MICHIGAN ROSS

Mobile Money and Financial Resilience:

Overcoming Economic Shocks Through Digital

Financial Technology

by

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Abstract

Mobile money has been touted as an opportunity to step toward formal financial inclusion in developing countries around the world, especially for those traditionally financially excluded. To further understand the impact of mobile money on those who adopt it, this study conducts a three-part meta-analysis to test the relationship between mobile money and long-term financial behaviors. The first part of the meta-analysis summarizes previous studies on mobile money as it relates to saving, borrowing, and economic stability. The second part uses regression models to understand how mobile money is related to saving and borrowing propensity using nationally representative survey data from 9 countries with 60,375 individual observations. The third part analyzes additional variables relating to coping behaviors during financial crises, reinforcing findings from the regression models and past studies. Results suggest that having a mobile money account increases saving propensity by 21% and increases borrowing propensity by 10% on average. Beyond this, findings from this study suggest a positive relationship between saving stock and mobile money use as well as a positive relationship between the amount borrowed and mobile money use. The validity of these findings is solidified by mobile money users being 5.8% more likely to use formal coping mechanisms during financial crises when compared to non-mobile money users. From these findings in Africa, Asia, and the Caribbean, it is possible to hypothesize more broadly about the outcomes of mobile money as it relates to overcoming economic shocks. These findings are especially relevant given the recent use of mobile money to distribute stimulus funds during the COVID-19 pandemic.

Contents

Introduction

As climate change progresses, global geopolitical relationships become more tense, and public health systems strain, economic shocks are becoming the new norm. Around the world, these frequent financial crises challenge cash-based economies, disrupting the ability to physically transact. At the same time, the digital transformation over the past 30 years has created tools to help combat these shocks. In the same way that telehealth has revolutionized access to healthcare during the pandemic, digital financial technologies have the potential to improve access to financial resources. Mobile money, which is one of the most easily accessible digital financial technologies, may be the key to improving financial wellbeing before, during, and after a financial crisis.

What is mobile money?

Mobile money is most broadly defined as "a service in which the mobile phone is used to access financial services" (*Mobile money definitions July 2010 - GSMA*, 2010). More specifically, the type of mobile money that this thesis investigates is a type of account that a user can access even if they don't have an existing bank account. These types of accounts require a SIM card or a cell phone number, and are common across Africa, Asia, and the Caribbean (Figure 1).

An important aspect of mobile money is that a mobile money agent is required to withdraw from or deposit money to the mobile account (Figure 2). Mobile money agents work and transact at physical locations and are much more widely available than traditional banks. For example, mobile money agents can often be found at a convenience store outside of a city center, making it more accessible for rural populations to deposit cash and load a balance onto their mobile money account. Once cash is deposited, person to person (P2P) transfers and person to

business (P2B) transactions can take place without physical currency. Many mobile money

networks also digitally document transactions that would otherwise go unrecorded with a

traditional cash transaction. It is also worth noting that mobile money does not require a

smartphone, as basic cell phones can connect to mobile money networks (Figure 3).

Figure 1: Example of Mobile Money App Interface

Macline Hien/Reuters

Figure 2: Basic Cell Phone Connects to Mobile Money Network

Tony Karumba/AFP via Getty Images

Figure 3: Example of Mobile Money Agent Physical Location

Thomas Mukoya/Reuters

The most notable and well researched example of mobile money is M-PESA, which started in Kenya and currently spans seven countries with 41.5 million users. Another powerful example of mobile money is MTN Mobile Money which includes 22 countries in Africa and the Middle East with 46 million users. Orange Money is also popular in Africa, with 45 million users across eight countries. Beyond Africa and the Middle East, mobile money is also making gains in Latin America, with over one billion mobile money accounts registered in the region (Andersson-Manjang & Naghavi, 2021).

It is necessary to distinguish between mobile money and other digital wallets. With mobile money, the account is linked to a specific mobile device, as it relates to a unique SIM card number or telephone number. Digital wallets act similarly, but are not the same, as they are mobile versions of online payment platforms. This study focuses on mobile money, not digital wallets. However, digital wallets have grown similarly to mobile money in more developed economies around the world.

Transaction Costs and Mobile Money

Costs associated with mobile money can be classified into indirect costs, direct costs, and switching costs. Starting with indirect costs, it has been found that mobile money lowers travel time. A study on M-PESA in Kenya finds that "[mobile money] has allowed individuals to transfer purchasing power by simple short messaging service (SMS) technology and has dramatically reduced the cost of sending money across large distances" (Jack and Suri, 2014). Additionally, M-PESA has been found to complement other savings products, such as a formal bank account, because households find it to be "more accessible and cheaper than the bank", in addition to being safer than storing cash at home (Morawczynski & Pickens, 2009).

Shifting to direct transaction costs, research on sub-Saharan Africa shows "lower service fees relative to conventional bank accounts have resulted in rapid use of mobile money, especially in developing economies" (Okello et al., 2018). Contrastingly, other studies suggest that while fees are low, poorer populations still struggle to afford them (Ozili, 2018). Taking the perspective that small fees are an extremely limiting factor for the poor, M-PESA, one of the world's largest mobile money providers has a payment schedule that promotes account creation for low-income users (Figure 4). Creating an account and balance inquiry are free to the user, while small day to day transactions have a very low fee. For example, a typical meal at an inexpensive restaurant would be 400 Ksh ($3.56 USD). To transfer this amount to another user, the fee would be 6 Ksh ($0.05US), which is about a 1% transaction fee. Where fees become significant is when a customer wishes to withdraw from an M-PESA agent or ATM. Withdrawals from a M-PESA agent usually cost twice that of transfer fees, and ATM withdrawals are even more expensive. This has the potential to discourage customers from depositing money, knowing that in the future they may need cash for transactions. At the same

time, high fees for withdrawals, as well as free features, could encourage users to keep their money within the M-PESA ecosystem. In other words, high switching costs could encourage individuals to remain within the mobile money ecosystem instead of returning to the cash economy.

Figure 4: M-PESA Cost Schedule 2021 (Madegwa, 2021)

TRANSACTION RANGE (KSHS)		TRANSACTION TYPE AND CUSTOMER CHARGES (KSHS)			
MIN	MAX	TRANSFER TO M-PESA USERS, POCHI LA BIASHARA AND BUSINESS TILL TO CUSTOMER	TRANSFER TO OTHER REGISTERED MOBILE MONEY USERS	TRANSFER TO UNREGISTERED USERS	WITHDRAWAL FROM M-PESA AGENT
1	49	Free	Free	N/A	N/A
50	100	Free	Free	N/A	10
101	500	6	6	45	27
501	1,000	12	12	49	28
1,001	1,500	22	22	59	28
1,501	2,500	32	32	74	28
2,501	3,500	51	51	112	50
3,501	5,000	55	55	135	67
5,001	7,500	75	75	166	84
7,501	10,000	87	87	205	112
10,001	15,000	97	97	265	162
15,001	20,000	102	102	288	180
20,001	35,000	105	105	309	191
35,001	50,000	105	105	N/A	270
50,001	150,000	105	105	N/A	300

MAXIMUM AMOUNT CUSTOMER CAN TRANSACT DAILY	MAXIMUM AMOUNT CUSTOMER CAN HOLD IN M-PESA
300,000	300,000

ATM WITHDRAWAL			OTHER TRANSACTIONS	KSHS
TRANSACTION RANGE (KSHS)		CUSTOMER CHARGE (KSHS)	ALL DEPOSITS	FREE
			M-PESA REGISTRATION	FREE
MIN	MAX		BUYING AIRTIME THROUGH M-PESA	FREE
200	2,500	34	M-PESA BALANCE ENQUIRY	FREE
2,501	5,000	67	CHANGE M-PESA PIN	FREE
5,001	10,000	112		
10,001	20,000	197		

- Download mySafaricom App and transact on M-PESA
- Dial *334# to access all M-PESA services

What is financial inclusion?

The World Bank defines financial inclusion as: "individuals and businesses having access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way" (*Understanding Poverty - Financial Inclusion Overview,* 2022). Measuring financial inclusion is based on (1) access; (2) usage; and (3) the quality of financial products and services (*G20 Financial Inclusion Indicators – GPFI,* 2016). By way of this definition, financial institutions, governments, and nonprofits must understand the needs and capabilities of financially excluded populations to have successful policies. Because every individual has different needs and capabilities, there is no "one size fits all" approach to financial inclusion.

Adding to financial inclusion, the World Bank defines *digital* financial inclusion as "the deployment of the cost-saving digital means to reach currently financially excluded and underserved populations with a range of formal financial services suited to their needs that are responsibly delivered at a cost affordable to customers and sustainable for providers" (Kim, 2016). It is possible to be financially included but not digitally financially included. For example, if an individual only utilizes a traditional bank account. It is also possible that individuals are only financially included through digital means, such as a family who solely utilizes online banking to receive direct deposits and pay utilities but does not utilize other services such as borrowing or savings accounts. In this study, the population includes a nationally representative sample, capturing individuals of all types of financial inclusion and exclusion. This is useful in analyzing the potential impact of broad mobile money implementation. For example, it is worth investigating whether mobile money impacts behaviors of individuals who already have a formal bank account but may not have digital access to it. For the purposes of this study, individuals who already have a commercial bank account are included in the sample for this reason.

Mobile money and financial inclusion

To combat poverty, not only must policy makers consider a lack of capital, but they must also consider the accessibility of tools and resources by which capital can be stored and transferred. Without these tools, individuals go without protection from financial crises and other economic shocks. Around the world there are 1.7 billion unbanked adults. Furthermore, a disproportionate number of unbanked individuals live below the poverty line (Demirguc-Kunt et al., 2018). Because of this, financial inclusion is the focus of many poverty alleviation initiatives globally (Chibba, 2009). It has also been found that financial inclusion helps sustain economic growth within a community (Subbarao, 2009). At the same time, policy makers and researchers

have identified mobile money as a tool that can be broadly implemented to increase financial inclusion. It is likely that increasing access to financial services like mobile money is one of the avenues to reduce poverty, however so far it is unclear what mobile money's impact is on a large scale. Therefore, it is important to study mobile money as a tool to boost financial inclusion and broader economic welfare.

Understanding the potential of mobile money is especially relevant now as the global adoption of smartphones has lowered barriers for mobile money adoption. Instead of reliance on physical bank branches, the main requirement for mobile money is to have a cell phone (Hannig & Jansen, 2010). With immense progress in digital access, this would suggest that mobile money can be a powerful tool to reach the unbanked.

Statement of the Problem

The purpose of this research is to test mobile money's potential as a tool economic stability and resilience during economic shocks. This thesis analyzes if individuals who utilize mobile money services show different behaviors in saving, borrowing, and formalized responses to financial emergencies, relative to those who do not use mobile money. Conducting a meta-analysis of countries in Africa, Asia, and the Caribbean will begin to reveal general conclusions about mobile money that can be applied to countries where data is otherwise unavailable, or where the mobile money networks are emerging.

Justification of Problem

There are three key reasons that justify research in this area. First, there is a lack of multi-country analysis. Most methodologies focus on single country analysis. Single country analysis is common due to challenges of data collection and cleaning across starkly different countries. Differences between individual national surveys create difficulties with data collection and aggregation from a variety of country level questionnaires. As a result, it has yet to be determined whether there are broad, generalizable trends that exist between mobile money and financial inclusion. Even further, most of these single country analyses are on Kenya, or other countries where M-PESA has been implemented (Jack & Suri, 2011; Gurbuz Cuneo, 2019; Ouma et al., 2017; Demombynes & Thegeya, 2012). Understanding mobile money companies beyond M-PESA will also allow for broader conclusions to be drawn about mobile money.

Second, another substantial portion of the literature has focused on determinants of individuals *adopting* mobile money, not specific *outcomes* such as saving, borrowing, and economic stability (Amohah et al., 2020; Okello et al., 2018; Honohan and King, 2012). Understanding specific outcomes is an important next step in this body of literature. Where there are studies on outcomes, populations tend to be niche and only one outcome is analyzed at a time. For example, several studies focus on savings behavior of rural farmers, but these conclusions are not necessarily applicable beyond these specific populations. Understanding multiple outcomes (saving, borrowing, economic stability) for multiple countries is valuable when considering future impacts of mobile money where it has not yet been fully implemented.

Finally, the COVID-19 pandemic resulted in adoption of mobile money at a rate previously unseen. This is due to governments partnering with mobile money companies to distribute stimulus, as well as the advantages of a digital economy during a public health crisis

(Appendix 1). Because of this, it is necessary to expand upon understanding of potential

outcomes so policymakers can make the best decisions for their countries.

Theoretical Framework

The theoretical framework of this paper considers 1.) how financial access and financial inclusion are measured and 2.) commonly cited barriers to financial access. Both theories are based on the Global Findex from the World Bank, where survey results and insights come from thousands of individuals in over 100 countries.

Defining financial resilience

The theoretical framework of this paper goes beyond the traditional understanding of financial inclusion. Instead, the framework takes a layered approach to financial inclusion. The framework begins with financial access, which is the opportunity to take advantage of financial infrastructure. Financial access answers the question: "what tools are available to meet the financial needs of a population?" The second layer of the framework is financial inclusion. Financial inclusion measures whether individuals take advantage of financial access. For example, the ability to have a debit card is financial access and using a debit card would be financial inclusion. By this logic, financial inclusion answers the question: "do individuals utilize financial tools that are available to them?"

To understand why it is necessary to go beyond financial inclusion, it is important to consider how financial inclusion is measured and reported. Financial inclusion is measured by the G20 beginning with financial access, then measuring usage and quality indicators (*G20 Financial Inclusion Indicators - GPFI,* 2016). "Usage" measures the "regularity" and "duration" of how financial tools are used (debit card, credit card, cash). For example, does a family consistently purchase goods with a credit card? Or only when they are short on cash? "Quality" indicators look to measure if the tools available are appropriate for a specific population.

Similarly, if credit cards were available in a community, but very few people qualify for a credit card, this would not be classified as a quality form of financial inclusion.

Neither usage nor quality indicators attempt to capture long-term changes in behavior because of financial inclusion. If there is financial access and the tools are utilized and of high quality, then it is to be expected that financial habits positively change in the long run.

To capture the long-term behavioral impacts of financial inclusion, this framework looks to add a third layer: financial resilience (Figure 5). Financial resilience answers the question: "to what extent can individuals withstand economic shocks by using financial tools?" To capture this, financial resilience measures long-term behaviors such as saving and borrowing habits, as well as the ability to respond during black swan economic events. Measuring these behaviors is a way to measure overall improvement in economic welfare and economic stability. For example, increased saving and borrowing improve overall liquidity, which would improve economic stability in the event of a family emergency such as illness or death. Improved economic stability during an economic shock translates to improved economic welfare in the long run.

Figure 5: Levels of Financial Inclusion

- **Financial access:** What tools are available to meet the financial and economic needs of a population?
- **Financial inclusion:** Do individuals utilize available tools?
- **Financial Resilience:** To what extent can individuals withstand economic shocks by using financial tools?
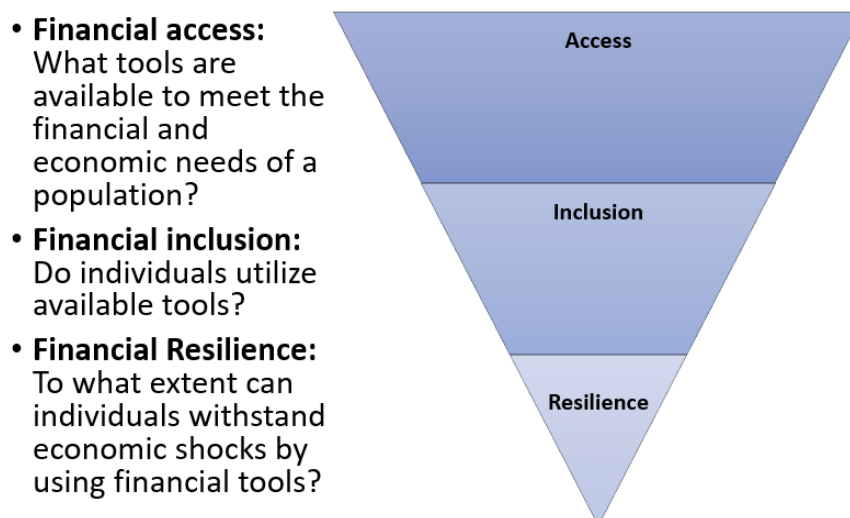
Cited barriers to access

The second part of the theoretical framework that guides this paper is the reported reasons for being unbanked from the World Bank Global Findex dataset. Globally, one quarter of respondents surveyed reported costs associated with a bank account, such as fees and time spent traveling, as reasons for not having a bank account (Demirguc-Kunt et al., 2018). Mobile money addresses both issues. As mentioned, mobile money eliminates the need to travel to financial institutions regularly. Additionally, mobile money offers powerful low-cost options. Because mobile money directly eases commonly cited pain points of financial inclusion, it is worth testing the impact of mobile money on financial resilience.

Literature review

      First this section outlines the benefits to financial inclusion, as mobile money is regarded as one of the main tools to reach the unbanked. Then, the second portion of the literature review serves as the first part of this study's meta-analysis (Appendix 2).

What are the benefits to financial inclusion?

      Several authors suggest that financial access and financial inclusion benefit both individuals and the countries they live in through poverty reduction, increased human development, increased economic growth, and lower economic inequality. Because of this, it is worth studying specific mechanisms by which financial inclusion can increase, such as through mobile money.

      Beginning with financial access, studies consistently show a positive relationship between increasing financial access and poverty reduction. One of the most notable works in this body of literature, *Finance, Inequality and the Poor*, shows that even when controlling for economic growth, increasing financial access is associated with a drop in the percentage share of a population that lives on less than $1 a day (Beck et al., 2007). Other studies find that financial sector growth is associated with poverty reduction (Jaililian and Kirkpatrick, 2005). Financial sector growth is a form of financial access and would be inclusive of expanding access to mobile money.

      Financial inclusion, like financial access, is associated with poverty reduction. Much research as suggested that the millennium development goals (MDGs) are not sufficient to address poverty reduction. However, focusing on financial inclusion related policies is the most effective way to reach MDGs, such as global poverty reduction (Chibba, 2009). A study on India suggests that financial infrastructure development and financial inclusion contribute to poverty

reduction (Williams et al., 2017). A broader study on Asia reports the same results, finding that financial inclusion has a significant correlation with lower levels of poverty and income inequality (Park and Mercado, 2018).

Beyond poverty reduction, there are country level benefits to financial inclusion. Strong correlation exists between financial inclusion and human development within a country (Sarma and Pais, 2011). Higher levels of human development exist for all, not just those being lifted out of poverty. Financial inclusion also relates to accelerating economic growth. Research suggests a chain reaction between financial inclusion, financial development, and country level economic growth (Mohan, 2006). Regarding financial technology, a recent study claims, "digital financial inclusion is associated with higher GDP growth" (Sahay et al., 2020). This would suggest that in the advent of digital technology expansion, inclusive of mobile money diffusion, there is new opportunity for country-wide growth.

Empirical evidence from other countries

While financial resilience has not been studied directly in a way similar to this thesis, saving, borrowing, and coping mechanisms have all been studied separately in a variety of different countries with high mobile money diffusion. These studies serve as the first step to understanding changes in financial habits and economic stability as a result of mobile money use.

<u>Saving</u>

Overall, existing literature on individual countries finds that mobile money increases the likelihood of having savings (Appendix 2). This is consistent across multiple countries and studies. Less researched has been completed on mobile money's impact on total saving stock. However, a number of studies find that savings stock is higher among mobile money users.

M-PESA, a mobile money company in Kenya, has offered many insights into the impacts of mobile money. Based on a study of early M-PESA adopters, it is seen that M-PESA is not only a way to transact, but an informal savings instrument (Jack and Suri, 2011). This paper also points out that M-PESA users are more likely to use a formal bank account to save than those without M-PESA, showing that mobile money can serve as a key steppingstone to formal financial inclusion. Additionally, research suggests that M-PESA increases the likelihood of having savings but does not examine if total savings stock changes (Demombynes and Thegeya, 2012). Gurbuz Cuneo (2019) confirms and builds on the work of Demombynes and Thegeya (2012), suggesting that saving among M-PESA users is 16-22 times more likely than among those without M-PESA. This paper also demonstrates that savings of M-PESA users tend to save 15% of average monthly earnings per household member, but does not compare this to non-users (Gurbuz Cuneo, 2019).

Moving away from M-PESA, an analysis in Sub-Saharan Africa observes that "not only does access to mobile financial services boost the likelihood to save, but also has a significant impact on the amounts saved. These benefits are likely to be the greatest for those with limited access to the formal banking system" (Ouma et al., 2017). In Rwanda, mobile money "contributes significantly to savings promotion" when using an endogenous switching regression model (Maniriho, 2021). However, this paper does not attempt to quantify by how much mobile money increases savings propensity. Similarly, in a field experiment in India, there are strong positive perceptions of mobile money, and it is often used as a savings tool for small savers (Nandhi, 2012). Again, this case study does not attempt to quantify the impact of mobile money. Evidence from Mozambique is consistent with India and Rwanda where the amount saved increased in interest bearing mobile money accounts (Batista & Vicente, 2019). In a study done

in Burkina Faso, likelihood to save is increased by 7-12% when using mobile money when compared to non-users (Ky et al., 2017). Despite low mobile money penetration in Uganda, results from Uganda's 2013 FinScope are consistent in that the effect on savings is positive (Mayanja & Adong, 2016), in addition to this effect on savings in Uganda being confirmed in a field study (Ryder, 2014). Another study in Uganda suggests that mobile money increases the likelihood to save by 17% (Munyegera & Matsumoto, 2017). A study conducted on Uganda, Kenya, and Tanzania indicates that mobile money users are 11% more likely to save compared to non-account users. This study goes on to explain that mobile money is a compliment to formal savings, as well as a substitute for informal savings (Ruh, 2017).

The paper *Debit Cards Enable the Poor to Save More* provides a plausible explanation for why this occurs. It explains that the difficulty of informal saving is the obligation to find safe places to store money and the manual, individual accounting a person must do when they do not have access to a formal account (Bachas et al., 2020). The paper also reports having constant access to informal savings (stored cash) can decrease total savings as it is easier to spend these reserves. Finally, in a different paper, Bachas elucidates a correlation between commute distance to account access and savings stock (Bachas et al., 2018). Broadly, these studies indicated that lower indirect transaction costs are associated with higher propensity to save.

From these studies in individual countries and niche populations, it is seen that mobile money has a positive impact on savings. Mobile money can act as an informal savings account, a steppingstone to formal financial inclusion, as well as lowering indirect transaction costs, which all lead to increased savings propensity and/or saving stock.

Borrowing

While it can be debated whether borrowing is a positive or negative outcome, it is seen

that higher financial inclusion and mobile money adoption translate to higher rates of borrowing

(Appendix 2). A study in Asia suggests that higher financial inclusion (broadly defined, not

specific to mobile money) lowers poverty rates, increases entrepreneurship, and increases

borrowing (Park and Mercado, 2021). A study Uganda that also investigated savings propensity

finds that mobile money increases the likelihood of borrowing by 14% (Munyegera &

Matsumoto, 2017). A working paper that analyzes borrowing decisions in a variety of

developing countries has found that individuals who use mobile phones for transactions such as

ecommerce, utilities, and receiving wage payments are 7-17% more likely to borrow (Lyons et

al., 2020). From these studies, mobile money is likely to have a positive impact on borrowing,

which is one of three key components of financial resilience.

Economic shocks and coping mechanisms

Generally, mobile money is positively associated with maintaining consumption during

financial crisis and utilizing formal coping mechanisms during economic shock (Appendix 2). A

study on M-PESA suggests that of households that utilize mobile money, these individuals can

maintain the same level of consumption through negative economic shocks (Jack and Suri,

2014). The study also discovered that households that did not utilize mobile money technology

suffered a 7% decrease in consumption when experiencing a negative economic shock.

Many of the studies that analyzed general savings behavior also analyzed whether

individuals rely on these savings during a financial crisis. In a field experiment in India, many

account users saved specifically for emergencies in an EKO mobile account (Nandhi, 2012).

Similarly, in Burkina Faso it was found that groups that are normally financially excluded, like

rural populations, less educated groups, and women were able to save for health emergencies when using mobile money (Ky et al., 2017). Overall, mobile money is associated with increased ability to cope with economic shocks and maintain economic stability, however the studies available are limited compared to saving and borrowing.

Rationale for method

There are a variety of methods that have been used to assess the impact of mobile money due to the lack of natural experiments that can be found in the real world, as well as the lack of available data (Figure 6). Studies can be grouped into three categories: (1) regression analysis of large datasets using instrumental variables (2) regression analysis of large datasets without instrumental variables and (3) smaller sample field studies completed over time (Figure 6). Often, studies use multiple types of regression models to help explain their results. In general, different types of regression models and field studies yield the same results: mobile money has a positive impact on saving and borrowing. However, it is difficult to compare the magnitude of results across different methods as many countries/populations have only been investigated with one method. The main difference between these approaches is the level of causality that can be inferred.

Multivariable regression models are often used because of their simplicity to implement. These models are a great start for beginning to identify relationships between variables of interest. However, it is difficult for standard multivariable regression models to be considered causal, even with many controls. Instrumental variable regression models share many similarities with multivariable regression models but are more difficult to implement. At times, instruments may be unavailable, weak, or theoretically flawed. Causal results can come from instrumental variable regression, but this is contingent on the strength of the instrument. Finally, field studies

require lots of time, effort, and capital to implement. In terms of small sample sizes, it is possible to have controls that lead to casual results. However, it is difficult to do a field experiment on a sample size large enough to answer the questions of this study.

Studies vary slightly in the variables analyzed, depending on the availability of data and survey respondents. Typically, financial inclusion is a function of demographic characteristics and income related measures. Studies that use instruments to improve their regression typically use the same instrument, which relates to distance away from a financial access point, like a mobile money agent.

Figure 6: Methods Used by Existing Studies

Regression, no instrument	Maniriho (2021); Ouma, Odongo, Were (2017)
Regression, instrument	Ky et al. (2017); Mayanja & Adong (2016); Ruh (2017); Demombynes and Thegeya (2012); Gurbuz (2017); Honohan, P., & King, M. (2012)
Field study	Nandhi (2012); Batista & Vicente (2019); Ryder (2014); Jack and Suri (2011); Jack and Suri (2014)

This study will utilize OLS regression and IV regression is ways similar to prior studies. Additionally, this study will attempt to use the same types of variables utilized in past studies. The main difference, however, is that this study will analyze many countries at once and solely focus on the mobile money coefficient as it impacts saving and borrowing propensity. As coping mechanisms are often analyzed using field studies, this study will complete descriptive analysis to identify if there are similar conclusions.

Methodology

This study uses available data from FinScope surveys collected from nine countries with a total size of 60,375 individuals (FinMark Trust, 2015). The countries analyzed are Benin, Burkina Faso, Cameroon, Eswatini, Haiti, Madagascar, Rwanda, Togo, and Zambia. The data collection of these surveys ranges from 2015-2019. This is acceptable, as it reflects the impacts of mobile money broadly, no matter the stage of mobile money diffusion into a country. Specifically, each country only has data from one period. From the FinScope survey, data from 18 survey questions was used to create variables of interest (Appendix 3). Summary statistics for variables used are in the table below.

Figure 7: Summary Statistics

Variable Description	Variable Name	Observations	Mean	StDev
Country	Country	67345		
Mobile money use (y/n)	MM	67345	0.24	0.43
Distance from Mobile Money Agent	DistMM	42925	50.38	44.44
Commericial Bank Account Use (y/n)	CB	67345	0.13	0.33
Distance from Commercial Bank Account	DistCB	34118	58.96	43.52
Urban / Rural	UrbRur	67345		
Age	Age	58847	38.65	16.12
Education Level	Education	56482	3.07	1.56
Head of Household (y/n)	HoH	67345	0.59	0.49
Personal Income (Numeric)	PersonalInc	33767	173066.08	1818905.30
Personal Income (Percent Rank)	PI_Perc	33767	0.55 *+	
Household Income (Numeric)	HHInc	29903	291995.81	2130953.94
Household Income (Percent Rank)	HI_Perc	29903	0.58 *+	
Combined Household and Personal Income (Percent Rank)	IncPerc	39368	0.56 *+	
Total Savings Reported (Numeric)	SaveNum	17092	1145849.01	6723271.22
Total Savings Reported (Percent Rank)	SN_Perc	17092	0.48 *+	
Indicated Savings (y/n)	SaveBin	67345	0.56	0.50
Total Debt/Borrowing Reported (Numeric)	BorrowNum	11886	1601087.78	13283345.76
Total Debt/Borrowing Reported (Percent Rank)	BN_Perc	11886	0.48 *+	
Indicated Borrowing (y/n)	BorrowBin	67345	0.31	0.46

*Mean is not exactly .5 because this is a discrete variable, not continous, so multiple reported values may have the same rank
+ Uniform

Models

For each outcome, saving and borrowing, there are 5 models (Figure 8). Three of the models are instrumental variable regressions utilizing different combinations of variables. Two of the models are ordinary least squares models, each also utilizing different combinations of variables. The OLS acts as a first step to understanding the relationship between mobile money

and financial resilience, while using an IV regression estimates the causal impact of mobile money on financial resilience.

The creation of the OLS(2) model was based on other studies like this one, where all proposed variables are put into one model. For purposes of better understanding the impact of the control variables, a simple OLS(1) regression model was created, with only one explanatory variable, mobile money use. A low VIF, as well as the use of both financial access and demographic variables in the same model in other studies, did not suggest potential endogeneity issues. Theoretically, there may be an endogeneity issue, but the OLS models in this study serve the purpose of testing my results against previous studies that used similar methods.

For the IV regression model, however, a high VIF indicated that there may be an endogeneity problem when using all proposed variables in the same model in addition to the instrumental variable. To overcome this, the IV models group variables between demographic variables (Urban/Rural, Age, Education, Head of Household) and financial access variables (income, commercial bank account use). For example, income may be a function of age and education level, so these predictor variables should not be utilized in the same model. Splitting the models between demographic and financial access variables resolved the VIF issue and is logically sound to solve the endogeneity problem. Like the OLS model, a basic IV model using only mobile money as the explanatory variable is used to compare the impacts of different variable groupings (demographic variables compared to financial access variables). The 5 general models for each outcome variable are described below.

Figure 8: General Model Description

COUNTRY_ IVREG:	*Without controling for demographic variables or differences in financial access, what is the impact of mobile money on the likelihood to save, using distance from a MM agent as an instrument*
COUNTRY2_IVREG:	*Controling for demographic variables, what is the impact of mobile money on the likelihood to save, using distance from a MM agent as an instrument*
COUNTRY3_IVREG:	*Controling for financial access, what is the impact of mobile money on the likelihood to save, using distance from a MM agent as an instrument*

COUNTRY_OLS:	*Without controling for demographic variables or differences in financial access, what is the impact of mobile money on the likelihood to save*
COUNTRY2_OLS:	*Controling for demographic and financial access variables, what is the impact of mobile money on likelihood to save*

Analysis of savings propensity and borrowing propensity is the first step in telling a complete story of mobile money's impact on financial resilience. Each model was then applied to savings propensity and borrowing propensity for each country (Figure 9).

Figure 9: Detailed Model Description

SaveBin	
COUNTRY_IVREG	SaveBin ~ MM | DistMM
COUNTRY2_IVREG	SaveBin ~ MM + UrbRur + Age + Education + HoH | DistMM
COUNTRY3_IVREG	SaveBin ~ MM + IncPerc + CB | DistMM
COUNTRY_OLS	SaveBin ~ MM
COUNTRY2_OLS	SaveBin ~ MM + UrbRur + Age + Education + HoH + IncPerc + CB
BorrowBin	
COUNTRY_IVREG	BorrowBin ~ MM | DistMM
COUNTRY2_IVREG	BorrowBin ~ MM + UrbRur + Age + Education + HoH | DistMM
COUNTRY3_IVREG	BorrowBin ~ MM + IncPerc + CB | DistMM
COUNTRY_OLS	BorrowBin ~ MM
COUNTRY2_OLS	BorrowBin ~ MM + UrbRur + Age + Education + HoH + IncPerc + CB

Instrument rationale

The need for an instrumental variable comes from a large potential for influence from confounding variables on the relationship between mobile money adoption and financial resilience. For example, an individual who knows of mobile money might also recognize the benefits to saving and borrowing. Similarly, an individual may not save or use mobile money platforms for the same reason: lack of money, lack of trust, or lack of financial education (Demirguc-Kunt, 2018). Because of this, an instrument is needed to assess the causal relationship between mobile money and financial resilience.

The instrument for the IV models is the reported time to travel to a mobile money agent. For example, in the FinScope survey, an individual can report that it takes them 5 minutes to get to a mobile money agent. Other studies previously mentioned use geographic distance as an instrument. Many studies utilize geospatial data available for mobile money locations in Kenya as it relates to the M-PESA program to create an instrumental variable. However, accurate geospatial data is not available for all the countries in this study, so distance reported as time is used as a proxy.

This is an acceptable instrument because distance from a mobile money agent should not correlated with financial resilience (propensity to save, borrow, and coping mechanisms) but should be correlated with the propensity to adopt mobile money.

First, any existing predisposition to save as a result of culture, upbringing, and psychological factors is not impacted by the existence of mobile money locations. It could be assumed that mobile money agents exist in communities where individuals are of higher economic status, and therefore they save more based on their wealth and disposable income. However, mobile money agents serve financially excluded individuals. Typically, financially

excluded individuals are of lower economic status. This factor suggests that financial resilience (as it relates to savings) should not be positively correlated with the distance away from a mobile money agent.

However, a meaningful negative correlation would also not satisfy the requirements to be a valid instrument. Something unique to mobile money agents is that deposit and withdrawal locations are in shops, markets, convenience stores, and other common locations. The locations are more likely to be randomly and evenly distributed as compared to bank branches, limiting the potential for a meaningful negative correlation.

Additionally, the likelihood of a meaningful negative correlation is mitigated by the fact that mobile money is not advertised as a savings tool. Mobile money agents will likely be located where individuals seek to do transactions with or without formal means, like credit cards. So, this can eliminate some elements of self-selection as all individuals need to transact, further justifying the random relationship between distance from a mobile money agent (Z) and propensity to save (Y).

When considering whether borrowing behavior is associated with distance away from a mobile money agent, it is important to remember that traditional banks can be lenders, while mobile money agents are not. It is very possible that an individual uses mobile money for day-to-day needs, then chooses to apply for a loan from a friend, family member, microlender, or a traditional bank. These are common sources of loans in many countries where the traditional banking sector does not reach all individuals. Given the diverse options available for a loan, it is not likely that the location of mobile money agents is correlated with the likelihood of applying for/receiving a loan.

Finally, this study does not propose an instrumental variable regression to predict coping mechanisms during a financial crisis, so these relationships are not relevant. However, this study looks to find a consistent story between regression outputs for saving and borrowing and the use of different coping mechanisms. Logically, individuals who have more savings and the ability to borrow quickly and reliably are more likely to withstand economic shocks without severe harm.

Based on this rationale, it follows that distance (in time) away from a mobile money agent should be a sufficient instrument for my analysis when considering the attributes of mobile money theoretically. However, the instrument must also be statistically and mathematically sound. To be a sufficient instrument, the correlation between mobile money use (X) and distance away from a mobile money agent (Z) must be strong. The correlation between X and Z for the 9 countries ranges from -.3 to -.45. That is, the further away an individual is from a mobile money agent, the less likely they are to use mobile money with a correlation of .3-.45. While many instruments ideally have a correlation > .6, the range of .3-.45 is sufficient considering that mobile money use (X) is binary and that reported distance from mobile money agent (Z) is discreet[1]. Should these variables be continuous, for example mobile money usage frequency or exact distance from mobile money agent, this correlation would likely be higher. That is, the instrument is theoretically sound, but could be stronger. The model outputs are strengthened by other control variables, nonetheless.

Additionally, to be a sufficient instrument, the correlation between Y (saving propensity, borrowing propensity) and Z (distance in time away from a mobile money agent) must be negligible. Where sample size of mobile money users is sufficient (Appendix 4)[2], the correlation

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[1] For the FinScope surveys, distance away from a mobile money agent could be reported in increments of 5, 10, 15, 20, 30, 45, and 60 minutes.

[2] In the original dataset for this study there was 67,345 observations from 11 countries. This paper included Gambia and Myanmar for all parts of the analysis, until it was realized that the use the instrument, distance from a mobile

of Y and Z ranges from .009 to -.07, which is low enough to confirm no significant relationship

between Y and Z, further demonstrating that the instrument of choice is valid. This is consistent

with the hypothesis above regarding low income and financially excluded communities, as well

as the more randomized placement of mobile money agents as to bank branches.

Descriptive analysis

Due to the nature of the survey data being at times incomplete, especially in questions

that require manual entry or questions towards the end of the survey, regression analysis is not

appropriate to analyze numeric saving or numeric borrowing variables. Additionally, descriptive

analysis is used to identify trends in coping mechanisms. The goal of these analyses is to help

support the findings of the IV and OLS regressions and to help create a story that surrounds the

outputs. Descriptive analysis of these variables serves as a robustness check for the 5 models

created.

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money agent, was statistically weak in these countries. This best explained by the fact that both countries have very low rates of mobile money diffusion and adoption, over-emphasizing variation within the small sample proportion of mobile money users. The weak instrument resulted in consistently insignificant results with outlier coefficients. However, there results were likely due to the low sample proportion of mobile money users and not representing the impact of mobile money on individuals within these countries.

Assumptions and Limitations

This methodology has 3 key assumptions: 1.) The instrumental variable is strong and appropriate 2.) FinScope surveys are nationally representative 3.) The variety of countries with data available (in addition to other studies) is sufficient to draw broad conclusions about mobile money.

Based on the explanation and assumptions above, the proposed instrument of mobile money agent concentration is appropriate. That is, saving and borrowing are only impacted by distance away from a mobile money agent through its relationship with mobile money adoption. Beyond the previous explanation and assumptions, the use of a geographic instrument (distance reported in travel time) is well documented in developmental economics and healthcare economics, providing further justification for its use. This instrument could be made stronger by using continuous variables, as the instrumental variable used was captured in the survey as a discrete variable.

When using the FinScope data, this study does not seek to confirm whether FinScope data are truly nationally representative. Given that the agencies that collect this data, as well as other studies that rely on the same data, report that the data is nationally representative this is a strong assumption in the analysis. However, with in-person surveys of this size, as well as potential changes in demographics over time, there is a risk that these data sources may not be nationally representative. Should the data not be nationally representative, or should the national makeup of a country strongly vary between the date of collection and present day, this would create limitations and potential estimation error in reported findings.

Finally, there may be features of the countries analyzed in this study, as well as the other individual studies, which allow mobile money to create a positive impact on financial resilience

that are rare / not present in other countries in the world. This study attempts to analyze a variety of countries in different parts of the world, but many of these countries are studied because of the existence of mobile money. Further, mobile money exists in these countries because individuals are financially excluded. Therefore, these results may be attributable to financial inclusion alone (mobile money as the only option). This means that mobile money may have less impact where traditional banking already exists.

Building further on this, the results from the descriptive analysis in the third part of this thesis are not causal, so concrete conclusions cannot be drawn until they are tested with more rigorous statistical methods. The direction of the results (positive or negative) helps further understand what is occurring with mobile money in these countries, however these results should not be overapplied when attempting to come to broad conclusions about mobile money.

There are many obstacles and deficiencies in the current literature that call for a study like this. However, these same obstacles and deficiencies can also limit the accuracy and applicability of prior studies that serve as the basis for this study. As a result, more field studies or additional surveys are needed in order to confirm the repeated findings of the FinScope data.

Results

Across all countries, the IV regression models suggest mobile money increases propensity to save by 21% on average (Appendices 5-7). Propensity to borrow also increases by 10% on average across all IV models when mobile money is used (Appendices 8-10). Both outcomes are consistent with previous studies of other countries. Using descriptive methods, results also suggest a positive relationship between total savings stock and mobile money use, as well as a positive relationship between total amount borrowed and mobile money use. These findings support the analysis of coping mechanisms, where mobile money users are more likely to use formal coping mechanisms during economic crises, and less likely to use informal coping mechanisms.

The use of instrumental variable regression to analyze savings propensity and borrowing propensity yields a wider range of results than the OLS regression, as well as larger confidence intervals. This is to be expected, as the instrument attempts to eliminate psychological and environmental influence that would simultaneously reinforce both financial resilience (saving and borrowing) and mobile money use.
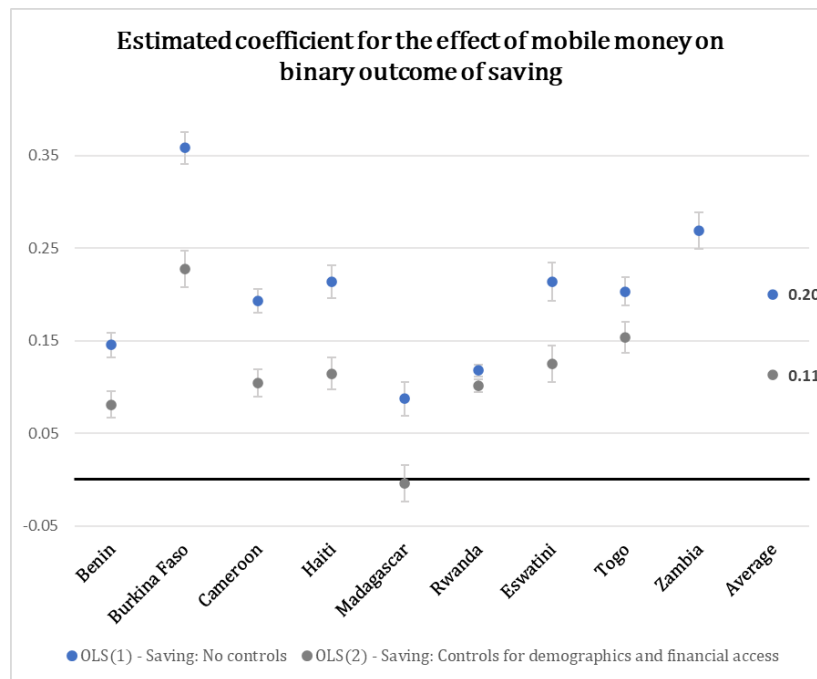
Saving propensity

Overall, models suggest that mobile money use is associated with a higher propensity to save. The preferred OLS and IV models suggest the range of 11%-30% increase in savings propensity due to mobile money use, which is consistent with prior studies.

The OLS(1)-Saving regression model indicates that across countries, on average the propensity to save is 20% higher for mobile money users when not controlling for other factors. Significant coefficients for propensity to save range from 35% to 8% (Figure 10). This model serves as a base to compare OLS(2)-Saving, and these results should not be interpreted as the

true impact of mobile money on savings propensity. Adding in demographic and financial access control variables, the effect of mobile money is estimated to be smaller. The OLS(2)-Saving regression model suggests that on average, saving is 11% higher for mobile money users, with country-specific estimates ranging from 22% to -.03% for all coefficients, demonstrating the impact of the demographic and financial access control variables decreasing the mobile money coefficient in the model relative to OLS(1)-Saving (Figure 10). The smallest coefficient, .03% in Madagascar, is result was not statistically significant in the OLS(2)-Saving regression, but all other observations in OLS(1)-Savings and OLS(2)-Savings are significant. Both OLS models, while not causal, suggest a positive relationship between mobile money and savings propensity.

Figure 10: OLS Savings Models
Appendix 11 and Appendix 12 offer exact results in tabular form


Turning to the IV models, which help in moving beyond correlation to identify causal effects, the IV(1)-Saving regression model indicates that propensity to save increases by 33% for mobile money users (Figure 11). The largest increase was 77% and the smallest increase was

10%. This regression has no controls, and is used to compare the effects of demographic variables in IV(2)-Saving and financial access variables in IV(3)-Saving.

Adding demographic controls, the IV(2)-Saving regression model suggests that mobile money increases propensity to save by 30% on average. Contrastingly, the IV(3)-Saving regression model shows that mobile money increases propensity to save by 12% on average, when including financial access control variables (Figure 11). Nonetheless, between the two models, the majority of countries fall between 10-30% increases in savings propensity for mobile money users.

Figure 11: IV Savings Models
Appendix 5, Appendix 6, and Appendix 7 offer exact results in tabular form
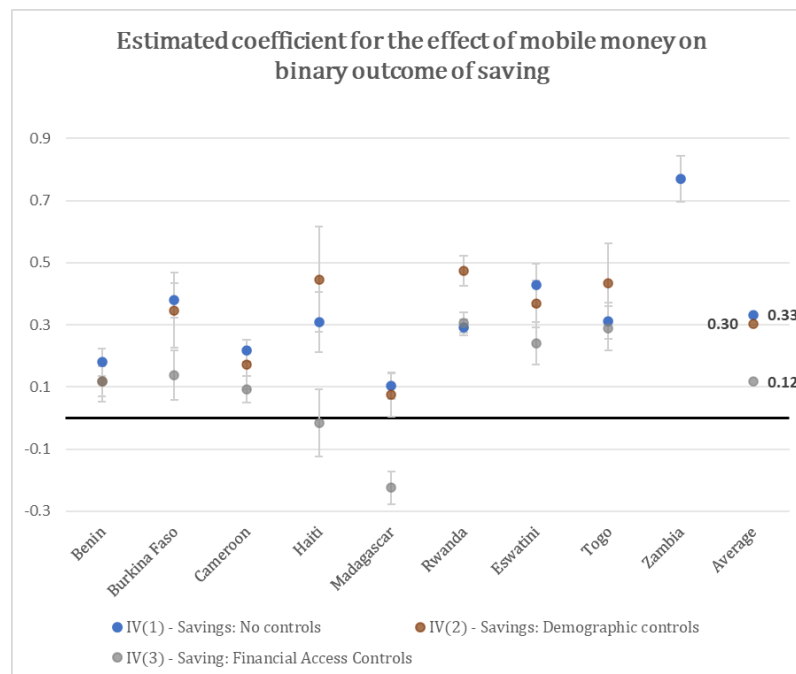
When comparing the OLS and IV models, it is seen that IV(3)-Savings (financial access controls) and OLS(2) have the most similar coefficients. At the same time IV(2)-Savings (demographic controls) suggests a much higher result (Figure 12). This could suggest that the combination of financial access controls and the instrument is the most appropriate for

explaining the variation in savings behavior that is caused by mobile money. Alternatively, differences in the IV(2)-Savings regression (demographic controls) could be explained by the "local average treatment effect" (LATE). This is where the IV coefficient results reflect the impact on savings for those affected by the instrument, distance from a mobile money agent. At the same time, it would not reflect the impact on savings for those not affected by the instrument (Becker, 2016). So, it could be that those who live very close to a mobile money agent have a higher propensity to save than those who live far away from a mobile money agent. It's very possible that those who report low times to mobile money have private transportation, which could also translate to a higher propensity to save relative to those who rely on public transportation and/or walking. In the case of IV(3)-Savings, financial access controls may do a sufficiently better job at capturing the impact on savings for the entire sample, decreasing the effects of LATE. That is, financial access variables, when combined with the mobile money predictor and instrument, best capture the behavior of the entire population as income and commercial bank account ownership may capture unidentifiable confounders in a similar way to the instrument, or at least better than the demographic controls in IV(2)-Savings (demographic controls). Alternatively, it's possible that there is an endogeneity problem with the OLS(2)-Savings model. Although this study chose to mimic the variable selection of past studies, there is likely endogeneity between the financial access and demographic variables that were both included in the OLS(2)-Savings model.

Figure 12: Comparing OLS and IV Savings Models

Estimated coefficient for the effect of mobile money on binary outcome of saving

Legend:
- OLS(2) - Saving: Controls for demographics and financial access
- IV(2) - Savings: Demographic controls
- IV(3) - Saving: Financial Access Controls
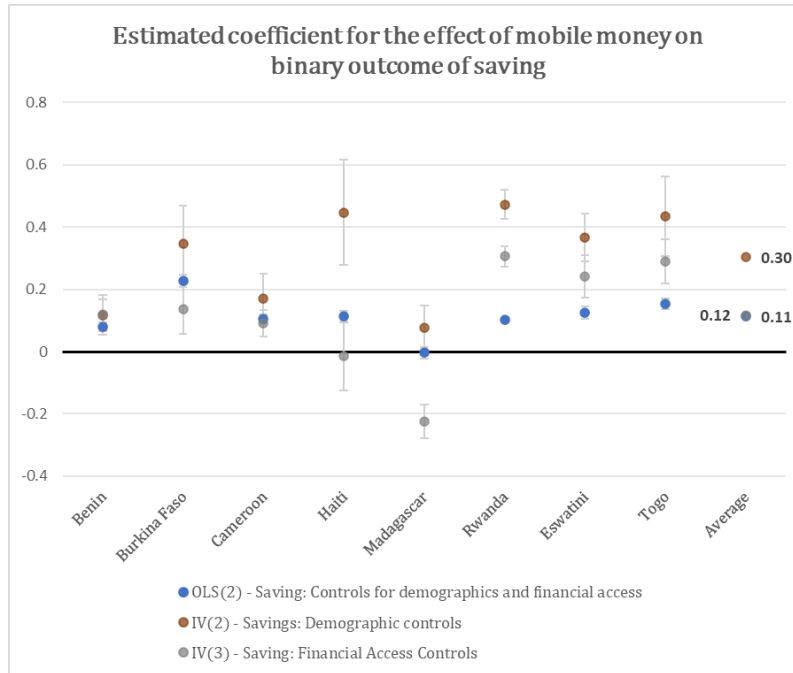
Borrowing propensity

When compared to the savings models, the results on borrowing are more mixed. While coefficients are generally positive, there are several more instances of insignificant results when compared to the Savings models. Relevant IV models suggest mobile money increases propensity to borrow by 7-13% on average.

The OLS(1)-Borrow regression model indicates that propensity to borrow is 10% higher for mobile money users without any controls (Figure 13). Individual country results range from 14% to 6%. All countries in the OLS(1)-Borrow model are significant, however this model is not reliable due to only predictor variable, mobile money use, being used in the model. This model serves as a baseline to compare OLS(2)-Borrowing. When applying controls, the OLS(2)-Borrow regression model indicates that propensity to borrow is higher 8% for mobile money users. The coefficients range from 11% to 4%. Again, all models are statistically significant, and

while significant controls are applied, this model cannot be considered causal. Instead, it helps identify a baseline relationship between mobile money and borrowing.

Figure 13: OLS Borrowing Models
Appendix 13 and Appendix 14 offer exact results in tabular form
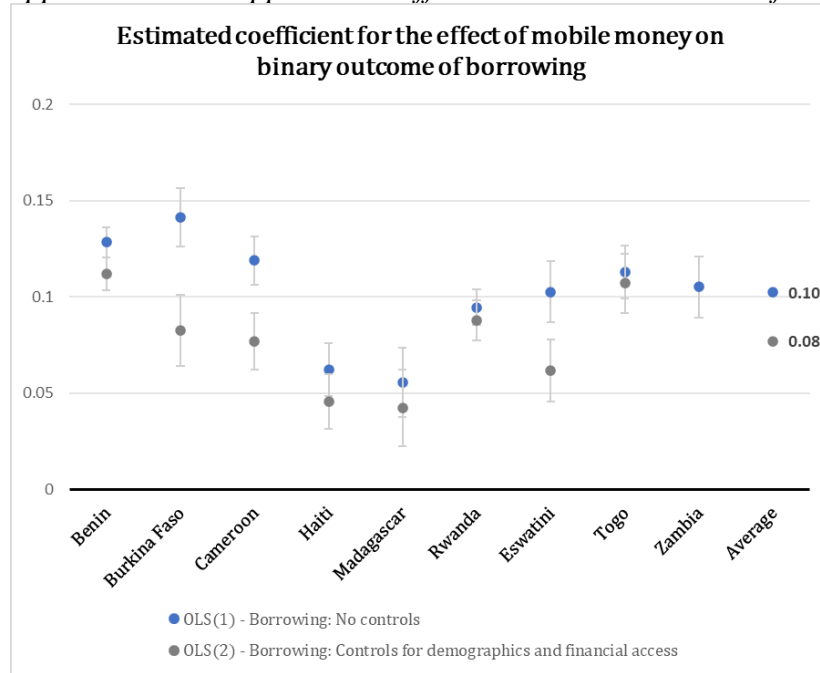
Without controls, the IV(1)-Borrowing regression model indicates that propensity to borrow increases by 11% for mobile money users (Figure 14). Results range from 24.4% to -4%. Haiti, Madagascar, and Togo are insignificant. The majority of reported values, however, are between 5% and 20% with small confidence intervals.

When applying demographic controls, the IV(2)-Borrowing regression model shows that propensity to borrow increases by 13% for mobile money users (Figure 14). The range of results is very large, with country level coefficients ranging from 46% to -15%. Cameroon, Haiti, Madagascar, and Togo are statistically insignificant. With financial access controls, the IV(3)-Borrowing regression model also suggests an increase in borrowing propensity for mobile money users of 7%. The range of individual country coefficients is also large, the largest increase is 25% and the smallest significant increase was -13%. Cameroon, Haiti, Madagascar, and Togo

are statistically insignificant in this model as well. Overall, 8 out of 9 countries report positive

results.

Figure 14: IV Borrowing Models

Appendix 8, Appendix 9, and Appendix 10 offer exact results in tabular form
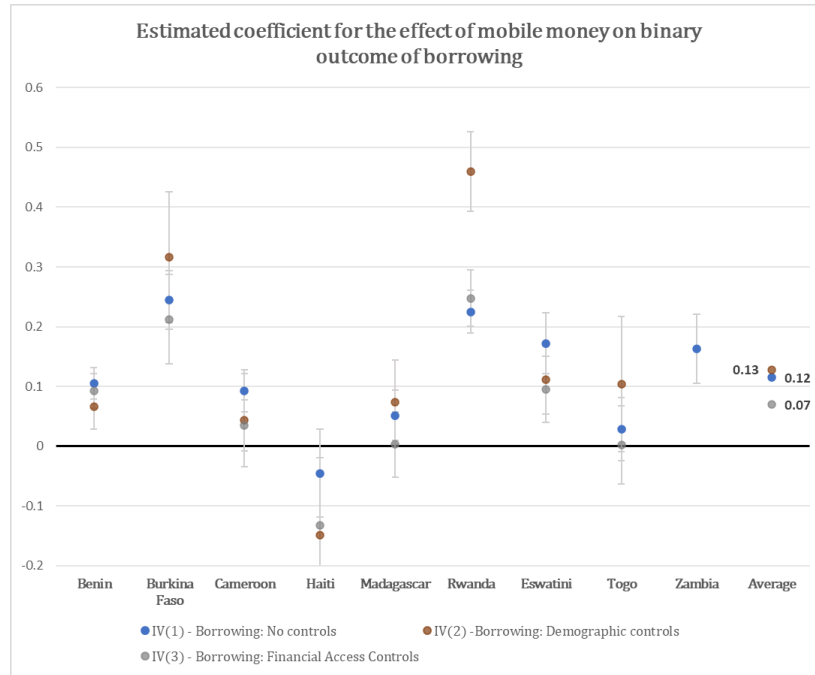
Borrowing results are much closer in range than the reported savings coefficients,

however OLS and IV results still differ (Figure 15). Similar to Savings, IV(3)-Borrowing

(financial access controls) and OLS(2)-Borrowing are the most similar, suggesting that financial

access variables and the distance instrument are the most appropriate ways to control for

observable and unobservable error. LATE also likely impacts IV(2)-Borrowing in a similar way

to IV(2)-Saving, where the combination of controls and the instrument reflects the results on

borrowing of only those impacted by the instrument. Demographic control variables may not be

sufficient to control for the impact of LATE, and financial access control variables capture a

more accurate result. These differences between OLS and IV regressions, like the savings case,

likely reflect that fact that those living very close to merchant could have high impact on the

likelihood of using mobile money. However, beyond those who live very close, the impact of distance on mobile money is relatively small. Because of this, the IV regressions could report higher results than the OLS, depending on the strength of other controls used. In any case, a more robust model would also likely result in more significant countries and a narrower range of results.

Figure 15: Comparing OLS and IV Borrowing Models
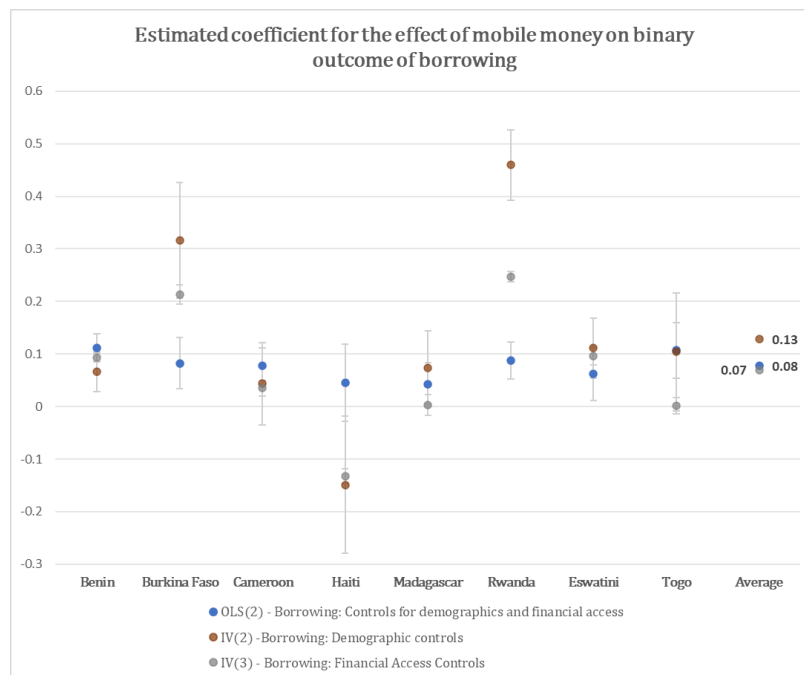
Saving stock and total debt

While the regression models provide strong evidence that individuals are more likely to save and borrow, this study also identifies a positive relationship between mobile money and numeric outcome variables. That is, there is a positive relationship between mobile money and saving more money, as well as a positive relationship between mobile money and borrowing more money. Unlike the IV regressions, this relationship is not causal.

The data for this analysis was far less complete than what is available for binary outputs. There were also issues with misreporting amounts. Because of this, the tables below represent 1.)

a percent rank of the entire population who reported their total savings and 2.) the average

reported savings of the middle 75% of the population who reported their total savings. Both of

these methods attempt to overcome reporting errors in different ways but attempt to capture the

magnitude of savings and borrowing. For example, higher average savings rank suggests higher

saving stock relative to the rest of the population, without concern to the dollar amount.

Similarly, a positive percent difference between mobile money users and non-users reflects how

much more mobile money users save relative to non-users. Limiting to the middle 75% simply

eliminates skew from the ultra-wealthy or extremely poor, who are not target populations of

mobile money to begin with. Finally, some countries are omitted from this dataset because there

were insufficient responses the numerical amount saved and borrowed, although there were

sufficient responses for the binary result of saving and borrowing.

Both methods point to the same relationship, among those who save, mobile money

account users typically save more relative to non-mobile money users. On average, the savings

rank is 10 percentage points higher for mobile money users. In other words, out of a ranked

population of 100, the average rank of a mobile money user's savings would be 55 and the

average rank of a non-mobile money user's savings would be 45 (Figure 16). Without

controlling demographic or financial access variables, mobile money users save 41% more on

average (Figure 17).

Both methods also point to the same relationship with mobile money and borrowing

among those who borrow, mobile money users typically borrow more than non-mobile money

users. With borrowing, the average rank is 16% higher where the rank of a mobile money user's

total amount borrowed would be 58, and the rank of a non-mobile money user's total amount

borrowed would be 42 (Figure 18). Without controls, mobile money users borrow 41% more

(Figure 19) across all countries sampled. Both savings and borrowing numerical results would likely be impacted in the same way that savings and borrowing propensity were impacted by controls, where the relationship between mobile money and saving/borrowing would remain the same, but the controls would lessen the impact of mobile money. Therefore, it is likely that the estimates of this table are high, but still report a meaningful relationship that represents the power of mobile money to positively influence financial resilience.

Figure 16: Mobile money impact on total amount saved, % rank

saving

Figures in % Rank of Country Sample	Mobile Money Users Savings Average Rank	Non-Mobile Money Users Savings Average Rank	Difference in Savings Average Rank
Benin (CFA)	56%	46%	10%
Burkina Faso (CFA)	65%	44%	21%
Cameroon (FCFA)	58%	45%	13%
Haiti (HTG)	49%	48%	2%
Madagascar (MGA)	52%	48%	4%
Eswatni (SZL)	36%	27%	9%
Togo (CFA)	57%	44%	13%
Zambia (ZMK)	60%	47%	13%

The average rank of a mobile money user is the 55th percentile, while the average rank of a non-mobile money user is 45th percentile. This 10% difference suggests that on average, of those who save, mobile money users typically save more.

Figure 17: Mobile money impact on total amount saved, middle 75%

saving

Figures in Local Currency	Mobile Money Users Average Saving Stock	Non-Mobile Money Users Average Saving Stock	Average % Difference in Saving Stock
Benin (CFA)	40,065	29,474	26%
Burkina Faso (CFA)	51,898	40,035	23%
Cameroon (FCFA)	48,151	35,610	26%
Haiti (HTG)	28,249	16,168	43%
Madagascar (MGA)	50,299	38,135	24%
Eswatni (SZL)	35,972	6,704	81%
Togo (CFA)	42,154	29,692	30%
Zambia (ZMK)	12,811	2,260	82%

The average difference in savings stock is 44%. While the magnitude of this result is not causal, this result supports the notion that of those who save, mobile money users typically save more on average.

Figure 18: Mobile money impact on total amount borrowed, % rank

borrowing

Figures in % Rank of Country Sample	Mobile Money Users Amount Borrowed Average Rank	Non-Mobile Money Users Amount Borrowed Average Rank	Difference in Amount Borrowed Average Rank
Benin (CFA)	53%	43%	10%
Burkina Faso (CFA)	63%	42%	21%
Cameroon (FCFA)	57%	44%	12%
Haiti (HTG)	60%	44%	16%
Madagascar (MGA)	61%	44%	17%
Eswatni (SZL)	51%	39%	12%
Togo (CFA)	57%	44%	13%
Zambia (ZMK)	67%	46%	21%

The average rank of a mobile money user is the 58th percentile, while the average rank of a non-mobile money user is the 42nd percentile when segmenting the sample for those who save. This 16% difference suggests that on average, of those who borrow, mobile money users borrow more.

Figure 19: Mobile money impact on total amount borrowed, middle 75%

borrowing

Figures in Local Currency	Mobile Money Users Average Amount Borrowed	Non-Mobile Money Users Average Amount Borrowed	Average % Difference in Amount Borrowed
Benin (CFA)	75,218	43,996	42%
Burkina Faso (CFA)	73,963	43,754	41%
Cameroon (FCFA)	7,850	5,869	25%
Haiti (HTG)	78,837	42,661	46%
Madagascar (MGA)	181,704	149,424	22%
Eswatni (SZL)	70,628	40,279	43%
Togo (CFA)	12,810	1,476	88%
Zambia (ZMK)	3,257	2,048	59%

The average difference in amount borrowed is 48%. While the magnitude of this result is not causal, this result supports the notion that of those who borrow, mobile money users typically borrow more on average.

Coping mechanisms

Descriptive analysis of coping mechanisms finds that mobile money users utilize formal coping mechanisms 5.8% more often than non-mobile money users. Similarly, mobile money users utilize informal coping mechanisms 5.5% less often compared to mobile money non-users. However, there are no significant changes in whether an individual borrows or remains helpless during a financial crisis.

This portion of the study analyzes the "Coping Mechanisms" portion of the FinScope questionnaire. Because coping mechanisms varied slightly from country to country, this study

groups them into 4 categories: Formal, informal, borrowing, and "Nothing I could do" (helplessness). Formal coping mechanisms include drawing from a bank account or using insurance. Informal coping mechanisms include selling household items and livestock for cash, sending more family members to work, or relying on cooperatives and savings groups. Borrowing, across all surveys, wasn't always defined between formal borrowing from a financial institution and informal borrowing from friends and family members. The "Nothing I could do" response suggests that individuals experienced the full impact of a financial crisis without capital to draw on. For the purposes of this study, this outcome would result in eating less as well as spending less on education and other necessities. Finally, there are countries omitted from this dataset because not all country surveys asked questions on coping mechanisms, or this section was at the end of the survey and was marked by incompleteness and/or poor reporting.

When only comparing formal and informal mechanisms, there is a clear story that mobile money users more often rely on formal coping mechanisms rather than informal ones (Figure 20, Figure 21). Use of formal savings mechanisms is 5.8% higher on average for mobile money users compared to non-mobile money users, with five out of eight countries showing positive differences greater than 5%. All countries show mobile money users more frequently use formal coping mechanisms when compared to mobile money non-users. Meanwhile, mobile money users opt for informal coping mechanisms 5.5% less during economic crisis when compared to mobile money non-users. Four out of eight countries show differences larger than 5%, and seven out of eight countries mobile money users less frequently use informal coping mechanisms when compared to non-users.

However, while mobile money increases likelihood of borrowing overall, there is no difference in borrowing for mobile money users and non-mobile money users during times of

financial crisis (Figure 22). Helplessness saw similar results to borrowing as a coping

mechanism, where there is no clear trend in sight (Figure 23).

The results for coping mechanism are descriptive and do not indicate any causality. Adding controls to test these trends would be an area for future research, given that more complete survey data on coping mechanisms is eventually available. The most relevant takeaway from this section is the nature of the differences for mobile money users, not necessarily the magnitudes.

Figure 20: Formal coping mechanism use by country
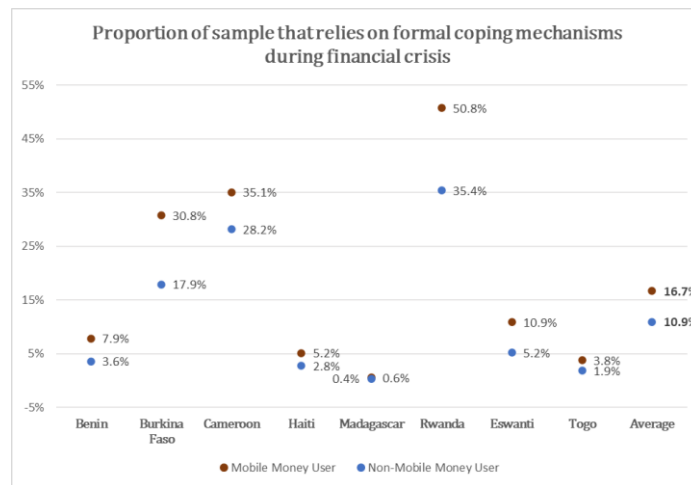
Figure 21: Informal coping mechanism use by country
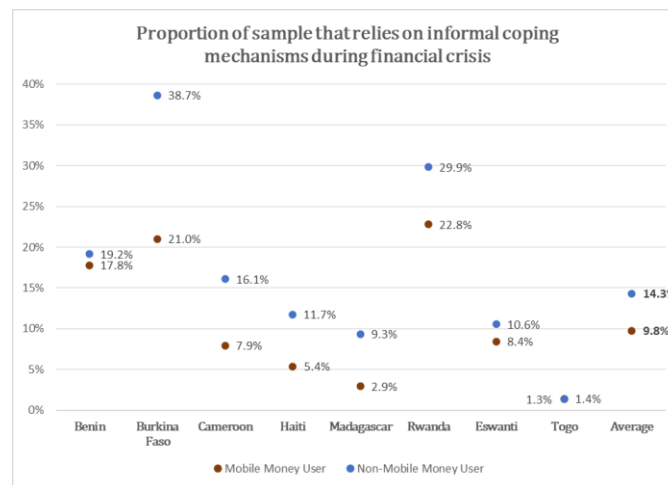
Figure 22: Borrowing during economic shock by country

Proportion of sample borrowed during financial crisis

- Benin: 6.0% / 5.9%
- Burkina Faso: 2.6% / 1.7%
- Cameroon: 3.3% / 2.2%
- Haiti: 2.9% / 1.9%
- Madagascar: 5.3% / 4.7%
- Rwanda: 18.4% / 14.7%
- Eswanti: 8.5% / 6.0%
- Togo: 0.3% / 0.3%
- Average: 7.0% / 6.4%

● Mobile Money User ● Non-Mobile Money User
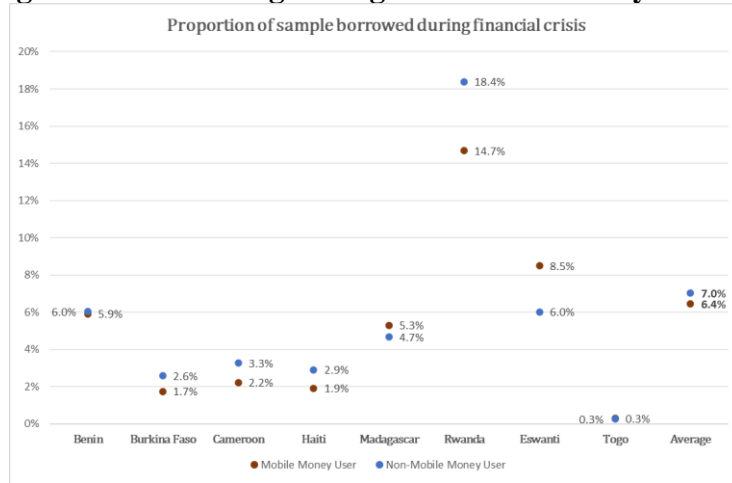
Figure 23: Unable to cope during financial crisis, by country

Proportion of sample that is unable to cope during financial crisis

- Benin: 9.6% / 5.6%
- Burkina Faso: 15.0% / 15.4%
- Cameroon: 3.0% / 4.4%
- Madagascar: 50.9% / 46.7%
- Rwanda: 10.4% / 7.4%
- Eswanti: 7.0% / 6.6%
- Togo: 1.1% / 1.8%
- Average: 9.7% / 8.7%

● Mobile Money User ● Non-Mobile Money User
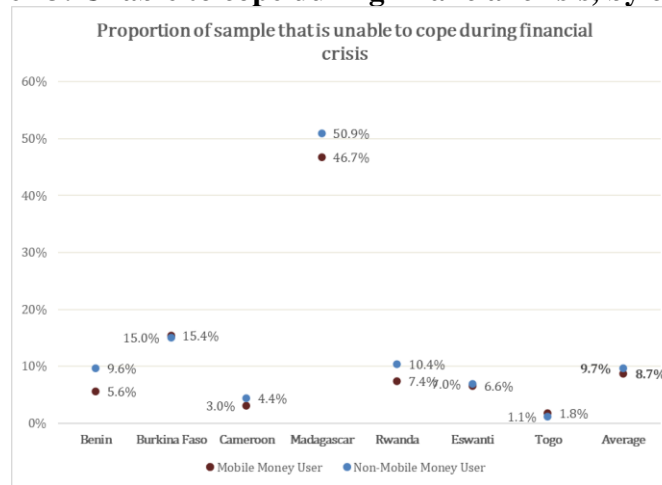
Discussion

This study has revealed three key findings 1.) Mobile money users are more likely to save and borrow. 2.) Among those who save and borrow, mobile money users typically save and borrow more than non-mobile money users, respectively. 3.) Mobile money users opt for formal coping mechanisms during financial crises more frequently than non-mobile money users. Therefore, mobile money improves financial resilience. The combination of these findings as well as specific features of mobile money make it possible to hypothesize why mobile money improves financial resilience.

Saving

Mobile money may increase saving propensity because it acts as an informal savings tool (Aggarwal et al., 2019; Morawczynski and Pickens 2009). While mobile money accounts are non-interest bearing, it often requires less documentation to create a mobile money account, lowering barriers to access. Mobile money accounts are also more secure than storing cash at home or with relatives. In other words, safe and secure storage of money eliminates the need to spend cash on goods immediately as there is less fear of losing cash or having it stolen. These benefits can potentially outweigh the costs and benefits of a traditional bank account, encouraging mobile money users to substitute a traditional bank account with mobile money.

Mobile money may also act as a step towards more formal forms of financial inclusion, which is also positively associated with savings stock and savings propensity (Mbiti and Weil, 2011). For example, an individual may enjoy features of a mobile money account so much that they choose to also apply for a formal bank account, a mobile bank account, or a debit card, furthering their financial inclusion as a result. Formal bank accounts also come with additional benefits to mobile money, such as financial advising and interest-bearing accounts, which may

further increase savings stock. This is driven by the idea that lack of trust in financial institutions in one of the main reasons billions of people around the globe choose to remain unbanked (Demirguc-Kunt, 2018).

Finally, mobile money may as a complement to formal bank accounts. It has been seen that mobile money compliments commercial bank accounts as it is a way to receive remittances and other transfer payments, such as child support (Jack and Suri, 2011). Being connected to the mobile money network is advantageous to transact with a broader range of individuals and businesses, but this money is ultimately stored in a bank account.

Borrowing

There has been little research done directly as it relates to borrowing and mobile money, but it would likely follow the same rationale as why individuals save more and save more often because of mobile money. It's reasonable to hypothesize this as mobile money is neither markets as a savings nor a borrowing tool, and yet mobile money has clear and profound impacts on these behaviors.

Propensity to borrow may increase as mobile money can act as an informal creditor. Similar to the way that mobile money allows rural individuals to receive remittances, may allow them to receive cash from lenders by using a secure transaction platform. For example, if an individual borrows from a family member or a friend, then this transfer may be sent and documented via mobile money. The documentation aspect makes a lending transfer faster and more secure than lending cash. However, this is still very risky compared to a traditional loan from a bank.

Mobile money may also act as a step towards more formal forms of financial inclusion for borrowing, not just saving. For example, as individuals become more familiar with mobile

money, they may feel more comfortable with options such as a formal bank account or applying for loans from a secured lender. Distrust of digital and online platforms is commonly cited among reasons to remain unbanked, and secure mobile money transactions could potentially help alleviate this fear (Demirguc-Kunt, 2018).

Lastly, mobile money may serve as a compliment to a formal loan if mobile money leads to overall more robust financial literacy and financial decision making. For example, if an individual saves more because of their mobile money use, this would also make them more likely to be eligible for a larger loan.

Coping mechanisms

When analyzing coping mechanisms, it is necessary to begin with changes in saving and borrowing behavior. Increased saving behavior and increased borrowing behavior indicates that individuals who use mobile money may be more liquid than non-mobile money users. Having more liquidity means more available funds to draw on immediately during economic crises and less reliance on informal coping mechanisms, increasing overall financial resilience.

Beyond this, if mobile money acts as a step towards more formal financial inclusion, individuals may feel more empowered to have formal savings and insurance before a financial crisis occurs. This would make them more likely to use formal coping mechanisms during a financial crisis, instead of turning to informal help from family, friends, and cooperatives.

While mobile money users typically have higher reported use of formal coping mechanisms, there is no evidence that mobile money decreases "helplessness", or the inability to cope. This is likely because mobile money does not solve a shortage of capital, more so it is a financial management tool. In other words, mobile money appears to be a more effective tool for those who have some capital (from saving or borrowing) prior to an economic shock.

There is also no evidence to suggest that mobile money decreases the likelihood of emergency borrowing. This could make sense as mobile money doesn't necessarily offer increased access to borrowing, so those who were borrowing before the economic shock would continue to borrow during the economic shock via other means and lenders. Additionally, borrowing as a last resort during an economic shock should be thought of differently from borrowing as a long-term financial decision. The analysis of borrowing earlier in the paper is closer to representing borrowing as a way of financial planning, while borrowing during a financial crisis signals a lack of liquidity in a specific moment.

These results suggest that mobile money serves as a financial management tool and is not a source of capital itself. With this logic, mobile money may not have as significant effects on those living far below the poverty line and would have meaningful effects on those with at least some income. From the perspective of mobile money companies, individuals with some income are already the customers that are targeted. These mobile money businesses will continue to grow where there is mobile connectivity combined with financial exclusion and a demand for secure transactions. As it is, mobile money is not designed to, nor does it intend to, improve the lives of the lowest income ranges and the very poor.

Overall, an increased use of formal coping mechanisms and decreased use of informal coping mechanisms tells a story that mobile money has a positive impact on the financial resilience for individuals with sufficient capital prior to an economic shock. However, when it comes to individuals who lack liquidity and capital prior to a financial shock, mobile money has little impact, as there is little difference in borrowing and helplessness for mobile money users and nonusers.

Policy implications

Throughout the last decade, expansion and adoption of mobile money has been celebrated. This study shows that this celebration is warranted, given that savings and borrowing propensity both increase as a result of using a mobile money account. Additionally, positive relationships between mobile money and formal coping mechanisms are a sign that increased saving and borrowing behavior could have an incredible impact on the economic resilience of mobile money users.

Most recently, though, mobile money has expanded because of the pandemic. During the pandemic, registered mobile money accounts grew globally by 1.21 billion accounts (12%). This growth was due to companies and governments working to relax fees and onboarding in order to distribute pandemic stimulus. Daily mobile money transaction activity in 2020 exceeded 2 billion dollars/day for the first time during the pandemic (Andersson-Manjang, 2021). While daily transaction value is expected to keep growing, the extent of financial inclusion from mobile money may be limited by a lack of continued government support as the pandemic eventually resolves. Because of this, in order to realize the benefits from mobile money that were found in this study, there must be specific policy initiatives to encourage continued expansion and retention within the mobile money space.

Incentives and mandates

Given the immense benefits to mobile money, governments should offer incentives and mandates to ensure their continued use. In other words, in order for individuals to increase resilience during financial crisis, governments must have policies to promote and maintain high levels of financial inclusion.

One example of an incentive to encourage the use of mobile money is linking conditional cash transfers with mobile money. One case of this is in Mexico, where government transfers for the *Oportunidades* program were linked to debit card adoption (Bachas et al., 2018). In many countries it is plausible to link government assistance to digital financial services, such as mobile money, instead of receiving a voucher in the mail. Incentives can be effective for some countries, communities, and specific target populations, but incentives may not always be feasible depending on the required cost or duration of the incentive.

As mentioned, COVID-19 stimulus will eventually end, and individuals may revert back to pre-pandemic habits. The alternative to an incentive is a mandate. For example, in Brazil there was a policy that prevented individuals from withdrawing stimulus funds that they received with a mobile banking app created during the pandemic for at least 30 days (del Valle et al., 2020). The goal of this policy was to increase familiarity with mobile banking instead of immediately returning to the cash economy. This was at least temporarily successful in encouraging longer term use of the mobile banking app. Successful policy may include a combination of incentives and mandates to facilitate long term mobile money adoption.

Lowering barriers to account ownership

The rapid spread of mobile money during COVID-19 was not only out of public health fears, but due to overall lower barriers to account ownership during the pandemic. The necessity to curb physical transactions in the cash economy encouraged governments and businesses alike to forego steps traditionally required to obtain a mobile money account.

First, mobile money providers instituted P2P transaction fee cuts and lowered balance and transaction limits (Bazarbash, 2020). These policy tools made it cheaper to own an account,

in addition to requiring less capital to maintain a balance, which are barriers for many low-income individuals.

Another effective policy tool is decreasing the amount of documentation required to open an account. Many parts of the world struggle with having the proper identification to enter the formal financial system. In Fiji, for example, when an individual lacks proper identification to open an account, they can substitute a "referee letter" where another person who knows them well confirms parts of their identity, such as birthday, occupation, and address. Examples of individuals who can serve as referees include teachers, landlords, village headmen, social welfare office, and employers (Chadha et al., 2020). Whether facing direct costs or indirect costs, lowering costs and barriers to account ownership will be important to increasing both mobile money penetration and retention.

Even with these policy suggestions, this study demonstrates that mobile money has already resulted in substantial improvements in financial resilience that go beyond the scope of mobile money's customer value proposition. Despite mobile money not being marketed as a saving or borrowing tool, features of this digital financial technology have profound impacts on long term behaviors such as saving, borrowing, and economic stability. Governments could accelerate the diffusion of mobile money with these benefits in mind through simple yet powerful policy solutions.

Areas for Future Research

From this study, there are 4 areas of future research that would greatly further understanding in the digital payment space as it relates to financial resilience. First, research that establishes causality in the descriptive relationships identified in this paper. Given the incomplete nature of the data presently available, field studies could draw stronger conclusions about how mobile money impacts that amount that an individual saves and borrows. Even further, having more survey questions dedicated to understanding coping mechanisms would provide a clearer picture of the impact of mobile money on economic resilience during a financial crisis.

Second, it would be beneficial to understand the long-term impacts of increased access to credit and/or familiarity with borrowing. Logically, there are two stories about borrowing more. One is where an individual borrows for productive purposes, like starting a business or furthering education. This is a story of poverty alleviation and economic growth; the other story is where an individual borrows to meet basic needs or borrows due to financial mismanagement. This is a story of a worsening scenario in terms of poverty and does little to further economic growth. The FinScope surveys, in their current design, do not offer much insight to why an individual may be borrowing, or if the individual finds that credit positively or negatively impacts their overall economic health. Understanding this question would require a shift in survey design where surveys emphasize with more granularity the impacts of credit on individual households.

Third, Latin America has had very robust policies as it relates to mobile banking. In Latin America, mobile banking is promoted with similar intentions to mobile money. Most of the data available focuses on Asia, Africa, and the Caribbean. Studies done on Latin America could help close gaps in understanding digital financial technologies as the economic landscape and style of

government varies greatly in Latin America compared to Asia, Africa, and the Caribbean. Results from Latin America would increase confidence in broad conclusions about mobile money, or they may present inconsistencies that lead to questions about where and how digital financial technologies are effective.

Finally, COVID-19 greatly advanced exposure to mobile money, mobile banking, and other new forms of digital financial technology. As time goes on, research relating to customer retention would be beneficial in forming future policies. Specifically, because stimulus was a component of opening these new accounts, analysis of long-term use and customer stickiness post-pandemic will help governments determine if transfer payments (as to other policies) are effective in maintaining high levels of digital financial technology use.

Conclusion

Over the past 15 years, mobile money has been taking hold in low to middle income economies around the world, especially has barriers to mobile phone adoption are lower than ever. More recent mobile money adoption is a result of the COVID-19 pandemic putting a strain on cash economies around the world. Because of this, it is necessary to understand how mobile money adoption impacts long term financial habits and economic stability. Using instrumental variable regressions with 9 countries and 60,375 individual observations, this study finds that mobile money adoption increases saving propensity by 21% on average and increases borrowing propensity by 10% on average. The results are in line with previous studies completed on niche populations within individual countries. Additionally, mobile money users have higher saving stock and borrow more on average. Finally, this study finds mobile money users more often utilize formal coping mechanisms during a financial crisis. Combining increased saving and borrowing behavior with a preference towards formal coping mechanisms indicates improved financial resilience as a result of mobile money adoption. This suggests that mobile money users are better off in the long run, and less likely to be severely harmed during an economic downturn, making mobile money a simple yet powerful tool to improve communities around the globe. Governments can support mobile money adoption through incentives, mandates, lower account fees, and minimizing documentation to obtain an account. With these policy tools, individuals and communities will likely be more financially resilient, having the ability to live more economically stable lives in an ever-changing world.

Appendices

Appendix 1:
List of countries who used mobile money to distribute COVID-19 Pandemic related stimulus (Chadha et al., 2020)

Country	Program Start
Kenya	April 2020
Ghana	April 2020
Togo	April 2020
Côte d'Ivoire	May 2020
Bangladesh	May 2020
Indonesia	May 2020
Thailand	March 2020

Appendix 2:
Summary of meta-analysis

Country	Relevance	MM ~ Savings	MM ~ Borrowing	MM ~ Coping
Benin	This Study	Positive	Positive	Shift to formal coping mechanisms
Burkina Faso	This Study	Positive	Positive	Shift to formal coping mechanisms
Cameroon	This Study	Positive	Positive	Shift to formal coping mechanisms
Rwanda	This Study	Positive	Positive	Shift to formal coping mechanisms
Eswatini	This Study	Positive	Positive	Shift to formal coping mechanisms
Togo	This Study	Positive	Positive	Shift to formal coping mechanisms
Zambia	This Study	Positive	Positive	Not investigated
Haiti	This Study	Positive	Negative	Not investigated
Madagascar	This Study	Impact unclear	Impact unclear	Shift to formal coping mechanisms
Kenya	Demombynes and Thegeya (2012)	Positive	Not investigated	Maintain consumption
Uganda	Munyegera & Matsumoto (2017)	Positive	Positive	Not investigated
Developing countries (broadly)	Lyons et al. (2020)	Positive	Positive	Higher incomes, formal coping mechanisms
India	Nandhi (2012)	Positive	Not investigated	Shift to formal coping mechanisms
Sub-Saharan Africa	Ouma et al. (2017)	Positive	Not investigated	Not investigated
Rwanda	Maniriho (2021)	Positive	Not investigated	Not investigated
Mozambique	Batista & Vicente (2019)	Positive	Not investigated	Not investigated
Burkina Faso	Ky et al. (2017)	Positive	Not investigated	Not investigated
Uganda	Mayanja & Adong (2016)	Positive	Not investigated	Not investigated
Uganda	Ryder (2014)	Positive	Not investigated	Not investigated
Tanzania	Ruh (2017)	Positive	Not investigated	Not investigated
Malawi	Aggarwal et al. (2019)	Positive	Not investigated	Consumption Increased
Kenya	Gurbuz Cuneo (2019)	Positive	Not investigated	Maintain consumption
Kenya	Jack and Suri (2014)	Positive	Not investigated	Maintain consumption

Questions and variables analyzed (FinMark Trust, 2015)

Are you currently saving or putting away money?	Outcome; Binary
In total, how much money do you have saved up or invested? Please include savings from all the activities that you have just mentioned	Outcome; Discrete
What is your total personal monthly income? Please include all sources of income such as salary, grants, wages from temporary job, pension, revenue from investment, etc	Predictor; Discrete
What is your total monthly income of your household? Please include all sources of income such as salary, grants, wages from temporary jobs, pension, revenue from investment, etc.	Predictor; Discrete
Many people borrow money or contract loans. I will read these assertions (proposals), and you tell me which ones apply to you?	Outcome; Binary – Used as proxy for those who indicate borrowing behavior
In total, how much do you currently owe? Please include all outstanding debts from all activities that you mentioned.	Outcome; Discrete
What is your highest level of education completed?	Predictor; Discrete – 1-6, 6 being University and 1 being Primary/Elementary school
Urban / Rural	Predictor; Binary
Age of respondent	Predictor; Discrete
Head of household	Predictor; Binary
Still on savings, investment and set aside money, could you tell me which of the following have you, have had in the past but not now, or have you never had?	Predictor; Binary – Used as proxy to indicate mobile money and commercial bank use
On the money you receive or earn, where do you mainly KEEP the money once you have it.	Predictor; Binary – Used as proxy to indicate mobile money and commercial bank use
We are now going to talk about the things people spend money on ... By what means do you pay these expenses?	Predictor; Binary – Used as proxy to indicate mobile money and commercial bank use
For which of the following activities do you use your mobile phone?	Predictor; Binary – Used as proxy to indicate mobile money use
Do you own a mobile money account with…?	Predictor; Binary – Used as proxy to indicate mobile money use
Please tell me what your household did in response to economic shock / financial crisis	Outcome; Categorical – Grouped into formal, informal, and general borrowing
How long do you usually take, or would you take to go from your home to your nearest mobile money agent	Instrument; Discrete

Appendix 4:
Sample proportion with a mobile money account by country

Country	Percentage of survey population with mobile money account
Benin	28.73%
Burkina Faso	19.25%
Cameroon	30.28%
Gambia*	5.58%
Haiti	20.85%
Madagascar	17.58%
Myanmar*	3.62%
Rwanda	38.37%
Eswatini	74.45%
Togo	27.17%
Zambia	7.54%
* = insufficient sample size	

Appendix 5:
IV(1) – Saving mobile money coefficient output

Country	Mobile Money Coefficient: IV(1) - Saving	Standard Error	p-value	Significant (90th percentile)
Benin	0.180	0.044	4.5E-05	Significant
Burkina Faso	0.379	0.055	9.0E-12	Significant
Cameroon	0.217	0.036	1.9E-09	Significant
Haiti	0.309	0.096	1.3E-03	Significant
Madagascar	0.102	0.042	1.5E-02	Significant
Rwanda	0.292	0.025	2.4E-32	Significant
Eswatini	0.428	0.068	4.0E-10	Significant
Togo	0.312	0.059	9.9E-08	Significant
Zambia	0.770	0.073	1.4E-25	Significant

Appendix 6:
IV(2) – Saving mobile money coefficient output

Country	Mobile Money Coefficient: IV(2) - Saving	Standard Error	p-value	Significant (90th percentile)
Benin	0.118	0.065	7.0E-02	Significant
Burkina Faso	0.346	0.121	4.3E-03	Significant
Cameroon	0.171	0.080	3.2E-02	Significant
Haiti	0.447	0.169	8.2E-03	Significant
Madagascar	0.076	0.071	2.8E-01	Insignificant
Rwanda	0.473	0.048	7.9E-23	Significant
Eswatini	0.367	0.076	1.5E-06	Significant
Togo	0.435	0.127	6.1E-04	Significant

Appendix 7:
IV(3) – Saving mobile money coefficient output

Country	Mobile Money Coefficient: IV(3) - Saving	Standard Error	p-value	Significant (90th percentile)
Benin	0.119	0.048	1.29E-02	Significant
Burkina Faso	0.138	0.080	8.42E-02	Significant
Cameroon	0.092	0.043	3.41E-02	Significant
Haiti	-0.015	0.108	8.89E-01	Insignificant
Madagascar	-0.225	0.054	3.10E-05	Significant
Rwanda	0.306	0.033	1.06E-20	Significant
Eswatini	0.241	0.068	4.26E-04	Significant
Togo	0.289	0.071	4.14E-05	Significant

Appendix 8:
IV(1) – Borrowing mobile money coefficient output

Country	Mobile Money Coefficient: IV(1) - Borrowing	Standard Error	p-value	Significant (90th percentile)
Benin	0.105	0.026	5.30E-05	Significant
Burkina Faso	0.245	0.049	6.82E-07	Significant
Cameroon	0.093	0.035	8.47E-03	Significant
Haiti	-0.045	0.073	5.40E-01	Insignificant
Madagascar	0.052	0.042	2.16E-01	Insignificant
Rwanda	0.225	0.035	2.02E-10	Significant
Eswatini	0.172	0.051	7.44E-04	Significant
Togo	0.029	0.053	5.88E-01	Insignificant
Zambia	0.163	0.057	4.51E-03	Significant

Appendix 9:
IV(2) – Borrowing mobile money coefficient output

Country	Mobile Money Coefficient: IV(2) - Borrowing	Standard Error	p-value	Significant (90th percentile)
Benin	0.066	0.038	8.37E-02	Significant
Burkina Faso	0.316	0.110	3.98E-03	Significant
Cameroon	0.043	0.078	5.78E-01	Insignificant
Haiti	-0.149	0.130	2.53E-01	Insignificant
Madagascar	0.074	0.070	2.93E-01	Insignificant
Rwanda	0.460	0.067	6.40E-12	Significant
Eswatini	0.111	0.057	5.20E-02	Significant
Togo	0.104	0.113	3.56E-01	Insignificant

Appendix 10:
IV(3) – Borrowing mobile money coefficient output

Country	Mobile Money Coefficient: IV(3) - Borrowing	Standard Error	p-value	Significant (90th percentile)
Benin	0.093	0.029	1.22E-03	Significant
Burkina Faso	0.213	0.074	4.28E-03	Significant
Cameroon	0.035	0.043	4.12E-01	Insignificant
Haiti	-0.132	0.090	1.43E-01	Insignificant
Madagascar	0.003	0.054	9.58E-01	Insignificant
Rwanda	0.247	0.047	1.51E-07	Significant
Eswatini	0.095	0.055	8.55E-02	Significant
Togo	0.002	0.065	9.74E-01	Insignificant

Appendix 11:
OLS(1) – Saving mobile money coefficient output

Country	Mobile Money Coefficient: OLS(1) - Saving	Standard Error	p-value	Significant (90th percentile)
Benin	0.146	0.013	2.44E-28	Significant
Burkina Faso	0.358	0.017	7.56E-94	Significant
Cameroon	0.193	0.013	4.11E-50	Significant
Haiti	0.214	0.018	7.56E-33	Significant
Madagascar	0.087	0.018	1.28E-06	Significant
Rwanda	0.118	0.006	4.70E-79	Significant
Eswatini	0.213	0.021	2.65E-24	Significant
Togo	0.203	0.015	3.47E-40	Significant
Zambia	0.269	0.020	5.91E-42	Significant

Appendix 12:
OLS(2) – Saving mobile money coefficient output

Country	Mobile Money Coefficient: OLS(2) - Saving	Standard Error	p-value	Significant (90th percentile)
Benin	0.081	0.014	1.47E-08	Significant
Burkina Faso	0.227	0.020	3.83E-30	Significant
Cameroon	0.105	0.015	2.77E-12	Significant
Haiti	0.114	0.017	4.21E-11	Significant
Madagascar	-0.004	0.019	8.43E-01	Insignificant
Rwanda	0.102	0.007	7.86E-48	Significant
Eswatini	0.125	0.020	2.44E-10	Significant
Togo	0.153	0.017	1.19E-19	Significant

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