealth utilizes mobile money services more than those on either extreme. The marginal effect of households on low wealth quintile level despite being positive was statistically insignificant. Similarly, the coefficient of highest wealth quintile was negative despite not being statistically insignificant which may imply that wealthy households may not care much about the use of mobile money services but may be using other means such as use of checking accounts with banking institutions.

On education of the household head, the coefficients for all the levels of education were positive and statistically significant. There was a 0.075 percentage points that a household head with primary level of education was more likely to utilize mobile money services than a household head with no education. For a household head with secondary

level of education, the probability of utilizing mobile money services increased by 0.081 percentage points compared to a household head with no education. The probability of utilizing mobile money services was highest for a household head with tertiary and other levels of education which was at 0.14 and 0.15 percent points, respectively. This showed that utilization of mobile money services increases with higher levels of education which implied that the more the educated the household head is, the higher the likelihood of using mobile money services. This is because literacy affects awareness and the required skills to use mobile money services. This finding is shared by Kirui *et al*., (2012) and Munyegera and Matsumoto (2016).

4.4. Effects of Utilization of Mobile Money Services on Household Financial Resilience

To analyze the effects of utilization of mobile money services on household financial resilience in Kenya, an endogenous switching regression (ESR) was estimated using Full Information Maximum Likelihood (FIML). In the study, resilience which was a binary variable was used as the dependent variable where a household was considered resilient if it was able to recover and return to its original position after experiencing a shock and non-resilient if otherwise. The results of ESR are presented in Table 4.4.

Table 4. 4: Full Information Maximum Likelihood Estimates of Endogenous Switching Regression for Household Financial Resilience

Model	Selection Equation (Probit)			Utilization of Mobile Money Equation (Regime 1)			Non-Utilization of Mobile Money Equation (Regime 2)		
Dependent Variable	**Mobile Money Utilization**			**Household Financial Resilience**			**Household Financial Resilience**		
Independent Variables	**Coefficient**	**Std. Errors**	**P-Value**	**Coefficient**	**Std. Errors**	**P-Value**	**Coefficient**	**Std. Errors**	**P-Value**
Age of the Household Head	0.0026**	0.0012	0.041	0.0012***	0.0003	0.000	0.0006	0.0004	0.109
Household Level of Dependency	0.0432***	0.0153	0.005	0.0164***	0.0042	0.000	0.0002	0.0049	0.964
Household Size	-0.0330**	0.0132	0.013	-0.0151***	0.0034	0.000	-0.002**	0.0043	0.004
Vulnerability Index (Vulnerable)	0.0254	0.0451	0.574	0.0214**	0.0104	0.041	0.0009***	0.0155	0.000
Wealth Quintile Level (Highest)	-0.1387	0.0622	0.026	0.0010	0.0125	0.930	-0.0161	0.0227	0.478
Wealth Quintile Level (Middle)	0.0769	0.0597	0.198	0.0177	0.0129	0.170	0.0163	0.0230	0.477
Residence of the Household (Urban)	0.1170**	0.0458	0.011	-0.0044	0.0099	0.656	0.0388**	0.0169	0.022
Marital Status (Married)	0.4058***	0.0424	0.000	0.0211**	0.0103	0.040	0.0343**	0.0171	0.045
Group Membership (Group Member)	0.0487	0.0479	0.310	0.0191*	0.0103	0.063	0.0240	0.0174	0.167
Mobile Phone Ownership (Yes)	2.6035***	0.0511	0.000	0.0694***	0.0549	0.007	0.0049***	0.0664	0.007
Education (Primary)	0.2226***	0.0628	0.000	0.0374**	0.0166	0.025	0.0333*	0.0198	0.092
Education (Secondary)	0.2831***	0.0743	0.000	0.0452***	0.0183	0.014	0.0048**	0.0265	0.005
Education (Tertiary)	0.8131***	0.1049	0.000	0.0471**	0.0215	0.029	-0.0053**	0.0628	0.002
Education (Other)	0.7621	0.6312	0.227	-0.0471	0.1012	0.642	0.3656	0.2341	0.118
Constant	-1.7332***	0.1156	0.000	0.1439**	0.0690	0.037	0.0633*	0.0354	0.074
Average Cost to the Nearest Bank	-0.0006***	0.0001	0.000						
Average Cost to the Nearest Mobile Money Agent	-0.0005**	0.0002	0.016						
Sigma_1 0.359758 (0.0031927) rho_1 -0.0557809 (0.0838131) Sigma_2 0.3295812 (0.004983) rho_2 0.0204659 (0.1278108) Wald chi2(14) = 66.50 Prob > chi2 = 0.0000 LR test of indep. eqns. : chi2(1) = 0.28 Prob > chi2 = 0.0595									

Number of observations = 8,669. Asterisks ***, ** and * denotes statistical levels of significance at 1 percent, 5 percent and 10 percent, respectively.

Source: Author's Computation Based on FinAccess Database (2019)

From Table 4.4, three equations were jointly estimated, namely probit selection equation, utilization and non-utilization of mobile money outcome equations. Probit selection equation presents the determinants of household utilization of mobile money services. It is from this equation that the inverse mills ratios were derived and added to the outcome equations as part of the regressors so as to address selection bias in the two-step estimation method (Maddala, 1983). Full Information Maximum Likelihood was used since it is the most efficient method of estimating ESR (Lokshin & Sajaia, 2004). As observed from Table 4.4, identification of the model demands that at least one variable from the selection equation should not enter into the outcome equations. Using a series of iterations to establish the variables to be excluded from the outcome equation, average cost of transport to the nearest mobile money agent and the average cost to the nearest bank were excluded since they could not produce desirable results. The two outcome equations were used to estimate the expectations of household financial resilience conditional on utilization of mobile money services. To ascertain the validity of the results, the ESR was subjected to post-estimation diagnostic tests whose results are presented in section 4.4.1. Average Treatment Effects on the Treated (ATET) were then computed from the ESR model.

4.4.1. Post-Estimation Diagnostic Tests Results

Wald Chi-square test was used to test the null hypothesis of interdependence of jointly estimated model of utilization and non-utilization of mobile money equations. The test result in Table 4.4 showed that Wald Chi Test coefficient was statistically significant at one percent level since its probability value was 0.000. This implied that the two

equations were statistically different hence jointly estimating them simultaneously was appropriate.

To examine for the endogeneity presence in the estimated model, correlation coefficient terms from the selection and utilization of mobile money outcome equation (rho_1) and the coefficient of correlation between the selection equation and non-utilization of mobile money outcome equation (rho_2) were considered. The test result indicated that the associated probabilities of correlation coefficients rho_1 and rho_2 were statistically significant at 6 percent and 2 percent levels, respectively. Therefore, the null hypothesis of no sample selection bias was rejected indicating existence of endogenous switching. The negative sign of the first parameter indicated a positive selection bias, suggesting that households that were more resilient utilized mobile money services.

Failure to correct for the sample selection and endogeneity biases would yield inconsistent estimates normally depicted by large standard errors. ESR model was deemed the most appropriate in correcting for selection biases. The model also estimated ESR using FIML method which simultaneously fits outcome and selection equation. This method also treats eminent heteroscedasticity in the model therefore producing consistent standard errors and homoscedastic estimates appropriate for interpretation (Maddala, 1983).

4.4.2. Results of the Effects of Utilization of Mobile Money services on Household Financial Resilience

To analyze the effects of utilization of mobile money services on household financial resilience, estimates of utilization and non-utilization of mobile money services from

Table 4.4 were used to compute the average treatment effects arising from utilization. ATET compares expectations of resilience of actual case (users of mobile money services as they were observed) and in counterfactuals (users had they decided not to use). ATEU compares expectation of resilience of non-users (observed) and in the counterfactual (non-users had they decided to use). Results for ATET, ATU, Base Heterogeneities (*BH*) and Transitional Heterogeneity (TH) are presented in Table 4.5.

Table 4. 5: Results of Treatment Effects of Utilization of Mobile Money Services on Household Financial Resilience

Sub-Samples	**Decision Stage**		
	To Utilize	**Not to Utilize**	**Treatment Effects**
Households that Utilized	(a) $\mathrm{E}(W_{1i}/M_i = 1)$	(c) $\mathrm{E}(W_{2i}/M_i = 1)$	ATET
	0.1545351	0.1255689	0.0289662
Households that did not utilize	(d) $\mathrm{E}(W_{1i}/M_i = 0)$	(b) $\mathrm{E}(W_{2i}/M_i = 0)$	ATEU
	0.207585	0.1469022	0.060683
Heterogeneity Effects	BH_1= -0.053050	BH_2= -0.021333	TH= -0.031717

Source: **Author's Computation Based on FinAccess Database (2019)**

Table 4.5 presents the expected probabilities of household financial resilience under actual and counterfactual cases. Cells (a) and (b) are the expected average scores of household financial resilience which were actually observed in the sample while (c) and (d) are the counterfactual cases. The average probability of a household being financially resilient after experiencing a shock was 15.4 percent if they utilized mobile money services. Similarly, had they not utilized mobile money services, a household that experiences a financial shock could have had an average probability of 12.5 percent

financial resilience. Comparing the two categories, the average treatment effect on users of mobile money services was 2.8 percent. This implied that households were 2.8 percent more likely to be resilient utilizing mobile money than if they decided not to use the service. The average probability of resilience for the households that did not utilize mobile money was 14 percent but had they decided to utilize, their probability would have been 20 percent. From these two categories, the average treatment on non-users (untreated) was 6 percent implying that households were 6 percent more likely to be more resilience had they decided to utilize mobile money services.

In terms of first base heterogeneity (BH_1), the value was negative implying that households that did not utilize mobile money services were 5 percent more likely to be resilient utilizing mobile money when they experienced financial shocks than if they had not utilized. The second base heterogeneity (BH_2) was also negative suggesting that for the households that utilized, the probability of being financially resilient reduced by 2.1 percent had they decided not to utilize mobile money services. The negative value of transitional heterogeneity (TH) showed that ATEU was larger than ATET implying that probability of resilience for households that did not utilize mobile money services could have been higher by 3.1 percent had they decided to utilize. TH implied that users of mobile money services were better off than non-users in terms of financial resilience against shocks. These findings were consistent with those of Jack and Suri (2014) who found that households holding accounts with mobile money were more resilient than non-mobile money account holders since former have a higher chance of receiving

greater remittances in terms of intensity and value especially during the events of shocks than the latter.

The positive nexus between mobile money services use and household financial resilience from the estimated treatment effects can also be associated with vital nature of such services in enhancing household financial resilience particularly for the low-income households where safety nets are limited and for those that are available, they are more often unreliable. For such households, access to short-term microloans offered through mobile money services enables many of them to access credit that would not have been accessible with the conventional banking system since such credit facilities do not require any collateral. As a result such households are better placed to respond to shocks without adjusting other expenditures hence are more resilient.

Besides utilization of mobile money services which was the main treatment variable, other variables that influenced household financial resilience included household size, age of the household head, vulnerability index, residence of the household, marital status of the household head, mobile phone ownership, and the education level of the household head. On the age of the household, household resilience increased by 0.1 percent for a year increase in the age of the household head of those who utilized mobile money services but the coefficient for non-users was not statistically significant. The implication of this finding was that over the years households heads may have accumulated wealth and even sometimes saving plans from retirement such that should a financial shock hit such a household, they can easily recover form it thereby its resilience increases. This was also consistent with result of a study by Jack & Suri

(2014) who showed that age of the household head positively influences household resilience to financial shocks

The coefficient of household level of dependency was statistically significant at one percent for the households that utilized mobile money services but was not statistically significant for non-users. Household level of dependency positively influenced household financial resilience which was against the expectation of the study and was also inconsistent with the study by Bharadwaj *et al*., (2019) which showed that that dependency level of the household would make them more vulnerable and hence reducing their financial resilience.

The coefficient of vulnerability level of users was statistically significant at 5 percent level while for non-users, it was statistically significant at 1 percent level. A more vulnerable household was 0.097 percent more likely to be resilient if it did not utilize mobile money services. However, it was 2.14 percent likely to be more resilient if it used mobile money services. This implied that a more vulnerable household that uses mobile money services was more resilient compared to vulnerable households that did not use mobile money services. This result was consistent with that found in a study by Bharadwaj *et al*., (2019) which also demonstrated that use of mobile money services by households which are vulnerable increases their financial resilience.

On the household size, the coefficient for both users and non-users were statistically significant at one percent level. As the size of the household increased by one member, its resilience reduced by 0.2 percent and 1.5 percent for users and non-users of mobile

money services, respectively. The implication of this result was that increase in household size was associated with the need for additional resources for household consumption budget for such needs as school fees for children, health cover for each additional member of the household and other needs. Theory asserts that insufficient resources for the household implies that savings may be low and hence household may be left vulnerable in case of any financial shock. The effect was more pronounced for non-users of mobile money services indicating that users were better off than non-user in term of financial resilience.

The coefficient for urban residence was statistically significant for non-mobile money services users but not for users. For non-users, a household that resides in urban areas was 2.2 percent more likely to be financially resilient than non-users in rural areas. This suggested that households in urban areas had access to alternative financial facilities besides mobile money and hence were better placed to deal with ensuing shocks and are therefore more financially resilient. Theory also affirms that majority of formal financial institutions are mostly concentrated in urban centers and hence residents may not necessarily need to utilize mobile money services to achieve whatever goals they would want to including resilience.

On the marital status of the household head, being married increased probability of financial resilience by 3.4 percent and 2.1 percent for users and non-users, respectively. The result of the finding may suggest that a household where the head was married could be more endowed with resources. This is because both of them can pool or access resources from various sources to ensure enough resource bases to handle any shock

should it arise and hence will be more resilient. This was in line with the theory that households that are well equipped with relevant resources such as sufficient income and assets are more prepared in case of a financial shock. However, the effect for non-users was more than for users of mobile money services which may imply that non-users of mobile money who were married could be having access to other alternative financial facilities.

In terms of education, a household head with primary level of education and uses mobile money services primary level was 3.7 percent more likely to be more resilient while the one who did not use was 3.3 percent more likely to be resilient. For a household whose head was using mobile money and had secondary education, he/she was 4.5 percent more likely to be resilient while those who did not use mobile money were 0.48 percent more likely to be resilient. Household head with tertiary level of education and uses mobile money were 4.7 percent more likely to be resilient but those who did not use mobile money were 0.5 percent less likely to be resilient. Generally, the result of this finding was in consistent with the view that education enhances literacy rate which may in turn enhances utilization of mobile money services and hence will enable households to derive benefits associated with it including dealing with unexpected shock, thereby enhancing resilience.

A household that owned a mobile phone was 6.9 percent more likely to be more resilient if they utilized mobile money services and were 0.4 percent more likely to be resilient if they did not use. It is through a mobile phone handset that mobile money services are executed and therefore owning a mobile phone motivates the household to activate and

subscribe to mobile money services. By so doing households will be able to derive the benefits associated with its use which includes financial resilience in case of a financial shock. Of particular interest was the difference in effect of mobile use on resilience between users and non-users, where the effect for users was more than for non-users which was a further confirmation that using mobile money increases household financial resilience.

4.5. Descriptive Statistics of Data on Variables Used for Analyzing MSE Performance

The data used to analyze the determinants and effects of utilization of mobile money services on MSE financial performance in Kenya was obtained from Business Establishment dataset by Republic of Kenya (2016b). The descriptive statistics for both the count and continuous variables used in the analysis are presented in Table 4.6.

Table 4. 6: Descriptive Statistics for Discrete and Continuous Variables

Variable	**Range**		**Total Sample N= 24,164**	**Utilized Mobile Money (1) N= 10,888 (45.06%)**	**Not Utilized Mobile Money (0) N= 13,276 (54.94%)**	**Difference (1 – 0)**
Variable	**Min**	**Max**	**Mean (S.D)**	**Mean (S.D)**	**Mean (S.D)**	
Number of Employees	1	50	6.311165 (55.20086)	7.725569 (34.86518)	5.151175 (67.42743)	2.574394***
Number of Business units	0	20	8.007456 (15.77416)	8.674742 (18.28765)	7.464471 (13.36118)	1.210271***
Monthly Income	0	200,000	29886.66 (37515.39)	33884.16 (40701.09)	26793.45 (34536.77)	7090.709 *

N= Number of observations, S.D= Standard Deviations in parentheses. Asterisks ***, **, * denoted the statistical significance at one, 5 and 10 percent confidence levels, respectively.
Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

Table 4.6 shows that from a sample of 21,164 micro and small enterprises 46.06 percent utilized while 54.94 percent did not. The maximum number of business units within the firm was 20 while minimum was zero. The sample mean was 8 business units. For the firms that utilized mobile money, the mean was 9 business units whereas those that did not utilized have a mean of 7 business units. From the statistics, larger businesses tend to utilize mobile money services than smaller ones. On the number of employees, the minimum was one while maximum was 50 employees. The sample mean was 6 employees. For firms that utilized mobile money the mean was 7 employees while those who did not, the mean number of employees was 5. The difference in mean was statistically significant at one percent level which may imply that businesses with bigger

number of employees utilized mobile money services compared to those with less number of employees.

The minimum monthly income was KShs 0 while the maximum was KShs 200,000. The sample mean was KShs 29886.66. Firms that utilized mobile money had an average monthly income of KShs 33884.16 while those that did not had KShs 26793.45 as an average income. The difference in mean was statistically significant at 10 percent confidence interval. This showed that firms with higher average incomes utilized mobile money services than those with lower income.

Table 4. 7: Descriptive Statistics for Categorical Variables

Variable	Total Sample N=24,164			Utilized Mobile Money (1) N= 10,888 (45.06%)		Not Utilized Mobile Money (0) N= 13,276 (54.94%)		Difference (1 – 0)
	Measurement	N	%	N	%	N	%	
Utilization of mobile Money	Yes	10,888	45.06					
	No	13,276	54.94					
Education level of firm owner	None	2,126	8.80	806	7.40	1,320	9.94	-2.54
	Primary	5,539	22.92	1,998	18.35	3,541	26.67	-8.32
	Secondary	8,396	34.75	3,831	35.19	4,565	34.39	0.08
	Tertiary	8,103	33.53	4,253	39.06	3,850	29.00	10.06
Sex of Business owner	Male	17,655	73.06	8,256	75.83	9,399	70.80	0.03
	Female	6,509	26.94	2,632	24.17	3,877	29.20	-5.03
Location of the Business	Fixed	20,932	86.62	9,431	86.62	11,501	86.63	-0.01
	Not Fixed	3,232	13.38	1,457	13.38	1,775	13.37	0.01
Group Membership	Yes	8,509	35.21	4,302	39.51	4,207	31.69	7.82
	No	15,655	64.79	6,586	60.49	9,069	68.31	7.82
Registration of business	Yes	6,269	25.94	3,457	31.75	2,812	21.18	10.57
	No	17,895	74.06	7,431	68.25	10,464	78.82	10.57
Business Ownership Structure	Sole Proprietor	20,778	85.99	9,153	84.07	11,625	87.56	-3.49
	Partnership	2,479	10.26	1,230	11.30	1,249	9.41	1.89
	Company	907	3.75	505	4.64	402	3.03	1.61
Credit Access	Yes	7,025	29.07	7,245	66.54	3,382	25.47	41.07
	No	17,139	70.93	3,643	33.46	9,894	74.53	-41.07
Mobile Phone	Yes	16,922	70.03	8,484	77.92	8,438	63.56	14.36
	No	12,941	29.97	2,404	22.08	4,838	36.44	-14.36
Radio	Yes	6,039	24.99	3,297	30.28	2,742	20.65	9.63
	No	18,125	75.01	7,591	69.72	10,534	79.35	-9.63

Notes: N= Number of observations, S.D= Standard Deviation (in Parentheses).
Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

From Table 4.7, 45 percent of the firms utilized mobile money services while 55 percent did not. The observed statistics point to the nature of high uptake of mobile money services in Kenya among the businesses. The difference in proportion as observed in the sample between firms utilizing and those not utilizing mobile money services was sufficient to make utilization of mobile money an appropriate variable for analysis.

In terms of education, most of the firm owners had secondary education at 34.7 percent followed by those with tertiary education at 33.5 percent. Firm owners with primary education were 22.9 percent while those with no education were 8.8 percent. In terms of utilization of mobile money services, larger proportions of users were firm owners with higher levels of education. From the statistics, majority of the firm owners had tertiary education at 39 percent followed by those with secondary education at 35 percent. Those with primary education were 18.35 percent while those with no education were 7.4 percent.

With regard to sex, majority of the firm owners were male at 73.06 percent with only 26.9 percent being female. Larger proportions of the firm owners who utilized mobile money services were male at 75.8 percent while females were 24.2 percent. The observed difference in proportion was an indication of the extent of the disparities that arises out of gender issues in terms of ownership and even in establishment of business enterprises. It was also an indication of degree to which women have been excluded from access to mobile financial services.

In terms of location of the business, 86.6 percent of them were in a fixed location while those which operated in non-fixed or mobile location were 13.4 percent. A similar trend was also observed regarding utilization of mobile money services where larger proportions of users were operating in a fixed location at 86.6 percent while non-users in mobile locations were 13.4 percent. There was no difference in proportion with regard to location of the firm between users and non-users of mobile money services.

Regarding whether a firm owner belonged to a group in relation to the business, 35.2 percent reported that they belonged to a group while 64.8 percent were not members of any group. For users of mobile money, 39.5 percent were group members while 31.7 percent did not belong to any group. This may be due to the fact that some of the group activities such as contributions and receiving loans may involve the use of mobile money services.

On whether the business was registered with the registrar of companies, 25.9 percent was registered while 74.1 percent did not register. These low registration rate may imply that majority of the businesses were not public nor private companies and therefore did not require registration with registrar of companies but only with the local authorities through licensing and permits. Concerning utilization of mobile money, a higher proportion of users were not registered at 31.7 percent while user businesses which were registered are 68.3 percent.

With regard to ownership structure of the business, 85.9 percent were sole proprietors, 10.2 percent were partnership and 3.8 percent were companies. The high proportion of sole proprietorship kind of businesses implied that majority of the businesses were MSEs operated by one individual or as a family. Larger proportions of mobile money users were also sole proprietorship businesses at 87 percent. This was followed by partnership at 11.3 percent and company at 4.6 percent.

In terms of credit access, 29.1 percent of firms were able to access credit while 70.9 percent could not. This showed that majority of the firms faced challenges in financial access. However, in terms of use of mobile money services, 65.5 percent of the firms

that utilized such services were able to access credit while 33.5 percent could not access credit. The observed larger proportion of the firms using mobile money and accessing credit may have been an indication that mobile money use may enhance access to credit since some of the credit facilities are provided through mobile money services.

As to whether firm owners own a mobile phone or not, 70 percent of businesses owned while 29.9 percent did not. A larger proportion of mobile money users (at 77.9 percent) owned a mobile phone while 22 percent did not. The observed difference in proportion arises from the fact that mobile phone was the platform which enables one to carry out mobile money transactions hence ownership and usage goes hand in hand.

Firms whose owners owned a radio were 24.9 percent while those who did not were 75.1 percent. In terms of mobile money use, 30.3 percent of users of mobile money owned a radio while 69.7 percent did not own a radio. This showed that majority of majority of the firm's owners did not own a radio. This may suggest that firms may be relying on other medium of communication such as television set, internet and other means.

4.6. Determinants of MSEs Utilization of Mobile Money Services

The third objective of the study was to establish the determinants of mobile money services use by firms in Kenya. To achieve this objective, a probit model was estimated using maximum likelihood estimation method (MLE). The output of this estimation is presented in Table A7 in the Appendix. From this estimated model, diagnostic tests were carried out to ensure that the estimated results are valid.

4.6.1. Diagnostic Tests Results

Multicollienearity test was carried out using Variance Inflation Factor (VIF). The test results are presented in Table A8 in the Appendix. From the results, none of the study variables suffered from multicollinearity problem since VIFs were less than 10. Link test was used to check for model specification. The results of the test are presented in Table A9 in the Appendix. The p-value of the value of linear predicted model ($\_hat$) was at one percent level statistically significant while the square of the linear predicted value ($\_hatsq$) was not statistically significant at any level. The result showed that the model was correctly specified and that the predictors of the model sufficiently predicted the dependent variable.

To establish if the data fitted well in the model, goodness of fit test using Hosmer-Lemeshow (H-L) test was carried out and the results are presented in Table A10 in the Appendix. From the results, the probability value of chi square was 0.2317 of the test at 8 degrees of freedom hence the null hypothesis of goodness of fit could not be rejected and hence the model fitted well in the data.

Heteroskedasticity test was conducted using the Breusch-Pagan or Cook-Weisberg test after running a regression model. Table A11 in the Appendix showed that the probability value of Breusch-Pagan/Cook-Weisberg test statistic was 0.000. This implied that the null hypothesis of homoscedasticity was rejected hence heteroskedasticity was present in the data. To solve this problem, heteroskedastic probit model was estimated (Alvarez & Brehm, 1995). The model corrects for disparities in variances of binary outcomes by producing heteroskedastic robust standard errors. To establish the determinants of

utilization of mobile money services by MSEs, heteroskedastic probit model was therefore estimated and its output was presented in Table A12 in the Appendix.

4.6.2. Results of Determinants of MSE Utilization of Mobile Money Services

Heteroskedastic probit (hetprob) model was estimated and its marginal effects computed and the output are presented in Table 4.8

Table 4. 8: Marginal Effects of Determinants of MSE Utilization of Mobile Money Services

Model	Heteroskedastic Probit		
Dependent Variable: 1 if a MSE Utilized Mobile Money Services, 0 otherwise			
Independent Variables	**Marginal Effects (dy/dx)**	**Robust Std. Errors**	**P-Value**
Location (Fixed)	0.0043	0.0134	0.746
Group Membership (Member)	0.0697***	0.0072	0.000
Sex (Male)	0.0387***	0.0073	0.000
Credit Access (Accessed)	0.0659***	0.0076	0.000
Education (Primary)	-0.0155	0.0212	0.463
Education (Secondary)	0.0561***	0.0207	0.007
Education (Tertiary)	0.0896***	0.0205	0.000
Mobile Phone Ownership (Owned)	0.1288***	0.0082	0.000
Radio (Owned)	0.0838***	0.0080	0.000
Ownership Structure (Partnership)	0.0033	0.0123	0.788
Ownership Structure (Company)	-0.0254	0.0261	0.331
Registration (Registered)	0.0559***	0.0091	0.000
Number of Business Units	0.0020**	0.0008	0.018
Number of Employees	0.0095***	0.0020	0.000

Notes: Number of obs. = 24,164. Wald chi2 (14) = 155.13, Prob > chi2 = 0.0000. Asterisks **, *** denotes statistical significance at 10 percent, 5 percent and one percent levels, respectively. No education and Sole proprietorship were the reference category.
Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

From Table 4.8, group membership, sex, credit access, education, mobile phone ownership, radio ownership, registration of business, number of business units and total number of employees were found to have significant effects on utilization of mobile money services by MSEs in Kenya. The other variables, that is, business location and ownership structure of the firm were found to have no significant influence on the use of mobile money services.

On membership to a group, the marginal effect was positive and statistically significant at one percent. Holding all other factors constant, a firm owner who was a member of a group in relation to his/her business was 6.9 percent more likely to utilize mobile money services. This means that a business owner who may belong to a group such as MSE associations, chamber of commerce, merry-go round, men/women association may have found it cheaper in terms of cost and availability to use mobile money services especially for borrowing or saving from the group or any other financial transaction that he/she will benefit from. The development of mobile money services has made such group memberships to be more efficient since one does not need to travel or convene a meeting for them to make contributions. This finding conformed to the study by Mdoe *et al*, (2018) which established that group participation was more likely to increase MSEs use of mobile telephony through receipt of credit.

The marginal effect for sex was positive and statistically significant at one percent level. A firm whose owner was female was 3.8 percent more likely to utilize mobile money services than if the firm was owned by a female. This finding was also consistent with descriptive statistics in Table 4.7 which revealed that 76 percent of firm owners who

utilized mobile money services were male. Since majority of the firm owners were male, and given the nature of doing business requires one to be using such services as mobile money more often, being a male firm owner therefore increased the possibility of using mobile money services. Further, nature of duties and roles in the society also works towards excluding women from accessing such services. This is because majority of women are mostly engaged in household duties and hence may not in contact with mobile financial services unlike male counterparts.

On credit access, its marginal effect was positive and statistically significant at one percent level. A firm that can access credit was 6.5 percent more likely to utilize mobile money services than those which could not access credit. Firms could access credit from various sources ranging from traditional "brick and mortar" financial institutions to the modern digital financial technologies such as mobile money services. Some of the most affordable and easily available credit facilities are those that can accessed through mobile money services. Therefore credit access, particularly digital credit such as *m-shwari*, KCB-*Mpesa*, *Timiza*, *Tala*, Branch and other platforms are normally accessed via mobile money services.

In terms of education, a firm owner with secondary education was 5.6 percent more likely to utilize mobile money services than a firm owner with no education. With tertiary level of education, a firm owner was 8.9 percent more likely to utilize mobile money services than a firm owner with no education. The result of this finding was in harmony with the view that higher levels of education enhances literacy rate which in turn equip one with skills necessary to use such services through operating a mobile

phone. This result was also in harmony with the findings in studies by Munyegera & Matsumoto (2016), Sekabira & Qaim (2017) and Kirui *et al*, (2013) which found that education also influences mobile money adoption.

Regarding mobile phone ownership, its marginal effect was positive and statistically significant at one percent level and consistent with the expectation. A firm owner who owned a mobile phone had a probability of 0.129 percentage point utilizing mobile money services than those who did not own. Mobile phone is the platform where mobile money services are accessed and executed. Therefore owning a mobile phone increases the chances of using the same phone to access mobile money services.

On radio ownership, the marginal effect was statistically significant at one percent. Holding other factors constant, a firm owner with a radio had a probability of 0.083 percentage points more likely to use mobile money services than a firm with none. Radio is a medium of communication and through such services as advertisements and promotions, mobile money services could play a crucial role. It can also provide financial education about financial products which may be accessed through a mobile phone hence encouraging firm owners to use mobile money.

Regarding business registration, its marginal effect was statistically significant at one percent confidence level. Ceteris paribus, registering a firm through licensing and business permit increases the probability of utilizing mobile money services by 0.055 percentage points, on average, more likely to influence a firm to utilize mobile money services than a firm that was not registered. Registration unlocks the potential of the firm to engage legally in business and even avail more opportunities to increase its scale of

operations and in the process such operations may require the use of mobile money services.

On the number of business units, its marginal effect was statistically significant at one percent level of significance. All other factors being constant, increasing the number of business units by one unit increases the probability of utilization of mobile money services by 0.002 percentage points. Increase in number of units within the firm implies that it is expanding and hence increases its liquidity level. This may necessitate the use of mobile money services particularly when there is need to centralize financial services. Mobile money services may be used particularly in terms customers paying for goods and services.

Concerning the number of employees, its marginal effect was positive and statistically significant at one percent level. An additional employee in the firm increased the probability of using mobile money services by 0.009 percentage points, ceteris paribus. Increase in the number of employees implies that the firm experienced expansion hence the need to use mobile money. An expanded business establishment means increased liquidity need and hence mobile money may be vital in the operations of the firm.

The marginal effect of the location of business was not statistically significant and therefore location was found to have no influence on utilization of mobile money services by firm in Kenya. This was in contradiction with notion that businesses with fixed location experiences reduced transport and logistics operation and therefore being in a fixed location is likely to enhance profits and therefore expansion which may warrant the use of mobile money services. This finding was also in contradiction with

the study by Munyegera & Matsumoto (2016) which found significant coefficient of the location of the business. The coefficient of the ownership structure of the business was statistically insignificant and therefore its influence on MSE utilization of mobile money services could not be established.

4.7. Effects of Utilization of Mobile Money Services on MSE Performance

To analyze the effect of utilization of mobile money services on MSE performance, Propensity Score Matching (PSM) method was used in the study following Rosenbaum and Rubin (1983). Estimating probit on MSE's probability of utilization of mobile money services was the first step in using PSM model. The estimated probit model was used to generate the propensity scores for matching which was calculated from utilization of mobile money as the treatment variable. After obtaining the propensity scores, matching process was carried out using Nearest Neighbor Matching (NNM) algorithm.

During the matching procedure, propensity scores for firms that utilized mobile money and for those that did not utilize were compared to establish if the differences in monthly income could be attributed to utilization of mobile money services.

4.7.1 Diagnostic Tests Results

Before causal effects of utilization of mobile money services were estimated by using average treatment effects, diagnostic tests were done on the model. The first test was the assumption of the common support condition. Figure A1 in the Appendix presents the histogram of the estimated propensity scores for the users and non-users of mobile money services. A visual examination of the density distributions of the estimated

propensity scores of the two groups reveals that common support condition was fulfilled. This implied that there was a significant overlap in the distribution of the propensity scores for both groups of users and non-users (Kassie, Shiferaw, & Muricho, 2011).). The bottom section of the graph shows the propensity scores distribution for non-users and the upper section for the users of mobile money services.

The other diagnostic test was for the balancing test and the results from the covariate balancing tests before and after matching are presented in Table A13 in the Appendix. The results showed that the standardized mean difference for all covariates in the estimation reduced from 15.6 before matching to 3.8 after Kernel Based matching using a bandwidth of [0.5; 2]. Moreover, the p value for the LR tests revealed a joint significance of all covariates in the probit model after matching. The Pseudo-R^2 was also reduced from 0.046 to 0.006 and was fairly low suggesting that there were no systematic differences in the distribution of covariates between the two groups after matching. As a result there was successful specification of the propensity score estimation process.

4.7.2. Results of the Effect of Utilization of Mobile Money Services on MSE Performance

To evaluate the effect of utilization of mobile money services on MSE performance in Kenya, the differences in income of the firm between the two matched groups was estimated using equation (3.28) and the results are presented in Table 4.9

Table 4. 9: PSM Results of the Effects of Utilization of Mobile Money Services on MSE Performance

Algorithm	Outcome	Effect	Coefficient	AI Robust Std. Err.	P-Value
Nearest Neighbor Matching (NNM)	Firm Monthly Income	ATET	6024.514 ***	733.0923	0.000

Asterisk *** Denotes the level of statistical significance at one percent; AI robust standard errors were used to generate heteroskedastic-robust variance estimators to correct for possible heteroskedasticity.

Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

From Table 4.9, the ATET of utilization of mobile money services on MSE performance was positive and statistically significant. This implied that monthly firm income on average increased by KShs 6,024.5 when a firm utilized mobile money services. This was consistent with the results of a study by Kalei *et al* (2016) who found that using mobile money services increased MSE performance by 0.198 percent. It was also consistent with the study by Kirui and Onyuma (2015) and Salia (2016) who found out that mobile money services increased MSEs performance through increase in sales.

The findings of the study supports the view that mobile money services enhance the speed at which cash is quickly mobilized from savings, credit from suppliers or even to have customers that can pay upon delivery (Bångens & Söderberg, 2011). This implies that the performance of MSEs businesses is contingent upon how quickly cash is

received any hold up may affect the operations of their businesses. Mobile money has also been a source of credit to majority of the establishments particularly those who had been initially unable to because of either demand or supply side barriers. Therefore with the development of mobile money services, they can access credit through mobile digital loans such as *M-Shwari*, KCB-*MPESA* and many other mobile loan applications. The availability of the credit facilities arises from the fact that majority of them do not require collateral or any other stringent requirements. Firms that are able to access these facilities will have their liquidity increased and can therefore expand their investment and hence increased income.

To further evaluate the distributional effects of MSE utilization of mobile money services on its performance, selected variables which included sex of the firm owner and access to credit by the firm were further analyzed. The aspect of sex was justified on ground that majority of women have been facing challenges in financial access despite various efforts established to enhance their entrepreneurial activities such microfinance institutions biased towards financing non-collatarized women. The variable credit access was also considered since majority of MSEs have been having challenges in an attempt to access credit. According to World Bank (2013), the MSEs' limited financial access is still major obstacle that hinders them from establishment of new businesses and expansion of those already existing. This is because most of the financial institutions consider MSEs as non-creditworthy because of their small capital investments and even smaller business transactions, thus denying them credit.

Table 4. 10: Effects of Utilization of Mobile Money Services on MSE Performance based on Selected Variables

Variable		ATET	AI Robust Errors	P- value	N
Sex of the firm owner	Male	4907.366***	898.3277	0.000	14,283
	Female	3661.565***	1038.471	0.000	5,774
Credit Access	Yes	5915.598***	1109.023	0.000	6,004
	No	4651.971***	875.7282	0.000	14,053

Asterisk *** Denotes the level of statistical significance at one percent; AI robust standard errors are used to generate heteroskedastic-robust variance estimators to correct for possible heteroskedasticity.

Source: Author's Computation Using Study Data (2016)

From Table 4.10, the sex of the firm owner was positive and statistically significant at one percent level. When the owner of the firm was male, the ATET was 4907.40, while for female it was 3661.60 implying that firm average monthly income increased by KShs 4907.40 and KShs 3661.60 if the owner of the firm was male and female, respectively. The implication of this finding was that businesses that are owned by women experiences lower profits than those that are owned by men. This finding may be a revelation of the extent to which women may have been excluded from access to financial services in Kenya. Financial exclusion of women may be a culmination of myriads of challenges that they face in the society which may be categorized into sociocultural, economic/legal and mobility issue, their income and education levels, and even access to collateral and information. Sociocultural challenges may include norms and the associated gender roles that may hinder women's access to financial services.

Women gender roles may not only limit their time but also their mobility which may further constraint their access to financial services.

On credit access, the ATET for those who access credit was 5915.60 and 4651.90 for those who could not. Specifically, average monthly firm income increased by KShs 5915.60 if a firm access credit facility and by KShs 4651.90 if there was no credit access. This implied that credit access was crucial for MSEs financial performance in Kenya because it increases the liquidity of the business and hence more investment and new establishments or expansion of an existing business which will ultimately lead to economies of scale and increased income.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

This chapter presents summary, conclusions, policy implications of the study findings, main contribution of the study to knowledge and possible areas for further research.

5.2 Summary

With the development of mobile money services, tremendous change with regard to financial services access for many people have been experienced particularly those who had formerly been financially excluded. This has been the case since mobile money services are provided through a mobile phone unlike financial institutions that needs many requirements to be met so as to have access to their services. The development of mobile money services in Kenya has seen financial access gap drastically decline. In particular, mobile money has greatly enhanced financial access in Kenya which has made it possible for 83 percent of Kenyans to be included into the formal financial system. This was expected to positively enhance households' resilience to financial shocks and performance of Micro and Small enterprises in Kenya (MSEs) in terms of ease of financial access and transactions costs. Despite these developments in financial sector, 36.2 percent of households in Kenya are still experiencing financial shocks and majority of them are unable to recover after experiencing such shocks and are therefore non-resilient to financial shocks. With regard to MSEs performance, majority of them are still confronted with myriad of challenges related to high levels of financial services exclusion particularly from formal financial institutions and other bottlenecks with

regard to their attempt to access credit. These contrasting circumstances elicit questions on whether utilization of mobile money services has any effect on household financial resilience to shocks and on performance of micro and small enterprises in Kenya.

Past studies did not focus on the entire concept of utilization of mobile money services as envisaged in this study. Some studies only focused on the borrowing aspect to analyze its effects on household resilience. Other studies did not pay attention to the self-selection and endogeneity which raises questions about the validity of the results. On the effects of utilization of mobile money on MSEs' performance, majority of the studies in Kenya only focused on major towns where firms are usually well served by formal financial institutions like banks leaving out rural areas where mobile money is being heavily relied on because of the absence of formal financial institutions.

This study analyzed the effect of utilization of mobile money on household resilience and small and microenterprise performance in Kenya. Specifically, the study sought to establish the determinants of utilization of mobile money by households and firms in Kenya, analyze the effects of mobile money utilization on household resilience to shocks in Kenya and to analyze the effects of utilization of mobile money on micro and small enterprises' performance in Kenya. To achieve these objectives, the study used the 2016 MSMEs establishment survey and 2019 FinAccess data sets.

The determinants of utilization of mobile money services by households in Kenya were established by estimating heteroskedastic probit model using Maximum Likeloihood Estimation (MLE). From the results, it was established that the determinants of utilization of mobile money services by households in Kenya are; household size,

household level of dependency, age of the household head, average cost to the nearest mobile money agent, marital status of the household head, residence of the household, group membership of the household, education level of the household head, and mobile phone ownership since their coefficients were statistically significant.

Effects of utilization of mobile money services on household financial resilience in Kenya were analyzed using endogenous switching regression (ESR) model fitted using Full Information Maximum Likelihood (FIML) technique. Financial resilience was used as an outcome variable. ESR results were used to obtain the ATETs for household financial resilience. Results revealed that households that utilized mobile money services are more likely to be financially resilient. It was further established from the study that age of the household head, vulnerability index, household size, residence of the household, marital status of the household head, mobile phone ownership, and the education level of the household head influences household financial resilience since their coefficients were statistically significant.

Determinants of MSEs utilization of mobile money services was established by estimating heteroskedastic probit model using maximum likelihood estimation (MLE) technique. The results indicated that group membership, sex, credit access, education, mobile phone ownership, radio ownership, registration of business, number of business units and total number of employees significantly determines utilization of mobile money services by MSEs in Kenya.

Propensity score matching technique was used to estimate the effect of utilization of mobile money services on the performance of MSEs in Kenya. Relevant ATETs were obtained using the nearest neighbor matching (NNM). It was established from the results of the study that monthly firm income on average increases when a firm utilizes mobile money services. When ATET was estimated based on sex of the firm owner, it was established that monthly income of firms that utilized mobile money services increases more if the owner of the firm was male compared to female. On the basis of credit access, average monthly firm income increases more if a firm using mobile money services accessed credit facility than those who could not access credit.

5.3 Conclusions

The following conclusions can be established from the study findings. Concerning the determinants of household utilization of mobile money services, the study concludes that a household is more likely to utilize mobile money services if the household head is married, has higher level of education and is older. The household is also more likely to utilize mobile money services if its members owns a mobile phone and belong to a group, is bigger in size, has high dependency level, reside in urban area and when the average cost to the nearest mobile money agent is low.

It was established in the study that utilization of mobile money services increases the household's possibility of being financially resilient in the event of shocks. It was further established from the study that a household is more financially resilient if its head is married, has higher level of education and is older. A household is also more

resilient if it has high level of dependency, is bigger in size, reside in urban area, and if its members owned a mobile phone.

On the determinants of MSEs utilization of mobile money services, the study concludes that a firm owner who is a male, has tertiary education, belongs to a group and owns a mobile phone and a radio were more likely to utilize mobile money services since their coefficients were statistically significant. Moreover, a firm that has more business units and more employees and can access credit is more likely to utilize mobile money services. Firm owners whose business establishments are legally registered are also more likely to utilize mobile money services.

From the findings of the study, utilization of mobile money services enhances MSEs financial performance. When the analysis was based on the sex of the firm owner who utilized mobile money services, the study concludes that businesses that are owned by women experience lower incomes than those that are owned by men. This may be a pointer to the extent to which women-owned enterprises have been facing gender based constraints that may have hindered firm's financial performance such as the society gender roles that limit women's time to concentrate on running their businesses. In terms of MSEs' performance based on credit access for the firms that utilize mobile money services, the study concludes that access to credit is an essential component in firm's financial performance since it provides the liquidity needs of the firm hence more investments and therefore more income.

5.4 Policy Implications

Various policy implications have been drawn based on the findings of the study for both households and the MSEs. First, various factors established in the study that determines the uptake of mobile money services by households and firms in Kenya is an indication of the need by the government through her regulatory authorities and mobile money services providers to design supportive policies that would further scale up the utilization of mobile money services to more financially excluded households and MSEs in Kenya. This is on the ground of the study finding that utilization of mobile money services can enhance household resilience to financial shocks besides raising MSEs financial performance.

The government through its ICT ministry and mobile phone and mobile money services providers should invest more in educational training particularly to households and firms. This is because the findings of the study showed that utilization of mobile money services increases with higher levels of education. Education enhances households and firms literacy rate through awareness and provision of skills that are essential in access and operation of mobile money services. There is also a need by the government through the Kenya Revenue Authority, ICT department and mobile money providers to create an enabling environment for accessing mobile money services to encourage its uptake. As a result individuals and firms stand the opportunity to acquire mobile phones since mobile phone ownership increases utilization of mobile money services since such services are provided through a mobile phone.

It is important to appreciate the fact that mobile money agents are essential factors in easing access to mobile money transaction in terms of deposits and withdrawals. Attention should therefore be given to infrastructural constraints such as improving the road networks that will make the cost of transport to the nearest agents affordable particularly to rural households. The findings of the study established that households preferred to subscribe to mobile money services if the cost of transport to the nearest mobile money agent is relatively cheap. This is because cheaper transport cost is associated with the shorter geographical distance to the nearest mobile money agent.

It is recommended that concerted efforts be put in place by the government through her regulatory authorities to legally recognize and if necessary register such groups such as MSE associations, *chamas*, and men/women associations with no constraints such as registration fee or tax attached. Doing so will make the groups to have more freedom and this will work towards encouraging more formations since such group membership is very crucial in times of emergencies since they lend with no collateral. This is in light of the study finding that households and firm owners who are members of a group such as *chama,* merry-go round, men/women associations and MSEs associations encourages households and firms to utilize mobile money services. They also provide opportunities to low income members of the households and businesses to save.

It is advised that government should create incentives that would encourage more women to utilize mobile money services in Kenya. Specifically, government should developed financial products that are tailored to enable women who engage in businesses to utilize mobile money services in their operations. For instance, the

government and mobile money services providers can develop more robust mobile financial kitties biased towards women besides strengthening the existing ones. This may go a long way in financially empowering women which may in the long-run encourage them to utilize mobile money services. This was on account of the study findings that majority of the firm owners who were adopters of mobile money services were male implying that women have exclusion challenges.

Government should create an enabling environment for MSEs to thrive in Kenya since providing them with most accessible, affordable and reliable credit access may encourage them utilize mobile money services. This may include adopting selective credit control mechanisms that will have the sector borrow at affordable rates. The government may also enhance MSEs' ease of doing business through incentives that will make them borrow at affordable rates. This is on account of study findings which showed that those that can access credit were more likely to utilize mobile money services than those that were not able.

Different levels of governments in Kenyan should create incentives that would facilitate the acquisition of licenses and permits by MSEs. Both county and national governments should get rid of bottlenecks that hinder the acquisition of licenses by making all the process and procedures for registration more efficient and affordable by ridding off red-tapes. This is because findings from the study revealed that registration of a business influences MSEs towards utilizing mobile money services.

5.5 Contribution to Knowledge

In terms of contribution of the study, none of the reviewed studies analyzed the effects of utilization of money services, as defined in this study and majority of the studies in Kenya had focused mainly on major towns leaving out rural areas where mobile money is being heavily relied on. The study therefore contributes to the existing literature on how utilization of mobile money services enhances household resilience to financial shocks using seemingly fresh concept on household resilience in Kenya. Specifically, the study demonstrated that households that utilize mobile money services are cushioned during the period of financial emergencies.

On MSEs, the study provides more comprehensive insights on how MSE utilization of mobile money services affects MSE financial performance. The study indicated that utilization of mobile money services has positive effects on income of the firm. When the analysis of users of mobile money services was based on sex of the firm owner, the study demonstrated that businesses run by women have not been performing well compared to those owned by men. The study established that socio-cultural and economic constraints may limit women enterprises from realizing full financial performance of their enterprises in Kenya. There is therefore a need for robust policies and financial product designs that would resolve these constraints besides encouraging utilization of mobile money services.

5.6 Areas for Further Research

This study provided an analysis of how utilization of mobile money services affects household financial resilience and performance of micro and small enterprises in Kenya.

To establish more appreciation of these relationships, further research can focus on areas such as the link between utilization of mobile money services and women owned enterprises in Kenya, link between mobile money services and household welfare and on the link between mobile money services and household savings in Kenya among other outcomes.

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APPENDIX

Table A. 1: Output of the Probit Model on Determinants of Household Utilization of Mobile Money Services

Dependent Variable: 1 if a Household Utilized Mobile Money Services, 0 otherwise				
Independent Variables	**Coefficient**	**Std. Errors**	**Z- Value**	**P-Value**
Household Size	-0.0342875	0.0151164	-2.27	0.023
Household Level of Dependency	0.0399898	0.0162219	2.47	0.014
Age	0.0053672	0.0015035	3.57	0.000
Average Cost to the Nearest Bank	0.0000206	0.0002403	0.09	0.932
Average Cost to the Nearest Mobile Money Agent	-0.0007949	0.0003079	-2.58	0.010
Residence of the Household (Urban)	0.1449669	0.0523005	2.77	0.006
Group Membership (Group Member)	0.0925916	0.049858	1.86	0.063
Wealth Quintile Level (Highest)	-0.0892311	0.063984	-1.39	0.163
Wealth Quintile Level (Middle)	0.0681233	0.0666498	1.02	0.307
Vulnerability Index (Vulnerable)	0.0047994	0.0506191	0.09	0.924
Marital Status of the Household Head (Married)	0.3675086	0.0481146	7.64	0.000
Education (Primary)	0.3779014	0.0725652	5.21	0.000
Education (Secondary)	0.407008	0.08475	4.80	0.000
Education (Tertiary)	1.129966	0.132661	8.52	0.000
Education (Other)	0.9618978	0.7488035	1.28	0.199
Mobile Phone Ownership (Own)	2.598037	0.056209	46.22	0.000
Constant	-2.013198	0.1357456	-14.83	0.000

Notes: Number of observations=6,895; LR chi2(15) = 4129.01, Prob > chi2 = 0.0000

Source: Author's Computation Based on FinAccess Dataset (2019)

Table A. 2: Results of Multicollinearity Test from Probit Model of Determinants of Household Utilization of Mobile Money Services

Variable	VIF	1/VIF
Household Size	2.27	0.440897
Household Level of Dependency	2.13	0.470374
Age	1.23	0.811418
Average Cost to the Nearest Bank	1.68	0.595952
Average Cost to the Nearest Mobile Money Agent	1.43	0.701235
Residence of the Household	1.28	0.780778
Group Membership (Group Member)	1.08	0.924134
Wealth Quintile Level (Highest)	1.81	0.553057
Wealth Quintile Level (Middle)	1.30	0.767750
Vulnerability Index (Vulnerable)	1.23	0.816268
Marital Status of the Household Head (Married)	1.11	0.899086
Education (Primary)	3.12	0.320940
Education (Secondary)	3.48	0.287689
Education (Tertiary)	2.32	0.430137
Education (Other)	1.02	0.982237
Mobile Phone Ownership (Own)	1.20	0.834906
Mean VIF	**1.73**	

Source: Author's Computation Based on FinAccess Database (2019)

Table A. 3: Results of Link Test from Probit Model of Determinants of Household Utilization of Mobile Money Services

Utilization of Mobile Money Services	Coefficient	Probability Value
Hat	1.012211	0.000
hat square	-0.0119807	0.716
Constant	-0.0010517	0.806

Source: Author's Computation Based on FinAccess Database (2019)

Table A. 4: Results of Goodness of fit Test Using Hosmer-Lemeshow Test from Probit Model of Determinants of Household Utilization of Mobile Money Services

Number of observations	6895
Number of groups	10
Hosmer-Lemeshow chi2(8)	3.50
Prob > chi2	0.8990

Source: Author's Computation Based on FinAccess Database (2019)

Table A. 5: Results of Heteroskedasticity Test Using Breusch-Pagan/Cook-Weisberg test from Probit Model of Determinants of Household Utilization of Mobile Money Services

chi2(1)	27.14
Prob > chi2	0.0000

Source: Author's Computation Based on FinAccess Database (2019)

Table A. 6: Output of Heteroskedastic Probit Regression for Determinants of Household Utilization of Mobile Money Services

Dependent Variable: 1 if a Household Utilized Mobile Money Services, 0 otherwise				
Independent Variables	**Coefficient**	**Robust Std. Errors**	**Z- Value**	**P-Value**
Household Size	-0.0246218	0.014407	-1.71	0.087
Household Level of Dependency	0.028582	0.0175107	1.63	0.103
Age	0.0049749	0.0012404	4.01	0.000
Average Cost to the Nearest Bank	-3.15e-07	0.0001967	-0.00	0.999
Average Cost to the Nearest Mobile Money Agent	-0.0005453	0.0002871	-1.90	0.058
Residence of the Household (Urban)	0.1367196	0.065667	2.08	0.037
Group Membership (Group Member)	0.0673712	0.0400791	1.68	0.093
Wealth Quintile Level (Highest)	-0.0745915	0.0473715	-1.57	0.115
Wealth Quintile Level (Middle)	0.0444847	0.0512714	0.87	0.386
Vulnerability Index (Vulnerable)	-0.0006789	0.0455792	-0.01	0.988
Marital Status of the Household Head (Married)	0.3234025	0.095507	3.39	0.001
Education (Primary)	0.2895637	0.0994839	2.91	0.004
Education (Secondary)	0.3185458	0.1050989	3.03	0.002
Education (Tertiary)	0.7941656	0.2887687	2.75	0.006
Education (Other)	0.8677507	0.3012046	2.88	0.004
Mobile Phone Ownership (Own)	2.25193	0.2926275	7.70	0.000
Constant	-1.996872	0.193417	-10.32	0.000
lnsigma2				
Average Cost to the Nearest Bank	-0.000098	0.0002058	-0.48	0.634
Residence of the Household (Urban)	0.0483927	0.0526243	0.92	0.358
Vulnerability Index (Vulnerable)	-0.0103484	0.0452773	-0.23	0.819
Marital Status of the Household Head (Married)	0.1373972	0.0647277	2.12	0.034
Mobile Phone Ownership (Yes)	-0.4997002	0.3775548	-1.32	0.186

Notes: Wald chi2 (15) = 283.35, Prob > chi2 = 0.0000. Statistical significance of probability value of Chi square suggests that heteroskedasticity is present in the model. Wald test of lnsigma2=0, chi2 (4) = 4.90, Prob > chi2 = 0.2981. Number of obs. = 6,895.

Source: Author's Computation Based on FinAccess Database (2019)

Table A. 7: Output of the Probit Model on Determinants of MSE Utilization of Mobile Money Services

Dependent Variable: 1 if a Firm Utilized Mobile Money Services, 0 otherwise				
Independent Variables	**Coefficient**	**Std. Errors**	**Z- Value**	**P-Value**
Location (Fixed)	-0.0482195	0.0251333	-1.92	0.055
Group Membership	0.1764556	0.0180894	9.75	0.000
Sex (Male)	0.1341317	0.019537	6.87	0.000
Credit Access	0.1877695	0.0187987	9.99	0.000
Education (Primary)	-0.088	0.0344919	-2.55	0.011
Education (Secondary)	0.117594	0.0327981	3.59	0.000
Education (Tertiary)	0.2144823	0.0326841	6.56	0.000
Mobile Phone Ownership (Yes)	0.2007404	0.0200131	10.03	0.000
Radio (Yes)	0.2574228	0.019604	13.13	0.000
Ownership Structure (Partnership)	-0.0457237	0.0286941	-1.59	0.111
Ownership Structure (Company)	-0.0690547	0.0471463	-1.46	0.143
Registration (Yes)	0.2167804	0.0211815	10.23	0.000
Number of Business Units	0.0025352	0.0005558	4.56	0.000
Number of Employees	0.000126	0.0001329	0.95	0.343
Constant	-0.7547999	0.0386253	-19.54	0.000

Notes: Number of observations=24,164; LR chi2(14) = 1573.05, Prob > chi2 = 0.0000

Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

Table A. 8: Results of Multicollinearity Test from Probit Model of Determinants of MSE Utilization of Mobile Money Services

Variable	**VIF**	**1/VIF**
Location (Fixed)	1.03	0.968257
Group Membership	1.07	0.930675
Sex (Male)	1.07	0.938272
Credit Access	1.05	0.952824
Education (Primary)	2.92	0.342199
Education (Secondary)	3.42	0.292131
Education (Tertiary)	3.36	0.297787
Mobile Phone Ownership (Yes)	1.06	0.944447
Radio (Yes)	1.04	0.964867
Ownership Structure (Partnership)	1.08	0.926337
Ownership Structure (Company)	1.12	0.890297
Registration (Yes)	1.22	0.818089
Number of Business Units	1.02	0.984797
Number of Employees	1.02	0.985121
Mean VIF	**1.54**	

Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

Table A. 9: Results of Link Test from Probit Model of Determinants of MSE Utilization of Mobile Money Services

Utilization of Mobile Money Services	Coefficient	Probability Value
Hat	0.8219879	0.000
hat square	0.1970754	0.201
Constant	0.0370562	0.235

Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

Table A. 10: Results of Goodness of fit Test Using Hosmer-Lemeshow Test from Probit Model of Determinants of MSE Utilization of Mobile Money Services

Number of observations	24,164
Number of groups	8
Hosmer-Lemeshow chi2(8)	8.09
Prob > chi2	0.2317

Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

Table A. 11: Results of Heteroskedasticity Test Using Breusch-Pagan/Cook-Weisberg test from Probit Model of Determinants of MSE Utilization of Mobile Money Services

chi2(1)	26.47
Prob > chi2	0.0000

Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

Table A. 12: Output of Heteroskedastic Probit Model for Determinants of MSE Utilization of Mobile Money Services

Dependent Variable: 1 if a Firm Utilized Mobile Money Services, 0 otherwise				
Independent Variables	**Coefficient**	**Robust Std. Errors**	**Z- Value**	**P-Value**
Location (Fixed)	0.0165554	0.0344992	0.48	0.631
Group Membership (Yes)	0.1725447	0.0377969	4.57	0.000
Sex (Male)	0.1103219	0.0362884	3.04	0.002
Credit Access (Yes)	0.1526177	0.0444093	3.44	0.001
Education (Primary)	0.000481	0.0949357	0.01	0.996
Education (Secondary)	0.1561911	0.0600456	2.60	0.009
Education (Tertiary)	0.2402753	0.0475214	5.06	0.000
Mobile Phone Ownership (Yes)	0.311535	0.04725	6.59	0.000
Radio (Yes)	0.2000338	0.0551621	3.63	0.000
Ownership Structure (Partnership)	-0.0614371	0.0701396	-0.88	0.381
Ownership Structure (Company)	-0.0736203	0.0480139	-1.53	0.125
Registration (Yes)	0.1417322	0.0418224	3.39	0.001
Number of Business Units	0.0044015	0.0019918	2.21	0.027
Number of Employees	0.0212253	0.0046352	4.58	0.000
Constant	-0.867857	0.0904654	-9.59	0.000
lnsigma2				
Location (Fixed)	-0.0501529	0.0878181	-0.57	0.568
Group Membership	-0.0779869	0.0702873	-1.11	0.267
Sex (Male)	-0.1073251	0.0655752	-1.64	0.102
Credit Access	0.108456	0.0688348	1.58	0.115
Education (Primary)	-0.1693113	0.1975928	-0.86	0.392
Education (Secondary)	-0.0654247	0.1830986	-0.36	0.721
Education (Tertiary)	-0.1437418	0.1915711	-0.75	0.453
Mobile Phone Ownership (Yes)	0.0000837	0.1418017	0.00	1.000
Radio (Yes)	0.0026813	0.0686779	0.04	0.969
Ownership Structure (Partnership)	0.5601039	0.2568012	2.18	0.029
Ownership Structure (Company)	0.0922261	0.2174552	0.42	0.671
Registration (Yes)	-0.1603005	0.1172653	-1.37	0.172
Number of Employees	0.0162526	0.0068901	2.36	0.018
Number of Business Units	0.0058974	0.005222	1.13	0.259

Notes: Wald chi2 (14) = 155.13, Prob > chi2 = 0.0000. Statistical significance of probability value of Chi square suggests presence of heteroskedasticity in the model. Wald test of lnsigma2=0, chi2 (4) = 46.56, Prob > chi2 = 0.0000. Number of obs. = 24,164.

Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

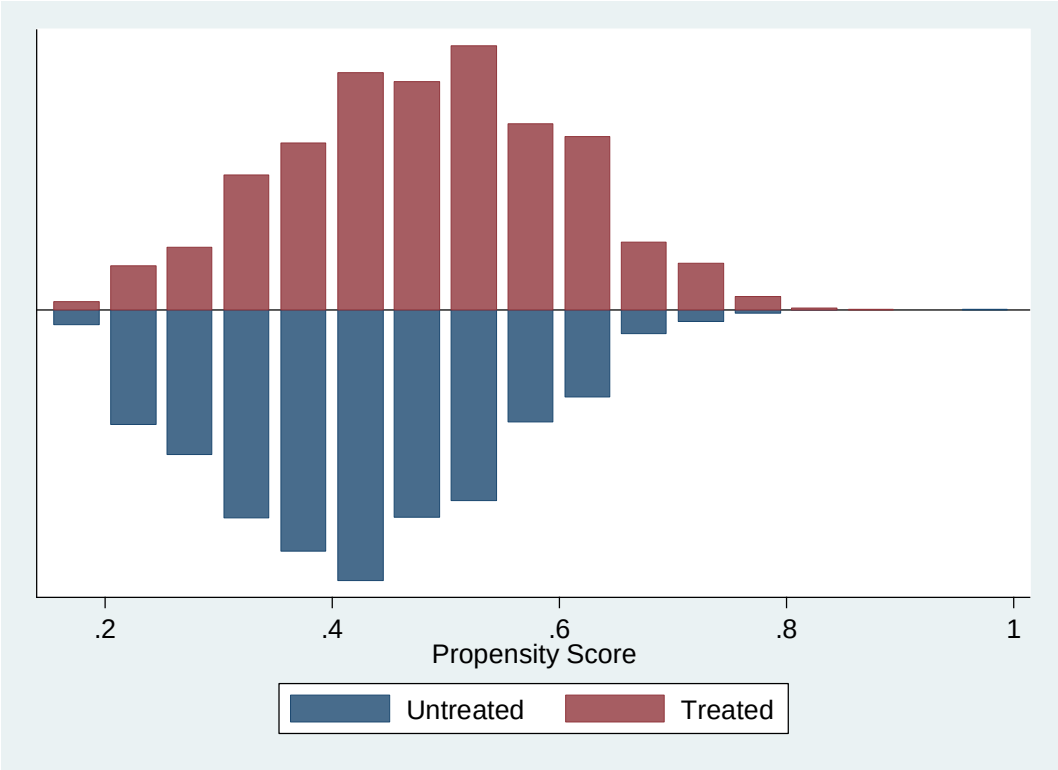

Figure A.1: Common Support for Propensity Score

Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)

Table A. 13: Matching Quality Indicators Before and After Matching

Matching Algorithm	Pseudo-R2		LR chi2(P-value)		MeanBias		Median Bias	
	Before	After	Before	After	Before	After	Before	After
Kernel Based Matching	0.046	0.006	1518.29 (0.000)	154.85 (0.000)	15.6	3.8	16.4	3.1

Source: Author's Computation Based on Business Establishment Dataset, Republic of Kenya (2016)