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ESSAYS ON THE RISE OF MOBILE FINANCIAL TECHNOLOGY IN DEVELOPING COUNTRIES AND ITS IMPACTS ON INDIVIDUAL FINANCIAL BEHAVIORS

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INTRODUCTORY CHAPTER

Across developing economies, the penetration of banking services or other formally regulated financial services varies widely across regions, countries. Globally, half of adults reports having an individual or a joint account at a formal financial institution while lower rate of financial access is reported in developing countries. Around 2.5 billion adults do not have a formal account and about eighty percent of poor adults (living on less than two dollars (U.S.) per day) are excluded from formal financial sector (Klapper and Singer, 2014).

Since the last decade, the diffusion of information communication technology through the adoption of mobile phone is increasingly recognized as the harbinger of a new revolution in the financial system in developing countries. The recent development of mobile financial technology that refers to the use of mobile phone to provide financial services shows promise to strengthen the financial sector and improve access to financial services.

In fact, the usage of mobile technology to access banking services is not new especially in developed countries. The usage of mobile phone to access banking services is a banks' strategy to reduce the cost of operating physical infrastructures and to create customers' loyalty by taking into account the changes in the payment behavior and preferences of individuals. By contrast, in developing countries, the provision of banking services through the channel of mobile phone has twofold effects. The first, known as mobile banking, is similar to the case of developed countries implying that already banked people may use their mobile phone to access their financial account. The second, that is mobile money, consists of providing basic financial services to the unbanked and underserved individuals.

In developing countries, the first mobile money product, Smart money, was initiated by the Philippines in 2001. However, the most cited successful mobile financial technology is reported in East Africa; that is M-Pesa in Kenya. M-Pesa is a mobile money service implemented in 2007 that is used by a non-negligible share of individuals (around 65% of households by the end of 2009) with lower economic means, and it has since expanded to reach households with a wide range of economic, demographic and educational characteristics (Jack and Suri, 2011). In 2014, M-Pesa reaches around 58% of adults in Kenya and starts to offer new service as well as credit through M-Shwari. Considering the potential impact of mobile money in Kenya and the focus of existing research on M-Pesa, evaluating the impacts of mobile money adoption in other

developing countries where initiatives have been implemented to spur financial access is valuable.

While mobile money expansion in East Africa -with about 35% of adults having mobile money account in Somalia, Tanzania and Uganda- dominates other regions, the latter have witnessed important efforts to implement mobile money. In West Africa, since 2006, the Central Bank (BCEAO) issued a regulation on electronic money to promote financial inclusion across its eight country members (Benin, Burkina Faso, Ivory Coast, Guinea-Bissau, Mali, Niger, Senegal and Togo). However, Ivory Coast, Mali and Burkina Faso are the countries where mobile money records more dynamism with around 85% and 91% respectively of the total volume and value of transactions in WAEMU (BCEAO, 2015). While the adoption of mobile money services in Ivory Coast and Mali is reported to have been mainly driven by an increase in remittance services which occurred during the socio-political instability as in the case of M-Pesa in Kenya (BCEAO, 2015; Morawczynski and Pickens, 2009), the scheme of mobile money deployment in Burkina Faso is different and reinforces our motivation to consider it as our case study. There are two mobile money services that operate in Burkina Faso since respectively 2012 (Airtel money) and 2013 (MobiCash). In the country, the financial sector comprises formal and informal systems with the latter being the most used by the population as in other developing countries. Thus, exploiting the expansive adoption of mobile technology to provide financial services appears as a prominent strategy to promote financial inclusion.

Contribution and content of the dissertation

From the above overview, our dissertation tackles the following questions related to the adoption of mobile financial technology in developing countries: What are the drivers of mobile financial technology adoption in developing countries? How mobile financial technology adoption as a storage of value affects individual saving behaviors? How individuals integrate mobile financial technology in their portfolio of traditional financial services? Given the scarcity of formal financial services in developing countries and the explosive growth in mobile financial technology it is worthwhile to investigate factors impacting mobile financial technology adoption and its consequences on individual financial behaviors.

This dissertation is composed of three self-contained papers[1] presented in three chapters that attempt to provide answers to these questions. The first chapter provides an overview of mobile financial technology adoption across developing countries, assesses empirically the drivers of mobile money adoption and underlines the specificities of Sub-Saharan African countries in this process. The two following chapters are devoted to assess at individual-level the impact of mobile financial services using data from a survey we conducted in 2014 in Burkina Faso. More precisely, the second chapter analyzes empirically the impact of mobile money adoption on individual saving behavior. The third chapter examines empirically the economic reasons of mobile money adoption over traditional financial services and its impacts on the choice of deposit vehicle.

We provide henceforward the summary of the three chapters, by briefly indicating the motivation, research questions and the contributions of each chapter.

Chapter 1: Determinants of mobile financial technology adoption in developing countries

In developing countries the financial system is incipient with limited access to banking services. To improve financial access, several initiatives are implemented to leverage mobile technology as a new channel to provide broader financial services. Thus, the increasing penetration of mobile phone across developing countries provides avenue for financial development by spurring mobile financial technology adoption.

In this chapter, we assess the growing adoption of mobile financial technology in developing countries. More precisely we distinguish mobile money from mobile banking to analyze which of the two mobile financial technologies dominates in developing countries by benchmarking Sub-Saharan Africa against other developing countries. Beyond this global overlook, we explore empirically the determinants of mobile financial technology adoption using data on 72 developing countries of which 32 are Sub-Saharan African countries from 2011 to 2014.

This chapter contributes to the existing literature in two main ways. First, our study extends the existent literature on mobile financial technology adoption by assessing its increasing adoption in developing countries. Second, to the best of our knowledge, existing research on

[1] Two of the papers presented respectively in the chapters 2 and 3, are co-written with Clovis, Rugemintwari and Alain Sauviat from the University of Limoges (LAPE).

mobile financial technology adoption mainly considers individual-level data. Our paper explores the determinants of mobile financial technology adoption through a cross-country analysis.

Our findings show that mobile money dominates mobile banking and this is particularly the case in Sub-Saharan Africa. From the empirical investigation, the results show that factors related to macroeconomic-level, remittances, banking sector and payments impact mobile money adoption in developing countries. We also find that Sub-Saharan African countries exhibit an advantage in the adoption of mobile money compared to other developing countries. We find that while the similarity in the determinants of mobile money adoption relies on domestic remittances, the differences come from structural factors, the outreach of financial services, the banking sector intermediation activities and the payment services.

Overall, our findings support the increasing initiatives implemented to foster mobile money adoption and promote financial development in developing countries.

Chapter 2: Does mobile money affect saving behavior? Evidence from a developing country

In developing countries, limited access to formal financial institutions makes individuals and households rely mainly on informal methods to save. Such informal saving mechanisms include saving in livestock or jewels, saving at home "under a mattress", saving with a neighbor or, in a more organized way, participating in a Rotating Savings and Credit Associations (ROSCAs). However, these informal saving devices provide an insurance which is well known to be risky, inappropriate and incomplete. Moreover, the findings by Dupas and Robinson (2013b), which show that simply providing a safe place to keep money is sufficient to increase preventative health savings, reinforce our motivation to analyze whether using mobile money can help individuals increase their propensity to save for health emergencies, particularly those with less access to formal financial instruments.

In this perspective, chapter two investigates whether the use of mobile money can help individuals build savings to face predictable and unpredictable life events. More precisely we ask whether the use of mobile money increases the capacity of individuals to save, particularly for unpredictable events such as health emergencies. Moreover, given that mobile money is affordable, easy to use and available anywhere throughout the country, we investigate whether disadvantaged groups such as individuals with low and irregular incomes, rural, female and less

educated individuals may benefit from the use of mobile money to increase their savings. We use hand-collected data from individual responses to a survey we designed and conducted between May and June 2014 in Burkina Faso.

The contribution of our study in this chapter is the following. First, our study is the first that empirically tests the impact of mobile money on saving patterns by distinguishing savings for unpredictable events and savings for anticipated events. Second, to the best of our knowledge, the existent studies on mobile money only describe the potential impact of this new technology on poor people financial management. Our detailed data set enables us to go further and test whether the use of mobile money has an impact on saving behavior of disadvantaged groups such as low and irregular incomes, rural, female and less educated.

Our main results show that, although using mobile money services has no impact on saving for predictable events, it increases the propensity of individuals to save for health emergencies. We also find evidence that using mobile money increases the propensity of disadvantaged groups such as rural, female, less educated individuals and individuals with irregular income to save for health emergencies. Addressing the mechanisms underlying individual saving behavior, we find that safety and the possibility to transfer money within the sub-region associated with mobile money may be factors that increase the propensity of mobile money users to save for health emergencies.

Overall, our results are in line with policymakers' agenda worldwide to increase financial outreach and improve financial inclusion by using mobile technologies.

Chapter 3: Mobile money adoption and its consequences on usage of formal and informal financial services: Evidence from a survey.

The financial services needs of lower-income people in developing countries, which have long been excluded from the formal finance, are receiving an increasing attention from researchers, governments, international organizations and even bank institutions. In fact, access to formal financial services enables households to anticipate, adapt to and/or recover from the effects of shocks in a manner that protects their livelihoods, reduces chronic vulnerability and facilitates growth. However, in developing countries access to formal financial institutions remains limited. The low penetration of financial services may stem from the scarce network of

formal financial institutions, the location of retail outlets concentrated mainly in urban areas and the weak population density that hinders people living far from financial institutions to access and use formal financial services.

Using individual-level survey data that we designed and conducted between May and June 2014 in Burkina Faso, we explore the reasons of the adoption of mobile money as a deposit instrument and its consequences on existing informal and formal financial deposit instruments. Specifically, we investigate the factors related to informal and formal deposit instruments that may lead individuals to use mobile money. Additionally, we analyze how mobile money may impact the usage of informal and formal deposit instruments.

The third chapter contributes to the existing literature is three main ways. First, we test the comparative advantages of mobile money by examining the relative characteristics of both formal and informal financial services (compared to mobile money) that may lead individuals to use mobile money account to make deposits. Second, we analyze the potential of mobile money to enhance formal financial access as a channel that brings out individuals from informal to formal deposit mechanisms. Third, as the unbanked are more likely to be individuals with low and irregular incomes, those who live in rural areas far from formal financial institutions, or socially excluded like female and less educated, we analyze whether mobile money increases their likelihood to use formal deposit instruments.

The results show that individuals value the ease of access and the lower cost related to mobile money compared to formal financial services and appreciate the higher liquidity and privacy of mobile money compared to both formal and informal mechanisms which lead them to prefer mobile money account to make deposits. Regarding the consequences of the introduction of mobile money, we find that the use of mobile money increases the likelihood of individuals participating in informal mechanisms and of disadvantaged groups, especially female and less educated individuals, to make deposits in a bank account.

Given the low access to formal finance in developing countries, our results taken together show how the increasing adoption of mobile technologies may be an opportunity towards financial inclusion.

DETERMINANTS OF MOBILE FINANCIAL TECHNOLOGY ADOPTION IN DEVELOPING COUNTRIES

1.1. Introduction

The financial technology expansion is changing the landscape in the financial system and their full impact on the financial behavior of households seems obvious. In fact, formal financial institutions have been documented to play a critical role in the well-being of economy and household. Formal financial products such as savings, credits and insurance help build household resilience by helping households align income and expenditure patterns across time, cope with economic shocks, as well as invest in human or physical capital. However, only 50% of adults worldwide have an account at a formal financial institution, though account penetration varies widely across regions, income groups and individuals' characteristics (Demirguc-kunt and Klapper, 2012). While 89% of adults in high income countries report having an account at a formal financial institution, only 41% is recorded in developing economies (Demirguc-kunt and Klapper, 2012). It is seems that formal financial institutions fail to reach individuals with financial services in developing economies where almost 2.5 billion adults do not have a formal account (Demirguc-kunt and Klapper, 2012). The challenge remains in the use of financial innovation to fill the gap in access to formal financial services.

The innovative digital financial inclusion aims to reach the unbanked people with formal financial services through the use of mobile phones. Digital financial inclusion can be defined as digital access to and use of formal financial services by excluded and underserved individuals (Lauer and Lyman, 2015). The providers of such digital financial services can be divided into four main groups including (i) banks that may offer a full range of banking services through a basic or simplified transactional account for payments, transfers and value storage via mobile device or payment card with point-of-sale (POS); (ii) banks in partnership with mobile operators (offering a limited banking services via mobile device or payment card with POS - point-of-sale); (iii) mobile network operators as e-money issuer; (iv) and e-money issuers that are non-bank, non-mobile network operators. All these four models of services use three main components as well as a digital transitional platform (internet or USSD[2] technology), agent networks, and individual's access device (mobile phone, payment card). The lightning adoption of digital

[2] Unstructured supplementary service data (USSD) is a communication service controlled by mobile network operators and considered as an important element used to provide mobile financial services on almost any phone, at low cost and without requiring access to user's SIM card (Hanouch and Chen, 2015).

financial services is expected to transform the life of billion people across developing countries where formal finance access remains scarce.

In developing countries many initiatives are implemented to exploit financial innovation to improve access to formal financial services. For instance, in Asia and in particular China, some non-bank institutions (e-commerce and social network applications providers) are now entering the formal financial sector (Ghose, 2016). Such penetration comes from the fact that Chinese banks are less developed in retail banking services with around 20% of credit offered to individuals and SMEs, and 40% of credit card usage. In addition, non-bank institutions bring with them their existent customers that constitute potential users that can be reached with financial services through digital channel. Similarly, in India only one of two Indians has a bank account as of 2013 and those who have one are not necessary use it (Demirguc-kunt et al., 2013). The limited use of financial services is due to distance that people have to travel for reaching a financial institution, the lack of financial services that meet their needs, and the lack of identity document for opening an account (Bakhshi, 2016). In this context, a huge program has been undertaken to facilitate individual identification through a unique and digital identity document on the basis of her/his biometric mark ("Aadhaar"). This program exploits the technology infrastructure combined with at least one financial inclusion account[3], to improve access to formal financial. In 2015, there is between 65% and 100% of Indian households with a bank account.

In Sub-Saharan Africa the story is less different. According to the World Bank, about two out of three adults do not have access to bank account compared four out of five in 2011 (Luherne, 2016). The reasons of such lower access include cost, distance and lack of financial infrastructure among others. To overcome these barriers, non-bank institutions take the advantage of mobile financial innovation to provide financial services to the unbanked and underserved individuals. In Africa, the number of mobile phone subscribers is estimated to have exceeded 500 million from 2005 to 2009 (Batista and Vicente, 2013). The provision of mobile money services is based on technologies controlled by mobile network operators that give them an advantage compared to traditional financial providers (Hanouch and Chen, 2015). The uptake of mobile money is rapid across Sub-Saharan Africa with at least one mobile money products across 38

[3] Financial inclusion account is a bank account that can be freely opened at a bank. It entitles a debit card and some facilities if the account remains active. For more details see, Bakhshi, 2016.

countries (GSMA, 2016). The growing adoption of mobile phone technology has been shown to have social and economic development implications in Africa (Aker and Mbiti, 2010). Thus, understanding the factors that promote mobile financial technology[4] adoption is critical for financial development.

Our paper contributes to the existent literature in two main ways. First, our study extends the existent literature on mobile financial technology adoption by assessing its increasing adoption in developing countries. Specifically, we describe the two types of mobile financial services that are mobile money and mobile banking. We also explore the patterns of the rapid deployment and the potential providers of mobile money services which are described to be prevalent in developing countries. In fact, the adoption of mobile money may come from the rising financial disintermediation characterized by the entry of non-banks in the financial sector. The increasing recognition of mobile money "leapfrogging" the provision of formal financial services reinforces our motivation. The leapfrogging comes from the use of new technology as solutions stemming from weak institutional infrastructure and the cost structure of conventional banking (Aron, 2015). Second, to the best of our knowledge, existing research on mobile financial technology adoption mainly considers individual-level data. Our paper explores the determinants of mobile financial technology adoption through a cross-country analysis. More precisely, we use structural factors and the latent demand for financial services to analyze their impacts on mobile money adoption. Moreover, we set Sub-Saharan African countries against other developing countries to analyze the disparities and similarities in the determinants of mobile money adoption.

Our data sample comprises 72 developing countries, of which 32 are from Sub-Saharan Africa, over the period spanning from 2011 to 2014 to analyze determinants of mobile financial technology. Our results show that GDP per capita, population density, the competition and efficiency of the banking sector, remittances, bank penetration, and payment services impact mobile money adoption in developing countries. We also analyze whether Sub-Saharan Africa exhibits a gap compared to other developing countries in the adoption of mobile money. We find a positive and significant relationship between being a Sub-Saharan African country and mobile money adoption. In further investigations, we analyze the reasons of this gap by highlighting the

[4] Mobile financial technology is used to refer to mobile money and mobile banking services.

disparities and similarities between Sub-Saharan African countries and other developing countries in the adoption of mobile money. We find that while the similarity in mobile money adoption relies on domestic remittances, the differences come from structural factors, the outreach of financial services, the banking sector intermediation activities and the payment services. Overall, our results are in line with previous studies highlighting Sub-Saharan Africa to be the region where mobile money achieves broader success and shows promise to improve financial inclusion (Allen et al., 2014; Aron, 2015; Demirguc-kunt et al., 2015; Gupta et al., 2009; Heyer and Mas 2009; Mas 2012).

The rest of the paper is organized as follows. The next section describes the two main mobile financial technologies, namely mobile money and mobile banking. In section 3, we present the characteristics of mobile financial services adoption in developing countries and the adoption of mobile money in Sub-Saharan Africa. We identify the potential determinants of mobile money adoption and describe our empirical strategy in section 4. Section 5 presents our empirical results. We conclude in section 6.

1.2. Mobile technology and mobile financial services

The extensive spread of mobile phone technology has been shown to greatly reduce cost of communication, allowing access information such as health care, education, employment opportunity, market information and improving people welfare (Aker and Mbiti, 2010; Batista and Vicente, 2013; Erickson, 2010). The expansion of mobile phone adoption has the potential to transform poor people access to formal financial services through innovative applications and services - that are mobile money and mobile banking.

1.2.1. Leapfrogging effects: Fixed and mobile phones

The access and use of mobile phone has increased dramatically in Sub-Saharan Africa over the past decades. Mobile phone subscription increases by 43% annually between 2005 and 2014 in Sub-Saharan Africa, while in high income countries this rate is around 8% (WDI, World

Figure 1a. Mobile and fixed phone adoption in Sub-Saharan Africa.

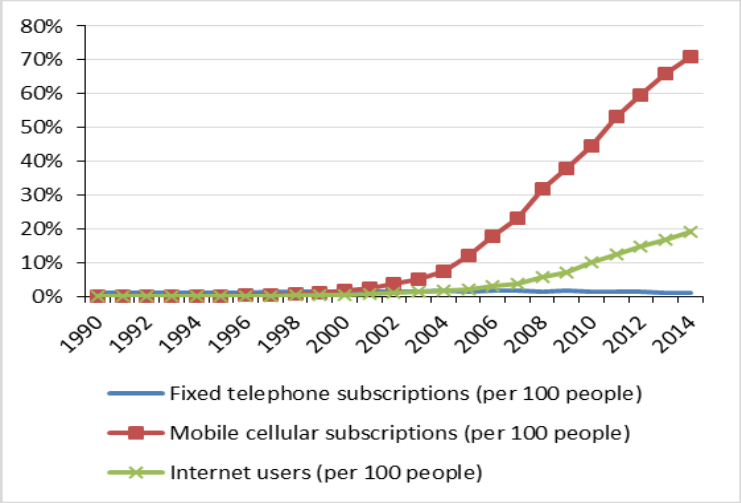
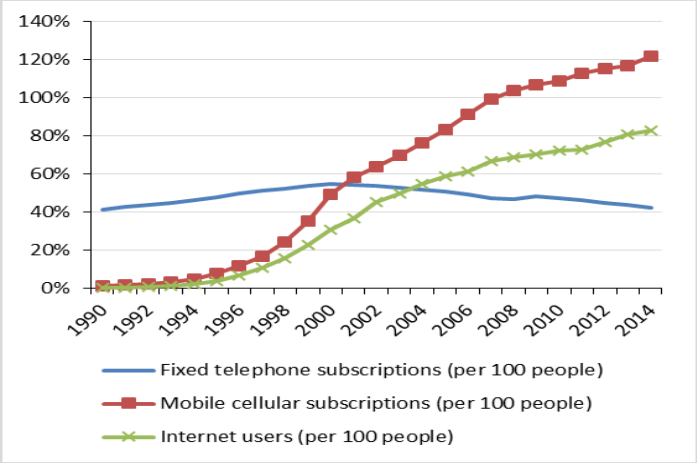


Figure 1b. Mobile and fixed phone adoption in High income countries.



Source: World Development Indicators, World Bank.

Bank 2016). Moreover, while the rate of mobile phone penetration has been growing at exponential rate, fixed-phone rates at best stagnated in developing and developed countries. Figure 1 exhibits the rapid penetration rates of mobile phone over fixed phone, and the growing adoption of internet that remains modest in Sub-Saharan Africa with 20% of users compared to 80% in high income countries.

Regarding the relationship between fixed-lines and mobile networks two theoretical point of view can be distinguished. First, the development of mobile network can be related to an initial development of fixed-lines and then a complementarity effect between these two telecommunication services. This is the case in developed countries with high fixed telephone penetration, therefore mobile phone is regarded as a complement service because at this step, the value of mobile phone depends on the possibility to use it to receive or make calls to the dominant fixed-telephone (Albon, 2006; Gruber, 2001). As figure 1.b illustrates, at the time mobile phone was adopted fixed phone had reached around 40% of the population. But, when there was enough mobile phone subscribers, the relative dependence on fixed-phone gradually decreases with an increasingly penetration of mobile phone. Second, the development of mobile network can stem from an underdevelopment of fixed-lines traffic and then resulting in a substitution effect between the two services. In developing countries where fixed-phone remains underdeveloped (Figure 1.a), there is a fixed-to-mobile substitution implying the use of mobile phone instead of fixed-phone. In fact, the lack of well-traditional fixed-lines telecommunication services makes mobile technologies an important alternative, with advantage in terms of mobility, network coverage and connectivity of people. Moreover, Aker and Mbiti (2010) document that while mobile phone connects individuals to each other beyond frontiers, it also allows farmers in Tamale (Ghana) to get information about corn and tomato prices in Accra, laborers in Niger to be aware about job opportunities in Benin.

Overall, in countries where fixed phone was well adopted before the penetration of mobile phone, both telecommunication services are considered as complements. While in developing countries as well as in Sub-Saharan Africa where fixed phone was undeveloped prior to mobile phone, there is a leapfrogging of mobile phone over the fixed phone (Albon, 2006). Thus, this leapfrogging effect may stem from the strategy of mobile operators of targeting at least in some areas or for some segments of the population lacking access to fixed phone with wireless technology. From the perspective of fixed phone operators, fixed-to-mobile phone might imply losing revenue and a substantial base of subscribers, even customers, if individuals decide to adopt wireless technology (Vagliasindi et al., 2006). Regarding the rapid adoption of mobile phone and the impact that it may have on individuals' livelihoods, it is worthwhile to investigate how the leapfrogging pattern of mobile phone may affect other economic sectors especially the financial system through mobile money and mobile banking.

1.2.2. Mobile financial technology and financial access

In what follows we briefly describe the main two financial technologies operated through the mobile phone.

Mobile money

Mobile money can be defined as a basic financial service that offers store-of-value and payment services to mobile phone subscribers (Mas, 2012). According to Aron (2015), the common trait of definitions of mobile money is that an electronic money is issued on receipt of funds in an amount equal to the available monetary value. The electronic money is redeemable for cash and the electronic value may be accepted as a means of payment by parties other than the issuer for instance person-to-person transfers, retail payments and payment of services and goods, government-to-person transfers. The issued electronic value is backed up by storage of equivalent funds in one or more banks depending on central banking or other regulations. Mobile money is documented to have transformative effect that entails the access to financial services through a mobile phone without owning a financial account (Mas and Porteous, 2015; Porteous, 2006). Thus, mobile money appears to be suitable for people in countries where the formal financial system remains underdeveloped with low level of bank penetration. The issuance of mobile money services depends on the jurisdiction in each country. Mobile money providers involve mobile network operators for instance in Kenya/Tanzania/Uganda, or licensed banks, microfinance institutions and electronic money issuers who receive the agreement from the central bank for example, in WAEMU countries (Aron, 2015; Ramada-Sarasola, 2012; BCEAO, 2014). In the cases where mobile money services are provided by licensed banks, mobile money system is fully embedded within the traditional banking services industry (Ramada-Sarasola, 2012). Access to mobile money services requires owning a SIM (Subscriber Identity Module) card and being able to satisfy the "know your customer" procedure by providing a national identity card. Each registered mobile money user has her/his mobile phone number linked to an electronic account accessible via the SIM card inside the phone. Hence, mobile money user can make deposit and store money in electronic form in the mobile money account, send that electronic value via text messages (SMS) to another mobile phone subscribers registered or not to

mobile money services, or withdraw physical cash from a retail mobile money agent that convert electronic into cash and vice versa.

Mobile banking

Mobile banking can be defined as the use of a mobile phone to access an existent bank or a credit union account[5]. This can be done either by accessing the bank or credit union account's web page through the web browser using the mobile phone, through text messaging, or by using an app downloaded to the mobile phone. It is also documented that mobile banking may have additive effect that refers to the access to an existent formal financial account via a mobile phone (Porteous, 2006). Thus, mobile phone appears as another channel through which bank customers can perform banking services such as deposits, withdrawals, account transfer, bill payment and balance inquiry. Mas and Kumar (2008) highlight how mobile phone can change the relationship between a bank and its customers. First, mobile phone can be viewed as a virtual bank card as it allows to store information about the user identity and his account. This information can be recorded on the SIM card. Moreover, mobile phone can be used as a POS (Point of Sale) terminal to initiate transaction requests and communicate with the appropriate bank to solicit transaction authorization. Similarly, mobile phone can play the role of ATM (Automated Teller Machines) as customers' savings are readily available on the mobile phone that is also considered as a POS. Furthermore, as customers may access internet on their mobile phone then it can be viewed as an internet banking terminal. However, the usage of mobile banking do not suppress the high costs related the bank account (minimum deposit required and cost of account maintenance) that are usually seen as barriers of access for poor and unbanked individuals.

Mobile banking has the potential to increase people access and usage of their existing account at a financial institution. By helping banked people to initiate operations from their account remotely, mobile banking helps resolve the problem of physical access to financial institutions but its impact on unbanked and unserved financial individuals is limited. However, as mobile money systems evolve and as cell phones become cheaper in less advanced economies, the range of possible services linked to products managed by formal financial institutions such as

[5] For more details about the definition, see Board of Governors of the Federal Reserve System, 2016, available at: www.federalreserve.gov/publications/default.htm.

banks and insurance companies could expand (Aron, 2015). This is the case of M-Shwari[6], in Kenya, launched in 2012 through a collaboration between Commercial Bank of Africa (CBA) and the mobile network operator Safaricom provider of M-Pesa (Cook and McKay, 2015). M-Shwari is a bank account -a mobile banking- subject to full bank regulation and offering its users a combination of savings and loans. In fact, the M-Shwari account must be linked to M-Pesa account meaning that all M-Shwari menu is incorporated into the M-Pesa SIM toolkit. While all deposits or withdrawals from the M-Shwari account are free of charge, they are only made through M-Pesa account. Overall, mobile money remains the dominant product, especially in Sub-Saharan Africa, and has the potential to galvanize the financial system by providing access to basic financial services.

1.3. Overview of mobile financial technology adoption in developing countries and key features of the Sub-Saharan Africa case.

The deployment of mobile financial technology increased dramatically in many developing countries. It has been documented that the financial innovation has expanded the frontier of financial inclusion beyond the realm of brick and mortar banks to mobile through a growing network of agents (IGC, 2016). These changes are characterized by the entry of new actors in the financial systems, to galvanize the financial sector and promote financial access. Thus, we present here how mobile money and mobile banking are adopted in developing countries with a particular focus on Sub-Saharan Africa.

1.3.1. Adoption of mobile financial technology in developing countries

Important disparities in the penetration rates exist across developing countries where mobile money and mobile banking services have been launched. To provide evidence about this phenomenon, we use data from the Global Findex (World Bank) on both mobile money and mobile banking to highlight disparities or similarities in the expansion of both services. For the sake of comparison, we distinguish Sub-Saharan African countries from other developing

[6] In the case of M-Shwari, mobile banking can be qualified as transformative as people can access through their mobile money account (M-Pesa) to a banking account without owning previously a bank account.

countries. Figure 2a reveals that globally mobile money dominates mobile banking in Sub-Saharan African countries. This trend is observed in all the Sub-Saharan African countries of our sample except in Mauritius, Namibia, Nigeria and South Africa where mobile banking is more prevalent than mobile money. Figure 2a also shows that Kenya is the country where mobile money meets rapid uptake than elsewhere with around 58% of adults[7] having mobile money account compared to 19% for mobile banking. Thereafter, come Somalia with 37% of adults having mobile money account, Uganda with 35% and Tanzania and Côte d'Ivoire with respectively 32% and 24% of adults having mobile money account. As regards to mobile banking , the countries where it records the highest penetration rates are Botswana and Kenya with about 19% adults having mobile banking account, followed by South Africa with 18% and Namibia 14%. Thus, regarding the landscape of mobile money and mobile banking in Sub-Saharan African countries mobile money penetration rate is three times higher than those of mobile banking. Therefore, it is obvious that mobile money is expected to achieve important impact on financial deepening than mobile banking in Sub-Saharan Africa.

Considering Figure 2b, it appears that mobile banking dominates mobile money in other developing countries. It shows that Mongolia records the highest level of penetration rate of adults having mobile banking account with around 17%, followed by Singapore and the United Arab Emirates with respectively 16%. Regarding mobile money adoption, Cambodia comes first with 13% of adults having mobile money account, followed by the United Arab Emirates and Singapore with respectively 11% and 6%. Thus, the expansion of mobile financial services across developing countries (other than Sub-Saharan African countries) may comparatively depend on the adoption of mobile banking rather than mobile money.

Overall, Figures 2a and 2b suggest that mobile money records the highest adoption rates with 58% compared to 19% for mobile banking across developing countries. However, both rates are recorded in Sub-Saharan African countries. Thus, the region possesses an advantage over other developing countries in the expansion of mobile financial technology. Therefore, one may expect it to be the region where mobile financial technology may have the potential to mitigate the lower penetration of formal financial services. Thus, we briefly describe hereafter mobile money deployment in Sub-Saharan Africa.

[7] The terminologies adults and populations used throughout the paper stand for the population aged 15 and more.

Figure 2a. Mobile money and mobile banking in Sub-Saharan African countries.

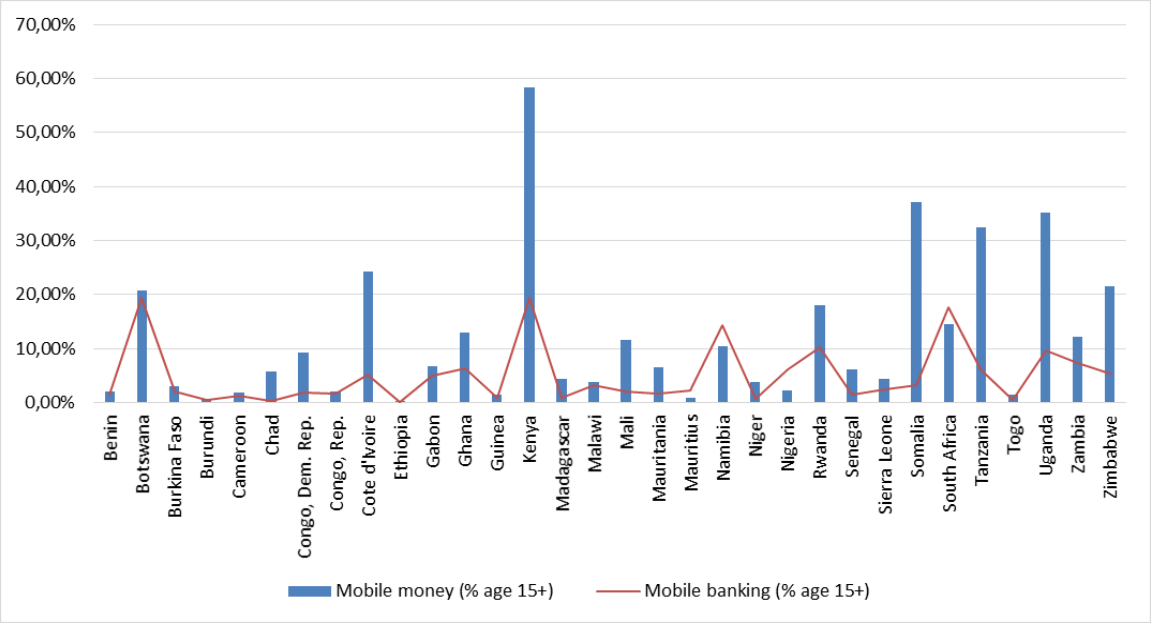
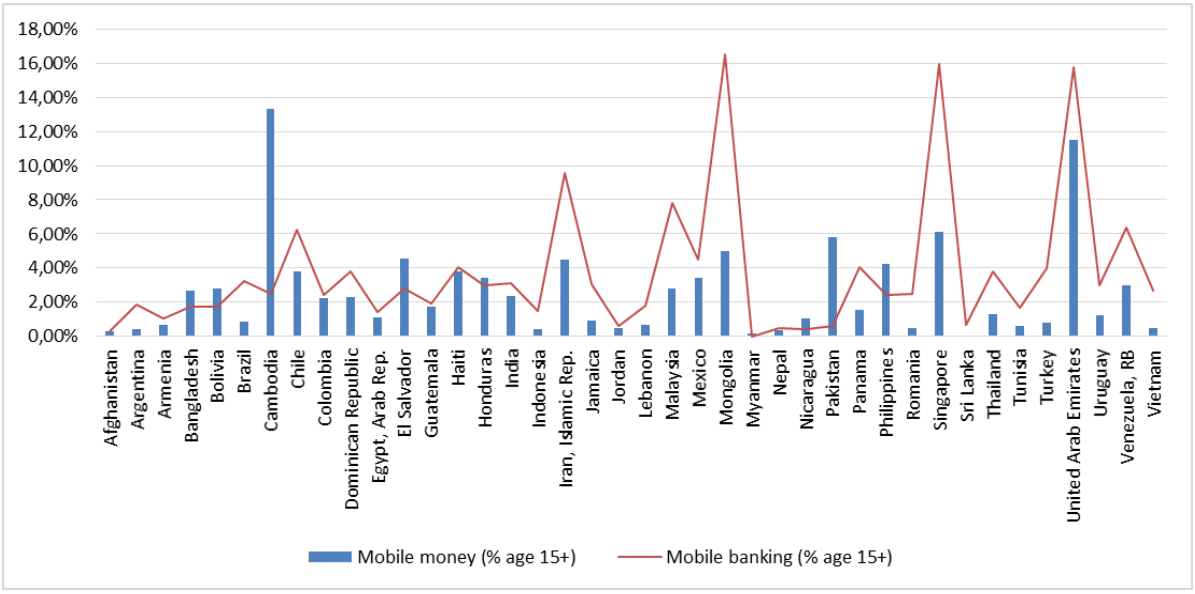


Figure 2b. Mobile money and mobile banking in other countries.



Source: Global Findex database, 2014. Mobile money is the percentage of adults having mobile money account. Mobile banking represents the percentage of formal account owners that used mobile phone to make a transaction from their account.

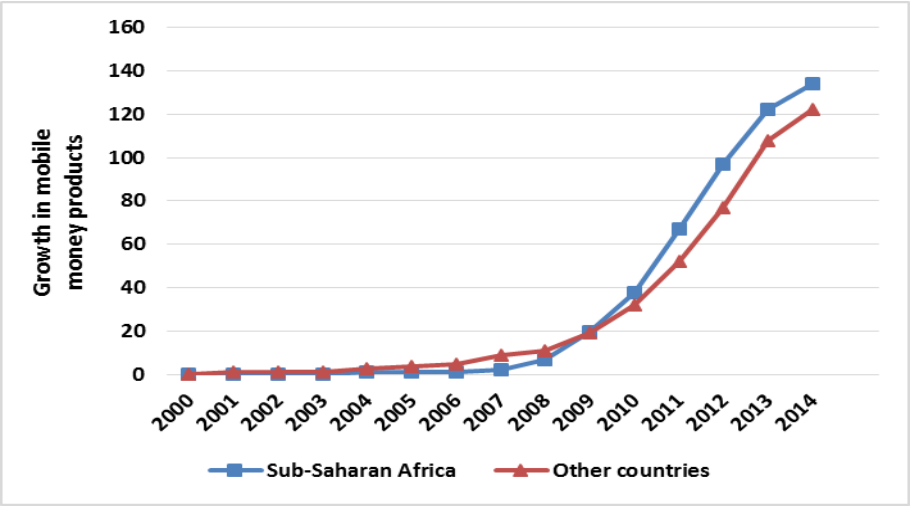
1.3.2. The rise of mobile money in Sub-Saharan Africa

Sub-Saharan Africa is the region where mobile money has operated exciting changes in the financial system. To improve access to financial services, mobile money plays an important role by leveraging mobile phones which are increasingly prevalent in Sub-Saharan Africa as a channel to provide financial services. It is reported that Sub-Saharan Africa[8] led the industry of mobile money as around 12% of adults have mobile money account and half of them has both mobile money account and an account at a financial institution, and half has only mobile money account (Demirguc-kunt et al., 2015). While mobile money penetration is increasing in West Africa and Southern Africa, East Africa records the higher level of penetration with 20% of adults reporting having mobile money account and 10% a mobile money account only. Across the region, there are 13 countries with mobile money penetration of more than 10% (in Namibia), and in five of them there are more adults with mobile money account than account at a financial institution (Côte d'Ivoire, Somalia, Tanzania, Uganda and Zimbabwe).

The most quoted success of mobile money product comes from East Africa. It is the M-Pesa, one of the most successful mobile money system launched in 2007 by Safaricom, a Kenyan mobile network operator. M-Pesa was initially designed to allow microfinance loan repayments to be made by phone before becoming a general money transfer scheme (The Economist, 2013). In 2009, M-Pesa reached around 70% of households who can use their M-Pesa account to store value, transfer money and purchase goods and services (Jack and Suri, 2011). M-Pesa account is also used to disburse salaries or pay bills that save users' times and money by avoiding them to spend several hours queuing up at the bank. In addition to payments, transfer and value storage services, credit and insurance products are also being offered to previously excluded and underserved individuals through the mobile money account (Lauer and Lyman, 2015), such as micro-credits that are now operated on the basis of credit scores, for instance M-Shwari in Kenya (Aron, 2015; Cook and McKay, 2015; Demombynes and Thegeya, 2012). Scores are dynamic and calculated using cell phone data on calling, texting, airtime and emergency patterns and habits to predict the creditworthiness of customers on a monthly basis.

[8] We present the level of penetration of mobile money account compared to bank account in Sub-Saharan Africa and in the world in Appendix A.2.

Figure 3. Expansion of mobile money products in developing countries.



Source: Mobile money deployment tracker, GSMA. 2016.

The expansion of mobile money products[9] (figure 3) shows that from 2009 to 2014 Sub-Saharan Africa alone records 135 mobile money products[10] (in 38 countries) compared to 129 in other countries in the rest of the world (56 countries). The significant deployment of mobile money products may stem from the presence of same mobile network operators or other actors in different countries of the region. According to GSMA (2016), Airtel Money a mobile money product is operated in 15 countries, followed by Orange Money launch in 11 countries, MTN Money in 10 countries, MobiCash in 7, Tigo Money/Cash and M-Pesa in respectively 6 countries[11]. Thus, the presence of same mobile network operators in several countries allowed the launch of 8 cross-border mobile money transfers systems (Table 1) (Scharwatt and Williamson, 2015). Similarly, mobile money network operators also build partnership with money transfer operators (Wester Union, MoneyGram and WorldRemit) that work through physical agents for cross-border money transfers.

[9] We provide in Appendix A.1. the deployment of mobile money products across America, Asia and Africa. We do not report European countries as there are only two countries (Albania and Romania) where mobile money product where launched with respectively one mobile money product launched in 2014.

[10] These statistics do not include other products that has been launched but related to an existent mobile money (for instance, M-Shwari, Mkopo Rahisi both related to M-Pesa account).

[11] For more details, see Table A.1 in Appendix. Some of mobile network operators also participate in the supply of mobile money services in other countries although the label of the mobile money product is different from their brand name.

Table 1. Mobile money and cross-border money transfers in Sub-Saharan Africa.

Operators involved	Mobile network operators	Countries included	Markets included
One operator	Tigo	Tanzania and Rwanda	2
	Orange	Côte d'Ivoire, Mali and Senegal	3
	MTN	Côte d'Ivoire and Benin	2
	Moov	Côte d'Ivoire, Benin, Niger and Togo	4
	Safaricom/Vodacom	Kenya and Tanzania	2
	Airtel	Zambia, Rwanda and Congo, Dem. Rep.	3
Multiple operators	Orange and Airtel	Côte d'Ivoire and Burkina Faso	2
	MTN and Airtel	Côte d'Ivoire and Burkina Faso	2

Source: Authors' analysis using data from Mobile Money for the Unbanked (MMU), GSMA, 2015.

Regarding the rapid adoption of mobile money, banks have begun to follow the trail of offering financial services using mobile phone. In fact, banks receive agreement from Central Bank for the launch of mobile money products leading mobile network operators to build partnership with banks. However, mobile operators remain the most active actors. For instance, in Rwanda, Uganda and Ghana the mobile network operator MTN has taken the lead by implementing automatic teller machines to allow its customers to withdraw cash from their MTN money account without a bank card - they send a message, then receive a one-time-PIN on their phone (Bhan, 2014). In Kenya, Equity bank in 2010 has built a partnership with Safaricom, to offer saving account that pay interest, called M-Kesho. Recently, Equity bank obtained a license as mobile network operator and launched Equitel that started in 2015 to provide SIM card to its customers for call, SMS and provide a mobile money account for full banking services including credit.

Overall, the implementation of mobile money products is increasingly taking place, although at different pace, across developing countries suggesting the following questions that our paper addresses:

(i) What are the determinants that may drive the adoption of mobile money in developing countries?

(ii) Are there disparities or similarities in the determinants of mobile money adoption between Sub-Saharan African countries and other developing countries?

1.4. Identifying the determinants of mobile money adoption

In developing countries, mobile money deployment is leapfrogging the provision of formal banking services (Aron, 2015). The leapfrogging effect stems from the usage of technologies to solve problems related to the weakness of traditional financial institutions to reach individuals with broader range of financial services. In this section we identify the determinants that may explain the adoption of mobile money in developing countries along with the description of our data and methodology.

1.4.1. Structural and demand factors

Structural factors (macroeconomic factors, outreach of financial services and banking sector intermediation activities).

Country-level factors such as investment climate, political and country risk environment may contribute to foster the adoption of mobile money. For instance, high level of inflation could reduce the value of a financial savings proposition for customers, but it may increase the need of speed money transfer that mobile money offers (Heyer and Mas, 2009). Moreover, an increase in GDP per capita may contribute to financial development and financial inclusion because the volume and the sophistication of financial activity demand increases with income levels (Allen et al. 2014; Beck et al., 2008). Indeed, higher income economies can also benefit from scale economies in the provision of financial services. As mobile money appears as an instrument of financial inclusion, income per capita may drive mobile money adoption. Furthermore, an uncertain political and economy environment would discourage investment in additional services (for instance in the financial sector) but mobile money may be appropriate in these cases where alternative services are obstructed. For example, in Kenya during the election-related violence in 2008, M-Pesa experienced a big surge because most banks remained closed and that people relied on M-Pesa for transfers to support friends or families (Morawczynski and Pickens, 2009). Additionally, a country with scattered population may be difficult to provide with convenient mobile agents services especially cash in/out functions.

Growth in adoption of mobile money may also be associated with the deployment base of mobile phone although mobile money may also induce an increase in the number of mobile phone subscription. In fact, the level of mobile phone subscription depends crucially on the network coverage which must be strong and geographically widespread. This is also the case for mobile money services that are channeled through mobile phone network. The experience of customers with mobile phone services such as SMS (that needs literacy level) or voice services also drives they ability to adopt mobile money services as the services function on SMS basis. In countries where SMS is cheaper than voice services, customers will tend to easily use the cheapest services and hence incorporate mobile money services. Similarly, a large mobile network market share is related to higher level of brand awareness and probably strong confidence among the public and broader base of potential customers to provide with mobile money services (Heyer and Mas, 2009).

In most developing countries, the financial system is quite nascent and tends to be concentrated especially in urban areas or areas with high income activities. The lack of a well-developed financial network creates a conducive environment for the uptake of mobile money. For instance, the estimated number of ATM (Automated Teller Machines) is 15 per 100,000 adults in low income countries, 14 and 43 respectively in Sub-Saharan Africa and Latin America and Caribbean whereas this figure rises to 97 in high income countries. Therefore, one may expect mobile money to meet success in developing countries where bank branches penetration is very low. Moreover, microfinance institutions seem more disseminated in countries where banking services remain limited. In many Sub-Saharan African countries, they have played an important role in providing microcredits and micro-savings to unbanked people. Like in other developing countries, microfinance has grown rapidly in Sub-Saharan Africa as reported by Microfinance Information eXchange (MIX). For instance, the number of active customers served increased from 2.3 million in 2005 to 4.8 million in 2009 (Beck and Cull, 2013). However, the cost of operating microfinance institutions remains very high, associated with high interest rate on their services (microcredits and limited size of their credit) (Ondiege, 2010; Sacerdoti, 2005). In this context, mobile money may have a considerable advantage by managing a network of retail agents reaching into the communities where people live. In fact, while the weakness of existent financial network may facilitate mobile money adoption, its success may also depend of its own network of agents that perform mainly cash in/out functions. Mobile money agents need

to ensure enough liquidity and electronic value to avoid shortage that may hamper the experience of users and reduce the willingness of potential news users. The ability of agents to sustain mobile money scheme depends on the level of bank branches penetration. Thus, a minimum of bank branches is critical to facilitate mobile money agents to rebalance their liquidity portfolios easily. Indeed, the role of agents is not limited to convert electronic value into cash and vice versa, but also promote the service within their communities to register new customers and educate them (Heyer and Mas, 2009).

Latent demand (domestic and cross-border remittances, savings needs and access to/usage of alternative financial services and payment services).

The adoption of mobile money could depend on the range and quality of existing alternative services (formal and informal services) that may induce latent demand for financial services. In countries where migration is significant and results in splitting of families from rural to urban centers seeking for better employment options, remittance services play an important role for sending money regularly to the family in rural areas (Heyer and Mas, 2009). In developed countries, it may be difficult to bring individuals toward mobile money because alternative services are well developed. However, in developing countries where existing alternatives are weak, mobile money may gain traction and speed uptake. Thus, a promising domestic environment is where the process of rural-urban migration is conveniently rooted to produce population flows that may increase the potential market size for domestic remittances. Moreover, the lack of school in rural areas may also drive remittances from rural to urban as individuals may be schooled in urban areas for better quality of education. Overall, these characteristics may favor the adoption of mobile money as it allows individuals not only to send and receive remittances but also with more safety and at lower costs compared to existing money transfer operators such as Western Union, MoneyGram (Mbiti and Weil, 2011).

In countries where the urbanization rate is important (like in Philippines and Latin America), remittances are more likely to stem from international rather than domestic migration patterns. International or cross-border remittances services are dominated by banks, postal services and money transfer operators. Regional migration may boost cross-border remittances through mobile money as most of mobile network operators are established in several countries.

Although remittances, which are mostly made through the formal system, could facilitate the entry of households into the formal financial market, their high costs are deterrent for many poor people, especially in Sub-Saharan Africa (Gupta et al., 2009). Moreover, although in most countries postal or microfinance institutions are more disseminated than banks, the services they provide are often inappropriate and expensive. Mobile money providers have the advantage over banks to provide a competitive transfer service at lower costs inside the country (Aron, 2015). Furthermore, informal remittances that are mainly done by bus companies or friends and families remain risky even if they may be convenient for low income people. For example, illegal informal remittances were developed in Tanzania through airtime transfers that consist in electronically transfers of airtime that the recipient can exchange for cash with agents (Heyer and Mas, 2009). Thus, several types of informal remittances may be seen as strong competitors of mobile money although the latter appears as more secure and safer.

Evidence also suggests that people in developing countries mainly lack access to safe place for savings (Collins et al., 2009; Dupas and Robinson, 2013). About 19% of the population has a bank account in low income countries, as compared to 90% in high income countries (Nyantakyi et al., 2015). In fact, banks are not able to compete with non-bank providers as they incur higher fixed and operating costs. The paucity of bank account represents an opportunity of growth of mobile money. Opening a bank account requires providing a formal address, identification card, a proof of formal employment and constant stream of income with a minimum amount of deposits. Mobile money greatly softens these conditions as the only requirements are having a SIM card and a national identity card. Regarding microfinance institutions, although they offer financial services that are more accessible, their quality is often deficient (Heyer and Mas, 2009). Mobile money is in this respect a convenient mean for mobilizing domestic savings by allowing especially poor people to save small amount securely and safely (Aron, 2015; Mas, 2010). Nevertheless, informal finance remains a major competitor for mobile money particularly informal savings that are widespread in developing countries such as India and West Africa but remains unreliable. Informal savings are well developed with important network such as deposit collectors, intra-household or savings groups that provide temporary safe-keeping of funds at lower costs. However, they are very risky and often require a lot of time in building group solidarity and monitoring performance. Thus, given the lack of

access to formal financial services, mobile money may be very attractive by offering a competitive and reliable option of savings.

The landscape of payments, especially salary, bill or government payments and microcredit repayments, offer substantial opportunities for mobile money adoption (Aron, 2015; Heyer and Mas, 2009). Moreover, in countries where the basic infrastructure is reasonably well developed, a substantial share of the population pays utility bills (phone, electricity or water). Mobile money may be convenient by enabling the users to avoid wasting time in long queues in crowded offices. It could also be an efficient channel to deliver salaries to workers in countries like Cambodia (Heyer and Mas, 2009). In South Africa and Afghanistan, some workers have moved to receiving salaries through mobile money and it allows costs saving for the employer (Blumenstock et al., 2015; De Koker and Jentzsch, 2013). Transactions made through mobile money are secure and traceable which make it suitable for collecting administrative tax payments or for granting subsidies, for health and social security fund payments in countries where traditional financial services are underdeveloped. Microcredit repayments and micro-insurance premium collection offer also a suitable frame for mobile money adoption. Microfinance and insurance institutions may provide through mobile money providers an account number to each customer for easy repayments.

1.4.2. Cross-country analysis: data and methodology

Data collection

For the purpose of this study, we use data from multiple sources on 72 countries including 32 Sub-Saharan African countries to analyze the determinants of mobile financial services adoption. We use data from 2011 to 2014 because data on financial inclusion (Global Findex) are available only for those years. Our data also include structural variables and data on latent demand for financial services as presented above (section 4.1) over the same period. We provide in Table A.7 in Appendix the description, expected sign and sources of the variables that we use for our analysis.

Model specification

To assess the determinants that may affect mobile money adoption, we consider the following specification:

$$MM_i = \alpha + \beta X_i + \varepsilon_i \qquad (1)$$

where MM_i is the dependent variable[12] that stands for mobile money adoption that is the percentage of mobile money account across our sample countries. X_i represents the explanatory variables that include structural and latent demand variables presented in section 4.1. In our estimations, we consider macroeconomic variables as control variables. The dependent variable mobile money[13] is available for the year 2014, while explanatory variables are available for the full period (2011 to 2014). Therefore, we follow Allen et al. (2014) and use the average of our explanatory variables over multiple years (2011 to 2014). Hence, we obtain one observation per country. As our aim is to describe a global outlook of determinants that may affect the adoption of mobile money, we report results from a cross-country regression. It is worthwhile to note that we are not claiming causal effect in our following results which should be considered as suggestive.

Table 2 provides key descriptive statistics for our full sample of developing countries, for the sub-sample of Sub-Saharan Africa countries and the sub-sample of other developing countries. The data show that on average 7% of adults has a mobile money account and 4% a mobile banking account in our full sample. However, in Sub-Saharan Africa 12% of adults in average have a mobile money account compared to 3% in other developing countries. The average GDP per capita is about 4,962 $US (constant 2010) in our full sample, 7,297 $US in other developing countries while in 2,026 $US in Sub-Saharan Africa. Regarding the outreach of formal financial services, there are on average 20 bank branches and 75 ATM per 1,000 km2 in the full sample, with respective figures of 31 branches and 128 ATM in other developing

[12] We also use as an alternative dependent variable mobile banking adoption. Although the determinants presented above (section 4) are those cited in the literature as affecting the adoption of mobile money, we suppose that they may also impact the adoption of mobile banking. As our main objective is to examine the determinants of mobile money adoption, we report results on mobile banking adoption only in the appendix.

[13] The lack of accuracy data on mobile money adoption for all the countries considered in this study leads us to consider only the data available for the year 2014. Moreover, the data on mobile banking are also available only for the year 2014. For more details, see Global Financial Inclusion database (World Bank).

countries and 6 branches and 10 ATM in Sub-Saharan Africa. However, we show that on average the number of mobile money agents is about 112 per 1,000 km2 in our sample, with 136 and 103 per 1,000 km2 in respectively other developing countries and in Sub-Saharan Africa. These statistics support the fact that the dissemination of mobile money agents compared to the outreach of formal financial may play a key role in the adoption of mobile money. Moreover, the low penetration of bank account (4% of adults) and formal financial account[14] (36% of adults) increases the latent demand for financial services. In Sub-Saharan Africa these rates are about 2% for bank account and 23% for account at a formal financial institution while they are respectively 6% and 41% in other developing countries. Furthermore, our sample of countries shows that 46% of the population makes domestic remittances (sent and received), while only 5% are involved in cross-border remittances via the formal financial system. Sub-Saharan Africa remains the region where domestic remittances are more important with 61% of adults involved compared to 33% for other developing countries. By contrast, cross-border remittances channeled through the formal financial system is around 2% in Sub-Saharan Africa while it is 6% in other developing countries. About 29% of the population reports to have saved in developing countries, this figure is 33% and 27% respectively in Sub-Saharan African countries and other developing countries. Regarding the use of informal methods such as savings club, Sub-Saharan Africa records the higher rate with 17% of the population compared to 15% in other developing countries. Considering the share of adults that pay utility bills, the reports show that they are about 50% for the whole sample of developing countries. In Sub-Saharan Africa this rate is two times lower than that for other developing countries with respectively 22% and 56%.

[14] Formal financial account refers to an account at a bank or other types of financial institution including for instance credit union, microfinance institution, cooperative or the post office. For more details see Global Findex (World Bank).

Table 2. Summary statistics.

	Full sample					Sub-Saharan African countries					Other developing countries				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs.**
Dependent variables															
Mobile money	6.65	10.19	0.03	58.39	72	11.74	13.41	0.03	58.39	32	2.58	2.83	0.08	13.29	40
Mobile banking	4.38	4.82	0.08	19.39	71	4.99	5.60	0.08	19.39	32	3.88	4.09	0.28	16.54	39
Structural factors, outreach of financial services and Banking sector intermediation activities															
GDP per capita	4,962.47	7,742.28	218.63	4,9837.33	70	2,025.62	2,684.17	218.63	10,176.64	31	7,296.89	9,514.54	628.29	4,9837.33	39
GDP per capita growth	2.96	2.35	-4.62	10.33	71	3.00	2.08	-0.36	9.13	31	2.92	2.56	-4.62	10.33	40
Population/1,000,000	54.74	154.09	1.26	1271.46	72	25.45	33.77	1.26	170.58	32	78.17	202.62	2.71	1271.46	40
Population density/1,000	0.24	0.89	0.00	7.57	72	0.10	0.14	0.00	0.62	32	0.35	1.19	0.00	7.57	40
Inflation	6.95	5.79	1.11	37.49	70	6.62	4.99	1.11	20.15	31	7.21	6.42	2.19	37.49	39
Primary education/1,000,000	6.68	17.42	0.11	139.59	67	3.58	3.59	0.11	14.85	30	9.20	23.05	0.14	139.59	37
Mobile phone subscriptions	92.94	38.51	19.08	178.57	72	74.67	38.57	24.26	178.57	32	107.57	32.00	19.08	165.53	40
SSA countries	0.44	0.50	0	1	72	1	0	1	1	32	0	0	0	0	40
ATM per 1,000 km2	75.36	458.21	0.03	3,843.08	70	9.67	38.99	0.03	218.47	31	127.58	611.33	0.18	3,843.08	39
Bank branches per 1,000 km2	19.63	73.93	0.04	610.48	71	5.52	19.76	0.04	110.84	25	30.58	96.07	0.58	610.48	40
Number of bank institutions	29.55	29.44	4.25	162.5	71	16.58	8.47	4.25	43	31	39.59	35.54	6.75	162.5	40
MM agent per 1,000 km2	112.45	268.30	0.00	1133.79	35	103.10	238.27	0.00	1133.79	25	135.84	345.97	0.03	1113.51	10
Capital regulatory index	6.77	2.08	1	10	64	6.28	2.40	1	10	29	7.16	1.71	3.75	10	35
Government owned bank	16.43	19.91	0	74	63	10.66	16.91	0	64.25	29	21.35	21.16	0	74	34
Bank cost to total asset	4.10	2.24	0.72	10.27	70	5.39	1.95	2.12	9.95	31	3.07	1.92	0.72	10.27	39
Bank concentration	65.19	18.85	24.06	100	68	70.44	17.76	39.67	100	29	61.29	18.91	24.06	96.56	39
Boone indicator	-0.05	0.09	-0.24	0.28	69	-0.04	0.09	-0.15	0.24	30	-0.07	0.09	-0.24	0.28	39
Remittances, Savings and access to/usage of alternative financial services and payment services															
Domestic remittances	45.68	24.37	0	114.01	72	61.19	23.35	10.94	114.01	32	33.27	17.09	0	83.10	40
Remittances inflow to GDP	4.84	5.93	0.01	26.48	64	2.47	2.76	0.01	10.99	26	6.46	6.94	0.04	26.48	38
Average cost of remittances	8.43	4.12	1.43	20.07	48	11.49	4.08	5.97	20.067	19	6.43	2.68	1.43	13.29	29
Cross-border remittances	0.17	0.38	0	1	72	0.38	0.49	0	1	32	0	0	0	0	40
Saved	29.31	11.08	7.48	60.90	63	32.51	12.93	7.48	60.90	26	27.06	9.10	8.07	51.26	37
Saving club	15.88	11.41	1.31	39.94	71	17.08	11.95	1.31	39.27	31	14.94	11.03	1.45	39.94	40
Bank account	41.30	46.65	1.91	318.31	63	19.83	18.61	1.91	65.87	30	60.81	55.48	3.7	318.31	33
Account at a financial institution	36.50	24.99	3.49	96.35	72	22.88	18.41	2.51	81.17	32	41.11	23.44	8.11	97.29	40
Receive agricultural payments	24.52	17.06	1.21	68.60	71	35.99	14.61	2.60	68.60	32	15.11	12.66	1.21	49.79	39
Receive government transfers	10.35	10.35	0.64	66.69	72	6.83	6.77	0.64	34.18	32	13.16	11.85	1.50	66.69	40
Paid school fees	24.94	10.02	6.61	51.26	71	25.42	11.32	6.61	51.26	32	24.55	8.95	7.99	47.21	39
Paid utility bills	40.93	23.59	2.86	87.98	72	22.45	14.32	2.86	64.97	32	55.72	18.59	8.05	87.98	40

Note: For variables that are available for one year particularly for 2014 (domestic remittances saved, saving club, receive agricultural payments, receive government payments, pays school fees and paid utility bills), we use it as a mean over our study period (2011 to 2014).

1.5. Determinants of mobile money adoption: is Sub-Saharan Africa special?

Table 3 reports our results[15] on the determinants of mobile money adoption in developing countries. We consider macroeconomic variables[16] and include alternatively other explanatory variables related to the outreach of financial services, banking sector intermediation activities, remittances, savings and access to traditional financial services and payments services. Across the table, the results show that GDP per capita and population density are negatively and significantly associated with mobile money adoption. Mobile money products are thus likely to be adopted in less developed countries with low density population. These results seem to contradict those of Allen et al. (2014) that show a positive correlation between GDP per capita and financial development and financial inclusion and those of Heyer and Mas (2009) who argue that sparse population is difficult to reach with convenient cash in/cash out (CICO) services. However, it demonstrates the specific characteristic of mobile money that can improve the welfare of poor people and allows remote access to financial services for scattered population.

Considering our explanatory variables related to outreach of financial services, none of the coefficients has a significant effect on mobile money services. However, we find that 3 out of 5 variables associated with the banking sector intermediation activities (Boone indicator, government owned bank and bank cost to total assets) have significant effect on mobile money adoption. We proxy the competitiveness of the banking sector using the Boone indicator to show whether the entry of non-banks in the financial sector improve access to cheaper financial services. The negative coefficient associated with the boone indicator indicates that increasing the competition in the banking system (hence, negative value of the boone indicator) through the entrance of non-banks (such as mobile money) in the banking sector contributes to provide a broader range of financial services at lower cost. Moreover, banks with limited activities may have less ability to engage into innovative financial initiatives (Sacerdoti, 2005). Hence, we include in our regression the percentage of banks owned by the government to analyze its effect on mobile money. The results show that government owned banks indicator is negatively related

[15] Results of estimations using mobile banking as dependent variable are reported in the Appendix from Tables A.3 to A.6.

[16] Our choice of macroeconomic variables as control variables for structural characteristics follows Beck et al. (2008) and Allen et al. (2014) who consider GDP per capita, Population size and density. Moreover, we also add inflation and GDP per capita growth.

Table 3. Determinants of mobile money adoption.

	Full sample	
	Mobile money adoption	
A. Structural factors		
	(1)	(2)
GDP per capita (ln)	-1.863**	
	(0.814)	
Population density (ln)	-1.394**	-0.760
	(0.574)	(0.467)
Inflation	-0.027	-0.011
	(0.107)	(0.114)
Primary education (ln)	0.949	
	(0.716)	
Mobile phone subscription (ln)		-1.612
		(1.855)
Constant	3.110	11.36
	(11.14)	(9.063)
Observation	65	70
R-squared	0.085	0.017
Fisher	3.157**	1.434

	Full sample			
	Mobile money adoption			
B. Outreach of financial services				
	(1)	(2)	(3)	(4)
GDP per capita growth	1.082	1.094	0.908	1.087
	(0.979)	(0.976)	(0.865)	(0.985)
Population (ln)	0.022	0.015	0.443	
	(0.653)	(0.644)	(1.403)	
Inflation	0.072	0.066		0.075
	(0.153)	(0.151)		(0.155)
ATM per 1,000 km2	-0.000			
	(0.000)			
Bank branches per 1,000 km2		-0.007		
		(0.007)		
MM agent per 1,000 km2			0.001	
			(0.006)	
Number of bank institution (ln)				0.101
				(1.429)
Constant	4.986**	5.088**	5.810	4.645
	(2.089)	(2.054)	(4.206)	(4.051)
Observation	63	64	35	64
R-squared	0.007	0.010	0.021	0.007
Fisher	0.42	0.49	0.42	0.46

	Full sample				
	Mobile money adoption				
C. Banking sector intermediation activities					
	(1)	(2)	(3)	(4)	(5)
GDP per capita (ln)	-2.030*	-1.782**	-1.880**	-1.625*	
	(1.056)	(0.860)	(0.913)	(0.904)	
Population density (ln)	-1.134	-0.881		-0.605	-0.465
	(0.787)	(0.589)		(0.600)	(0.528)
Inflation	-0.057	-0.041	-0.021		-0.063
	(0.112)	(0.131)	(0.143)		(0.135)
Bank concentration	-0.106				
	(0.082)				
Boone indicator		-19.18*			
		(10.74)			
Capital regulatory index			0.292		
			(0.393)		
Government owned bank				-0.112***	
				(0.042)	
Bank cost to total asset					1.240**
					(0.485)
Constant	26.29**	16.97**	19.14**	19.53**	0.235
	(12.48)	(6.923)	(7.531)	(8.631)	(1.573)
Observation	66	67	63	63	69
R-squared	0.098	0.089	0.054	0.102	0.088
Fisher	1.308	1.947	1.851	3.109**	4.034**

	Mobile money adoption			
D. Remittances				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	-0.455	-3.267**	-2.148**	
	(0.523)	(1.270)	(0.942)	
Population density (ln)	0.489	-1.762*	-0.752	-0.446
	(0.551)	(0.900)	(0.699)	(0.507)
Inflation	0.063	-0.334	-0.030	0.169
	(0.127)	(0.444)	(0.113)	(0.166)
Domestic remittances	0.279***			
	(0.078)			
Average cost of remittances		1.080***		
		(0.356)		
Remittances inflow to GDP			-0.304**	
			(0.131)	
Countries involve in cross-border remittances				11.32**
				(4.970)
Constant	-2.434	20.83*	22.32**	1.860
	(4.945)	(11.27)	(9.051)	(1.629)
Observation	69	47	63	70
R-squared	0.476	0.292	0.099	0.200
Fisher	5.320***	6.634***	2.741**	2.458*

	Mobile money adoption			
E. Savings and access/usage of alternative financial services				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	-1.616*	-1.731**		
	(0.838)	(0.839)		
Population density (ln)	-0.702	-0.742	-0.759	-0.680
	(0.562)	(0.564)	(0.515)	(0.496)
Inflation	-0.009	-0.002	0.063	0.022
	(0.115)	(0.105)	(0.165)	(0.127)
Saved	0.123			
	(0.255)			
Saving club		0.024		
		(0.226)		
Bank account			-0.033*	
			(0.017)	
Account at a formal financial institution				-0.007
				(0.038)
Constant	13.08	17.27**	5.513***	4.416**
	(10.86)	(6.710)	(1.993)	(2.147)
Observation	69	69	63	70
R-squared	0.062	0.057	0.030	0.011
Fisher	1.812	1.907	2.097	0.807

	Mobile money adoption			
F. Payments services				
	(1)	(2)	(3)	(4)
Population density (ln)	-0.436	-0.732	-1.147**	-0.650
	(0.521)	(0.473)	(0.565)	(0.471)
Inflation	0.029	0.031	0.004	0.025
	(0.120)	(0.137)	(0.110)	(0.129)
Receive agricultural payments	0.248***			
	(0.093)			
Receive government transfers		-0.050		
		(0.067)		
Paid school fees			0.394*	
			(0.201)	
Paid utility bills				-0.110***
				(0.036)
Constant	-1.259	4.517**	-6.756	8.761***
	(2.140)	(1.875)	(5.626)	(2.681)
Observation	70	70	70	70
R-squared	0.205	0.014	0.176	0.085
Fisher	3.340**	1.110	2.254*	4.816***

Note: This table presents OLS estimations of the adoption of mobile money measured through the percentage of mobile money account on a set of country-level variables (including structural and latent demand for financial services). Robust standard errors are in brackets. *** Significance at the 1% level, ** Significance at the 5% level, * Significance at the 10% level.

to mobile money adoption. A common feature of the banking system in developing countries is that many banks invest in government securities, primarily Treasure bill that restrict their involvement into innovative banking practices (Allen et al., 2011; Sacerdoti, 2005). Thus, our findings suggest that countries with a lower level of banks owned by the government may meet rapid adoption of mobile money. Furthermore, we find a positive relation between mobile money adoption and the overhead costs of bank to total assets. In fact, higher operating costs may lead banks to charge higher fees to end users of banking services, consistently with previous research (Aron, 2015; Kendall, 2010), individuals may chose using mobile money that is cheaper and allows access to basic banking services.

Regarding variables related to remittances, our results are consistent with the existent literature (Gupta et al., 2009; Heyer and Mas, 2009) who document that weak alternative remittances and the higher fees charged may motivate the adoption of mobile money. Thus, as mobile money is available, mobiquitous (mobility + ubiquity) and permits domestic money at a lower cost, these features obviously facilitate its adoption over other money transfer systems. However, we find that cross-border transfers (that we proxy using remittances inflow to GDP) has an opposite effect. Although cross-border remittances can improve access to formal financial services, they are mainly channeled through formal financial institutions and the high costs charged lead individuals (migrant workers) to rely on other means of transactions which may not be recorded (Gupta et al., 2009). In these cases, the development of a cheaper cross-border remittances via mobile money might motivate individuals to adopt/use mobile money services. Therefore, to test this assumption, we include in our regression (Table 3.B, column 4) a dummy variable that captures countries where mobile money providers built partnership with other mobile money providers located in other countries to set up cross-border remittances. We find a positive and significant coefficient meaning that the availability of cross-border transfers through mobile phone increases the adoption of mobile money. Our result supports the study of Aron (2015) that documents that mobile money has the potential to dominate cross-border remittances.

Concerning our variables related to savings and access to/usage of alternative financial services we find that only the share of people having a bank account (Table 3.E, column 3) has a significant effect on mobile money adoption. Its negative coefficient supports the fact that lower bank account penetration increases the adoption of mobile money. This result is in line with

previous studies arguing that the lack of savings accounts is prevalent in developing countries and that mobile money appears as an alternative saving account (Aron, 2015; Collins et al., 2009; Dupas and Robinson, 2013).

Turning to payment services, we use four different measures that are the receipt of agricultural payments, government payments, payments of school fees and utility bill payments. Among these four variables, three have significant effect on mobile money adoption (Table 3.F, columns 1, 3 and 4). Interestingly, the variable *receive agricultural payments* can also be considered as a proxy of rural population whose main activities rely on farming. We find that this proxy has a positive impact on the mobile money use. Individuals who receive payments for the sale of agricultural products may adopt mobile money services that are more secure than owning cash for their transactions via a simple transfer. Making regular payments of school fees has also a positive effect on mobile money adoption in line with previous who show that mobile money is convenient for face-to-face transactions and school fee payments (Heyer and Mas, 2009; Mas, 2012). By contrast, we find a negative relationship between utility bill payments and mobile money adoption. Even if mobile money appears practical for bills payments (Heyer and Mas, 2009), only the wealthier households are likely to pay utility bills in developing countries, precisely those who use traditional banking products, as checks or bank transfers, and, hence, may statistically reduce the use of mobile money. Nevertheless, the fees charged for bill payments through mobile money may also discourage to use it and favor cash for such payments.

Sub-Saharan Africa is the region where mobile money has achieved the broadest success and shows promise to promote financial access than elsewhere as shown in our data and in previous studies (Allen et al. 2014; Aron 2015; Demirgüç-Kunt and Klapper 2012; Kendall et al., 2013). Hence, to benchmark whether Sub-Saharan Africa, on average, exhibits a background favorable to mobile money adoption we include in our equation (1) a dummy variable[17] for Sub-Saharan African countries (Table 4). The positive and significant coefficient associated with the dummy for Sub-Saharan Africa confirms the highest penetration in this region other things being equal.

[17] We also include in the regression other explanatory variables chosen according to the correlation between the variables. The correlation matrix is presented in Table A.8 in the Appendix.

Table 4. Mobile money adoption in developing countries: The case of Sub-Saharan African countries

	Full sample		
	Mobile money adoption		
	(1)	(2)	(3)
GDP per capita growth	0.297	-0.061	0.068
	(0.296)	(0.542)	(0.395)
Population (ln)	0.803	0.573	0.225
	(0.667)	(0.682)	(0.578)
Inflation	0.025	-0.043	-0.003
	(0.123)	(0.158)	(0.139)
Sub-Saharan African countries	9.003***	9.515***	9.477***
	(2.613)	(2.545)	(2.337)
Paid school fees		0.362*	0.340*
		(0.200)	(0.177)
Saved		0.129	
		(0.235)	
Capital regulatory index		0.734	
		(0.467)	
Boone indicator			-27.289**
			(12.930)
ATM per 1,000 km2		0.001*	
		(0.000)	
Bank branches per 1,000 km2			0.005
			(0.006)
Constant	-1.267	-17.422	-8.839
	(2.723)	(11.647)	(5.479)
Observation	70	63	68
R-squared	0.217	0.366	0.400
Fisher	4.82***	2.41**	2.75**

Note: This table presents OLS estimations of the adoption of mobile money measured through the percentage of mobile money account on a set of country-level variables (including structural and latent demand for financial services). Robust standard errors are in brackets. *** Significance at the 1% level, ** Significance at the 5% level, * Significance at the 10% level.

We now explore the similarities and differences between Sub-Saharan Africa and other developing countries in the explanatory power of each variable of the global set of determinants of mobile money adoption. Thus, we divide our sample in two groups by distinguishing Sub-Saharan African countries from all other developing countries and we estimate our equation (1) using the same dependent and explanatory variables on these two sub-samples. Tables 5 and 6 compare the results for Sub-Saharan African countries (upper part) and other developing countries (lower part).

Across Table 5, the results show that GDP per capita is positively associated in Sub-Saharan African countries with mobile money adoption in the econometric specification of Table 5.A (column 1), in line with the study of Allen et al. (2014) highlighting that per capita income may be positively linked to financial development and financial inclusion. Thus, mobile money can be seen as a full-fledged financial services in Sub-Saharan Africa due to lower supply of

traditional financial services. Nevertheless, this result disappears in all others specifications. By contrast, for other developing countries, we obtain a unique negative and significant coefficient related to GDP per capita in Table 6.B (column 2) that may reveal the existence of a threshold effect beyond which the level of development could limit the relevance of mobile money as a tool for financial inclusion. Regarding other structural factors, we find that primary education level and mobile phone subscription (Table 5.A, columns 1 and 2) foster mobile money adoption in Sub-Saharan African countries but not in other developing countries. These results support the existent literature arguing that a minimum literacy level (for SMS services) and sufficient mobile phone subscriptions are needed to drive mobile money adoption (Heyer and Mas, 2009).

Furthermore, the number of mobile money agents per 1,000 km2 and the number of bank institutions (Table 5.B, columns 3 and 4) also influence positively mobile money adoption in Sub-Saharan Africa. In many Sub-Saharan African countries, mobile network operators who want to launch mobile money products need to build partnership with bank(s) that must receive an agreement from the Central Bank. Therefore, the positive coefficient associated with the number of bank institutions supports the fact that banks play a critical role in the adoption of mobile money product. Considering the results from other developing countries, the number of ATM per 1,000 km2 and bank branches per 1,000 km2[18] (Table 5.E, columns 1 and 2) spur mobile money. Indeed, mobile money services benefit from ATM and bank branches for their cash in/cash out functions (Mas, 2012). Moreover, we find in Table 5.C (columns 1 and 2) that inefficiency and competitiveness of the banking sector (Boone indicator) affect positively and significantly mobile money adoption in Sub-Saharan African countries while they have no effect regarding the sample of other developing countries. Indeed, from Table 5.C (column 3) we find that higher cost of traditional banking infrastructure that may stem from less efficiency, restrictions and lower competition lead customers to prefer mobile money services (Aron, 2015; Kendall et al., 2011).

In addition, the results show that domestic remittances (send and receive) contribute to mobile money adoption in Sub-Saharan Africa (Table 6.A, column 1) and in other developing countries (Table 6.D, column 1) with a strong effect for the former. These findings may support

[18] In fact, some mobile money schemes allow mobile money customers to use ATM for withdrawals or cash out functions (for instance M-Pesa in Kenya) in addition to mobile money retail agents, while other models only rely on bank branches for cash in and cash out functions (Airtel money in Burkina Faso). Therefore, we include both measures in our regressions.

Table 5. Determinants of mobile money adoption in Sub-Saharan Africa vs. Other developing countries.

	Sub-Saharan African countries	
	Mobile money adoption	
A. Structural factors		
	(1)	(2)
GDP per capita (ln)	5.782*	
	(3.056)	
Population density (ln)	0.370	0.559
	(1.044)	(1.462)
Inflation	-0.105	0.449
	(0.401)	(0.428)
Primary education (ln)	7.097**	
	(3.249)	
Mobile phone subscription (ln)		6.850**
		(3.317)
Constant	-130.8*	-19.12
	(63.55)	(12.23)
Observation	30	31
R-squared	0.257	0.059
Fisher	1.458	1.724

	Sub-Saharan African countries			
	Mobile money adoption			
B. Outreach of financial services				
	(1)	(2)	(3)	(4)
GDP per capita growth	2.548	2.582	1.922	2.928
	(2.055)	(2.051)	(2.310)	(1.803)
Population (ln)	2.610	2.586	1.509	
	(2.371)	(2.381)	(1.871)	
Inflation	-0.046	-0.044	-0.145	-0.158
	(0.438)	(0.438)	(0.470)	(0.332)
ATM per 1,000 km2	-0.021			
	(0.022)			
Bank branches per 1,000 km2		-0.043		
		(0.045)		
MM agent per 1,000 km2			0.067*	
			(0.038)	
Number of bank institution (ln)				14.83**
				(6.787)
Constant	2.618	2.675	3.718	-30.57*
	(6.261)	(6.267)	(4.704)	(17.60)
Observation	29	29	26	29
R-squared	0.085	0.085	0.309	0.321
Fisher	4.06**	3.73**	1.13	2.74*

	Sub-Saharan African countries				
	Mobile money adoption				
C. Banking sector intermediation activities					
	(1)	(2)	(3)	(4)	(5)
GDP per capita (ln)	-1.383	0.043	2.081	0.152	
	(2.255)	(1.515)	(1.591)	(2.148)	
Population density (ln)	-2.406	-0.546		0.305	-0.411
	(1.825)	(1.091)		(1.647)	(1.151)
Inflation	0.164	0.011	-0.046		0.096
	(0.326)	(0.417)	(0.403)		(0.427)
Bank concentration	-0.445**				
	(0.186)				
Boone indicator		-53.94*			
		(27.84)			
Capital regulatory index			1.855**		
			(0.671)		
Government owned bank				-0.139	
				(0.109)	
Bank cost to total asset					0.899
					(0.893)
Constant	44.16*	7.205	-14.88	12.45	4.186
	(22.91)	(10.24)	(12.95)	(15.81)	(7.082)
Observation	29	30	29	29	31
R-squared	0.308	0.144	0.106	0.032	0.020
Fisher	1.999	1.171	2.616*	1.060	0.435

	Other developing countries	
	Mobile money adoption	
D. Structural factors		
	(1)	(2)
GDP per capita (ln)	-0.899	
	(0.757)	
Population density (ln)	-0.429	0.178
	(0.313)	(0.292)
Inflation	0.018	0.028
	(0.043)	(0.039)
Primary education (ln)	0.013	
	(0.191)	
Mobile phone subscription (ln)		0.730
		(0.738)
Constant	8.423	-0.802
	(7.543)	(3.111)
Observation	35	39
R-squared	0.109	0.021
Fisher	0.785	0.698

	Other developing countries			
	Mobile money adoption			
E. Outreach of financial services				
	(1)	(2)	(3)	(4)
GDP per capita growth	0.414	0.393	-0.701	0.313
	(0.518)	(0.524)	(0.686)	(0.536)
Population (ln)	-0.101	-0.136	0.312	
	(0.231)	(0.226)	(0.404)	
Inflation	0.012	0.012	-0.283	-0.007
	(0.047)	(0.046)	(0.319)	(0.053)
ATM per 1,000 km2	0.001***			
	(0.000)			
Bank branches per 1,000 km2		0.006***		
		(0.001)		
MM agent per 1,000 km2			0.001	
			(0.001)	
Number of bank institution (ln)				0.049
				(0.433)
Constant	2.079**	2.213**	3.638	1.999
	(0.862)	(0.849)	(3.152)	(1.274)
Observation	34	35	16	35
R-squared	0.081	0.075	0.164	0.012
Fisher	24.76***	12.15***	2.15	0.16

	Other developing countries				
	Mobile money adoption				
F. Banking sector intermediation activities					
	(1)	(2)	(3)	(4)	(5)
GDP per capita (ln)	-0.356	-0.177	-0.427	0.154	
	(0.565)	(0.571)	(0.734)	(0.838)	
Population density (ln)	0.133	0.127		0.336	0.126
	(0.299)	(0.356)		(0.218)	(0.303)
Inflation	0.004	-0.016	-0.009		-0.003
	(0.059)	(0.055)	(0.053)		(0.045)
Bank concentration	0.027				
	(0.017)				
Boone indicator		-3.919			
		(3.486)			
Capital regulatory index			-0.477		
			(0.343)		
Government owned bank				-0.026	
				(0.023)	
Bank cost to total asset					-0.066
					(0.158)
Constant	3.958	3.947	9.342	2.613	2.810***
	(4.970)	(4.599)	(8.228)	(7.318)	(1.013)
Observation	37	37	34	34	38
R-squared	0.059	0.039	0.132	0.062	0.010
Fisher	0.913	0.367	0.747	2.594*	0.169

Note: This table presents OLS estimations of the adoption of mobile money measured through the percentage of mobile money account on a set of country-level variables (including structural and latent demand for financial services). Robust standard errors are in brackets. *** Significance at the 1% level, ** Significance at the 5% level, * Significance at the 10% level.

Table 6. Determinants of mobile money adoption in Sub-Saharan Africa vs. Other developing countries. (*Continued*).

	Sub-Saharan African countries			
	Mobile money adoption			
A. Remittances				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	-0.594	1.389	2.113	
	(1.706)	(2.731)	(1.927)	
Population density (ln)	1.320	0.404	-0.655	-0.904
	(1.240)	(2.256)	(1.683)	(1.186)
Inflation	0.005	-0.357	0.243	0.561
	(0.285)	(0.575)	(0.491)	(0.559)
Domestic remittances	0.411***			
	(0.116)			
Average cost of remittances		0.735		
		(0.735)		
Remittances inflow to GDP			0.0147	
			(0.610)	
Countries involve in cross-border remittances				9.290
				(6.263)
Constant	-6.264	1.438	-6.834	0.837
	(9.955)	(18.39)	(13.02)	(7.418)
Observation	31	18	26	31
R-squared	0.538	0.054	0.032	0.109
Fisher	4.010**	0.915	0.721	0.749

	Sub-Saharan African countries			
	Mobile money adoption			
B. Savings and access/usage of alternative financial services				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	1.673	1.569		
	(2.041)	(2.113)		
Population density (ln)	0.393	0.252	1.147	-0.443
	(1.517)	(1.560)	(1.478)	(1.446)
Inflation	0.197	0.183	-0.0718	0.180
	(0.436)	(0.424)	(0.390)	(0.422)
Saved	0.181			
	(0.442)			
Saving club		0.277		
		(0.802)		
Bank account			0.184	
			(0.113)	
Account at a formal financial institution				0.206
				(0.169)
Constant	-6.721	-4.871	11.71*	3.553
	(22.92)	(22.01)	(6.221)	(6.015)
Observation	31	31	30	31
R-squared	0.019	0.018	0.071	0.091
Fisher	0.211	0.194	0.899	0.741

	Sub-Saharan African countries			
	Mobile money adoption			
C. Payment services				
	(1)	(2)	(3)	(4)
Population density (ln)	-0.193	0.333	-0.0248	-0.0453
	(1.046)	(1.434)	(1.448)	(1.387)
Inflation	-0.005	0.165	0.016	0.156
	(0.394)	(0.433)	(0.321)	(0.439)
Receive agricultural payments	0.267			
	(0.182)			
Receive government transfers		0.353		
		(0.302)		
Paid school fees			0.579**	
			(0.269)	
Paid utility bills				0.106
				(0.162)
Constant	0.728	8.412	-4.057	7.397
	(6.659)	(5.938)	(9.248)	(5.907)
Observation	31	31	31	31
R-squared	0.094	0.037	0.270	0.018
Fisher	0.782	0.538	1.771	0.215

	Other developing countries			
	Mobile money adoption			
D. Remittances				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	-0.258	-0.856**	-1.074	
	(0.584)	(0.364)	(0.881)	
Population density (ln)	0.154	0.0267	-0.180	0.148
	(0.307)	(0.215)	(0.252)	(0.295)
Inflation	0.024	-0.257*	0.012	0.023
	(0.040)	(0.130)	(0.047)	(0.041)
Domestic remittances	0.040*			
	(0.022)			
Average cost of remittances		-0.030		
		(0.089)		
Remittances inflow to GDP			-0.091	
			(0.098)	
Countries involve in cross-border remittances				(Omitted)
Constant	3.367	10.55***	11.22	2.532***
	(4.604)	(3.031)	(8.117)	(0.832)
Observation	38	29	37	39
R-squared	0.087	0.180	0.140	0.008
Fisher	1.208	2.620*	0.642	0.230

	Other developing countries			
	Mobile money adoption			
E. Savings and access/usage of alternative financial services				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	-0.267	-0.259		
	(0.606)	(0.619)		
Population density (ln)	0.102	0.126	0.245	0.151
	(0.358)	(0.358)	(0.316)	(0.303)
Inflation	0.015	0.022	-0.017	0.025
	(0.046)	(0.048)	(0.048)	(0.035)
Saved	0.042			
	(0.084)			
Saving club		-0.014		
		(0.079)		
Bank account			0.006	
			(0.011)	
Account at a formal financial institution				-0.002
				(0.024)
Constant	3.498	4.921	2.759***	2.621*
	(4.305)	(4.444)	(0.933)	(1.395)
Observation	38	38	33	39
R-squared	0.026	0.019	0.023	0.009
Fisher	0.325	0.301	0.375	0.227

	Other developing countries			
	Mobile money adoption			
F. Payments services				
	(1)	(2)	(3)	(4)
Population density (ln)	0.118	0.201	0.0515	0.162
	(0.331)	(0.248)	(0.346)	(0.321)
Inflation	0.031	0.008	0.020	0.024
	(0.037)	(0.038)	(0.039)	(0.041)
Receive agricultural payments	0.041			
	(0.066)			
Receive government transfers		0.044		
		(0.029)		
Paid school fees			0.042	
			(0.042)	
Paid utility bills				0.003
				(0.018)
Constant	1.784	2.174**	1.303	2.408**
	(1.305)	(0.845)	(1.471)	(1.065)
Observation	39	39	39	39
R-squared	0.052	0.051	0.028	0.009
Fisher	0.602	0.812	0.625	0.154

Note: This table presents OLS estimations of the adoption of mobile money measured through the percentage of mobile money account on a set of country-level variables (including structural and latent demand for financial services). Robust standard errors are in brackets. *** Significance at the 1% level, ** Significance at the 5% level, * Significance at the 10% level.

the view of Demirguc-Kunt et al. (2015) who describe that in developing countries 14% of unbanked adults send or receive domestic remittances in cash compared to 22% in Sub-Saharan Africa which represents an opportunity, for instance, for the uptake of mobile money. In Table 6.C (column 3) we find that the share of the population making payments of school fees has a positive and significant impact on mobile money adoption only in Sub-Saharan African countries. In fact, the choice of making school payment through mobile money resides with the schools or institutions (Demirguc-kunt et al., 2015), suggesting that the availability of this possibility in Sub-Saharan Africa may promote mobile money adoption by providing convenient and affordable way for payments.

Overall, our findings highlight disparities and similarities in the determinants of mobile money adoption between Sub-Saharan Africa and other developing countries. We show that mobile money tends to meet a broader and quicker uptake in Sub-Saharan Africa compared to other developing countries.

1.6. Conclusion

In developing countries, the expansion of innovative mobile financial technology is revolutionizing the landscape of financial system. Despite the importance attributed to formal financial services, lack of access to banking services remains common in developing countries. The adoption of mobile money provides an opportunity to improve access to financial services by leveraging mobile phones which are increasingly prevalent in developing countries as an alternative channel to provide financial services. Thus, the expansion of the adoption of mobile money is expected to sharpen the financial sector and promote financial development.

In this paper, we explore the state of mobile money adoption and its determinants in developing countries with a particular focus on Sub-Saharan Africa. We use data from 72 developing countries of which 32 are Sub-Saharan African countries from 2011 to 2014 and consider structural factors and latent demand for financial services as determinants of mobile money. Our results show that in developing countries GDP per capita, population density, competition in the banking market, government owned bank, bank account, and payment of utility bills affect negatively mobile money adoption. By contrast, we find that bank cost to total

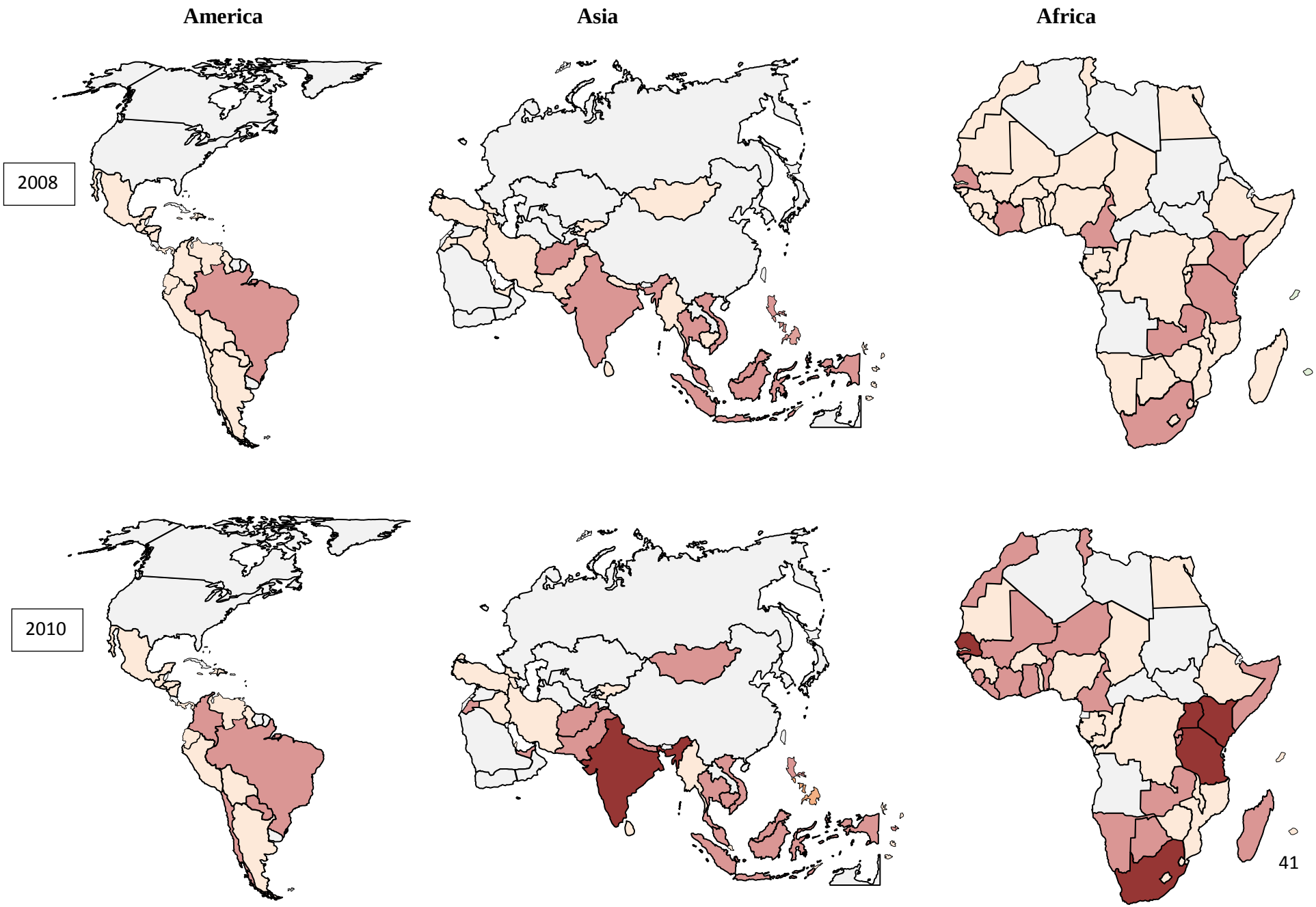
assets, domestic remittances, average cost of remittances, cross-border remittances via mobile money, and agricultural payments have a positive relationship with mobile money adoption. We benchmark Sub-Saharan Africa to determine whether the region presents an advantage over other developing countries in the adoption of mobile money. In line with Allen et al. (2014), we find that Sub-Saharan Africa exhibits a gap compared to other developing countries in the adoption of mobile money. In further investigations, we assess the similarities and differences that may exist in the adoption of mobile money between Sub-Saharan Africa and other developing countries. We find that while the similarity in mobile money adoption relies on domestic remittances, the differences come from structural factors, the outreach of financial services, the banking sector intermediation activities and the payment services.

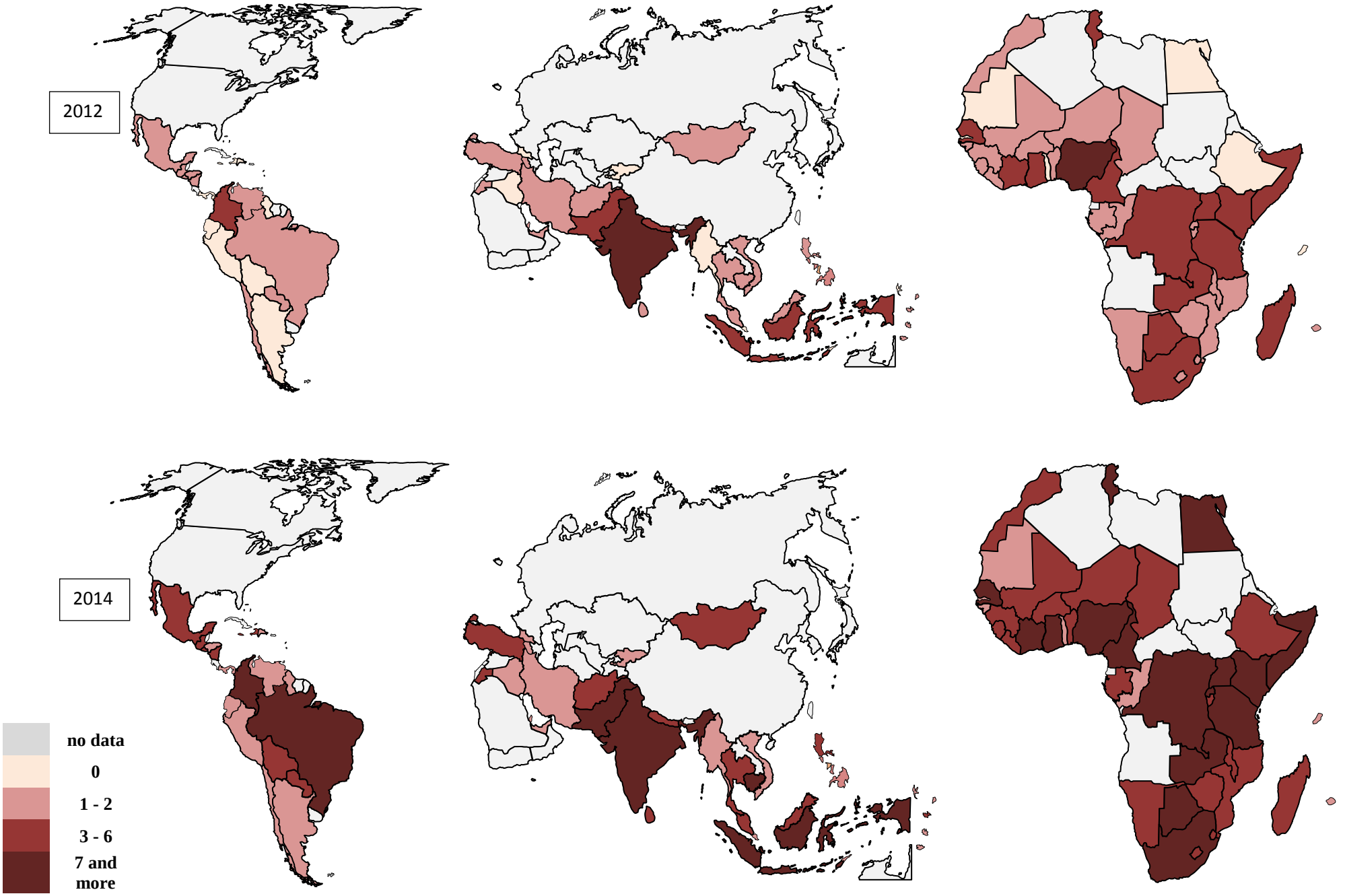
Mobile money has the potential to improve financial access given the high penetration of mobile phone and the latent demand for financial services across developing countries. In many developing countries some improvements have been done in the regulation context to allow the entry of non-banking institutions in the provision of payment services through innovative mobile technology. This in turn increases competition in the banking sector and hence has the potential to improve access to a broader range of financial services. However, some improvements are still needed to allow non-bank institutions, especially mobile network operators, to launch their own mobile money products. In fact, in several developing countries mobile network operators need to build partnerships with banks -that have agreement from Central Banks- in order to launch mobile money services. Moreover, mobile network operators remain the active actors in the supply of mobile money products through their presence across countries and scalable retail agents. Hence, enabling mobile network operators to launch mobile money products may galvanize the supply of financial services and foster mobile money system development.

It is interesting to note that the deployment of mobile money is expanding outside developing countries and starts to reach developed economies. For instance, in France Orange Money was launched by the mobile network operator Orange which already exists on African market. The service allows cross-border remittances between France and Sub-Saharan African countries where Orange is established. In this regard, it could be interesting to investigate the role that mobile money may play in cross-border remittances between developed and developing countries and its potential consequences.

Appendix

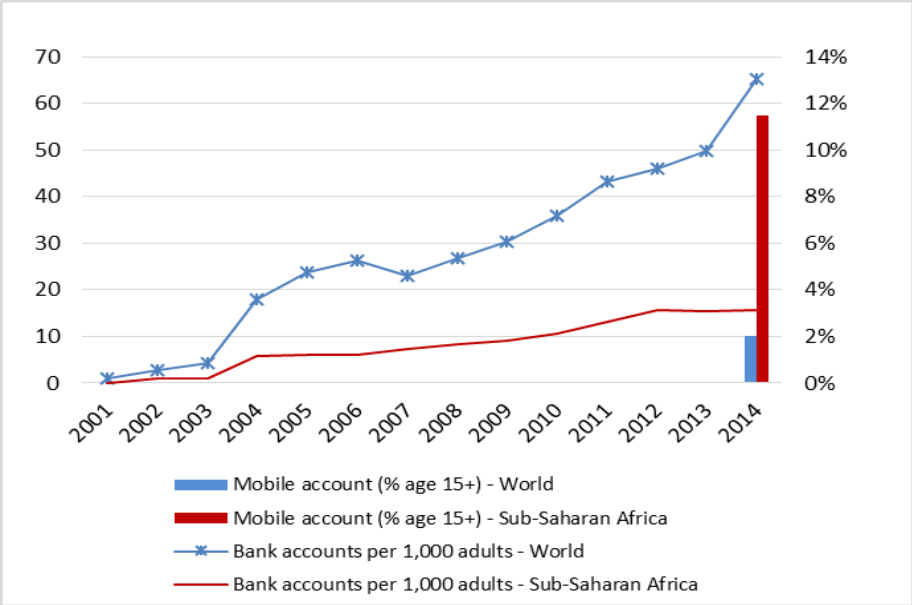
A.1. Mobile money products adoption across the world.





Source: Author's analysis using Mobile money deployment tracker, GSMA. 2016.

A.2. Bank account and mobile money account (as of 2014).



Source: Author's analysis using Global Findex database (World Bank, 2014) and data from Global Financial Development (World Bank)

Table A.1. The most disseminated mobile money products in Sub-Saharan African countries.

Mobile Money product	**Airtel Money**	**Orange Money**	**MTN Mobile Money**	**MobiCash**	**Tigo Money/Cash**	**M-Pesa**
Organization	Mobile network operator Airtel (Bharti Airtel)	Mobile network operator Orange	Mobile network operator MTN	A company that provide cashless mobile financial platform	Mobile network operator Tigo (Millicom)	Mobile network operator Vodafone
Country	Burkina Faso, Chad, Congo Dem. Rep., Gabon, Ghana, Kenya, Madagascar, Malawi, Niger, Rwanda, Seychelles, Sierra Leone, Tanzania, Uganda, Zambia.	Botswana, Cameroon, Congo Dem. Rep., Côte d'Ivoire, Guinea, Kenya, Madagascar, Mali, Mauritius, Niger, Senegal.	Cameroon, Congo Rep., Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau, Rwanda, Swaziland, Uganda, Zambia.	Botswana, Burkina Faso, Burundi, Gabon, Mali, Mauritania, Rwanda.	Chad, Congo Dem. Rep., Ghana, Rwanda, Senegal, Tanzania.	Congo Dem. Rep., Kenya, Lesotho, Mozambique, South Africa, Tanzania,

Note: Authors' analysis using data from Mobile money deployment tracker, GSMA

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Table A.2. The list of countries.

List of countries			
Afghanistan	Dominican Republic	**Malawi**	**Senegal**
Argentina	Egypt, Arab Rep.	Malaysia	**Sierra Leone**
Armenia	El Salvador	**Mali**	Singapore
Bangladesh	**Ethiopia**	**Mauritania**	**Somalia**
Benin	**Gabon**	**Mauritius**	**South Africa**
Bolivia	**Ghana**	Mexico	Sri Lanka
Botswana	Guatemala	Mongolia	**Tanzania**
Brazil	**Guinea**	Myanmar	Thailand
Burkina Faso	Haiti	**Namibia**	**Togo**
Burundi	Honduras	Nepal	Tunisia
Cambodia	India	Nicaragua	Turkey
Cameroon	Indonesia	**Niger**	**Uganda**
Chad	Iran, Islamic Rep.	**Nigeria**	United Arab Emirates
Chile	Jamaica	Pakistan	Uruguay
Colombia	Jordan	Panama	Venezuela, RB
Congo, Dem. Rep.	**Kenya**	Philippines	Vietnam
Congo, Rep.	Lebanon	Romania	**Zambia**
Cote d'Ivoire	**Madagascar**	**Rwanda**	**Zimbabwe**

Note: Sub-Saharan African countries are in bold. The choice of our sample of countries is based on United Nations report on country classification (World Economic Situation Prospects, 2014). However, few countries of our sample are high income countries such as Singapore, United Arab Emirates, Chile and Uruguay.

Table A.3. Determinants of mobile banking adoption in developing countries.

	Full sample	
	Mobile banking adoption	
A. Structural factors		
	(1)	(2)
GDP per capita (ln)	0.891**	
	(0.420)	
Population density (ln)	-1.025**	-0.397
	(0.462)	(0.622)
Inflation	0.124	0.158**
	(0.074)	(0.069)
Primary education (ln)	0.058	
	(0.378)	
Mobile phone subscription (ln)		2.859**
		(1.154)
Constant	-7.197	-10.65**
	(7.187)	(5.147)
Observation	65	69
R-squared	0.186	0.113
Fisher	2.428*	3.192**

	Full sample			
	Mobile banking adoption			
B. Outreach of financial services				
	(1)	(2)	(3)	(4)
GDP per capita growth	0.519	0.479	-0.418	0.377
	(0.929)	(0.935)	(1.342)	(0.956)
Population (ln)	-0.510	-0.536	-0.617	
	(0.484)	(0.489)	(0.701)	
Inflation	0.138*	0.138*		0.084
	(0.082)	(0.082)		(0.080)
ATM per 1,000 km2	0.003***			
	(0.000)			
Bank branches per 1,000 km2		0.016***		
		(0.004)		
MM agent per 1,000 km2			0.003	
			(0.004)	
Number of bank institution (ln)				0.324
				(1.074)
Constant	4.244***	4.267***	6.830***	2.480
	(1.485)	(1.497)	(2.341)	(2.890)
Observation	62	63	41	63
R-squared	0.130	0.110	0.026	0.015
Fisher	74.22***	6.85***	0.53	0.59

	Full sample				
	Mobile banking adoption				
C. Banking sector intermediation activities					
	(1)	(2)	(3)	(4)	(5)
GDP per capita (ln)	1.312**	1.251**	1.194**	1.407***	
	(0.554)	(0.525)	(0.478)	(0.483)	
Population density (ln)	-0.482	-0.533		-0.138	-0.525
	(0.579)	(0.595)		(0.574)	(0.675)
Inflation	0.087	0.0733	0.0425		0.079
	(0.067)	(0.072)	(0.048)		(0.067)
Bank concentration	0.032				
	(0.037)				
Boone indicator		-5.330			
		(4.937)			
Capital regulatory index			0.187		
			(0.207)		
Government owned bank				-0.049**	
				(0.022)	
Bank cost to total asset					-0.142
					(0.241)
Constant	-9.748	-7.614*	-6.719*	-6.241	2.837
	(5.865)	(3.901)	(3.944)	(3.943)	(2.155)
Observation	66	67	63	63	68
R-squared	0.154	0.150	0.107	0.180	0.035
Fisher	2.282*	2.637**	3.411**	4.777***	0.525

	Mobile banking adoption			
D. Remittances				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	1.904***	1.065	0.730*	
	(0.396)	(0.646)	(0.411)	
Population density (ln)	0.120	-0.625	-1.100*	-0.487
	(0.447)	(0.560)	(0.595)	(0.693)
Inflation	0.139***	0.0249	0.0836	0.112
	(0.043)	(0.164)	(0.066)	(0.071)
Domestic remittances	0.134***			
	(0.023)			
Average cost of remittances		0.606***		
		(0.178)		
Remittances inflow to GDP			-0.102	
			(0.072)	
Countries involve in cross-border remittances				0.941
				(1.780)
Constant	-17.39***	-11.02*	-4.380	1.998
	(3.392)	(6.138)	(3.953)	(2.001)
Observation	69	47	63	69
R-squared	0.565	0.344	0.223	0.046
Fisher	12.92***	4.143***	4.116***	0.899

	Mobile banking adoption			
E. Savings and access/usage of alternative financial services				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	1.300**	1.274**		
	(0.521)	(0.501)		
Population density (ln)	-0.468	-0.458	-0.280	-0.783*
	(0.586)	(0.565)	(0.577)	(0.443)
Inflation	0.107	0.119*	-0.006	0.0383
	(0.072)	(0.062)	(0.061)	(0.050)
Saved	0.014			
	(0.089)			
Saving club		-0.084		
		(0.099)		
Bank account			0.043***	
			(0.010)	
Account at a formal financial institution				0.116***
				(0.026)
Constant	-8.214*	-6.303*	1.747	-1.923
	(4.727)	(3.775)	(1.584)	(1.220)
Observation	69	69	62	69
R-squared	0.149	0.155	0.189	0.347
Fisher	2.604**	2.934**	17.06***	12.03***

	Mobile banking adoption			
F. Payment services				
	(1)	(2)	(3)	(4)
Population density (ln)	-0.518	-0.354	-0.682	-0.517
	(0.673)	(0.534)	(0.712)	(0.666)
Inflation	0.100	0.048	0.095*	0.099*
	(0.063)	(0.074)	(0.049)	(0.059)
Receive agricultural payments	-0.010			
	(0.038)			
Receive government transfers		0.211***		
		(0.075)		
Paid school fees			0.152**	
			(0.062)	
Paid utility bills				0.022
				(0.018)
Constant	2.416	0.715	-2.038	1.288
	(2.241)	(1.629)	(3.011)	(2.220)
Observation	69	69	69	69
R-squared	0.042	0.256	0.145	0.053
Fisher	1.084	3.141**	2.695*	1.298

Note: This table presents OLS estimations of the adoption of mobile banking measured through the percentage of formal account owners that used mobile phone to make a transaction from their account on a set of country-level variables (including structural and latent demand for financial services). Robust standard errors are in brackets. *** Significance at the 1% level, ** Significance at the 5% level, * Significance at the 10% level.

Table A.4. The gap between Sub-Saharan African countries and other developing countries.

	Full sample		
	Mobile banking adoption		
C. Region specificity			
	(1)	(2)	(3)
GDP per capita growth	0.259	-0.065	0.229
	(0.286)	(0.265)	(0.351)
Population (ln)	-0.441	-0.094	-0.554
	(0.465)	(0.420)	(0.471)
Inflation	0.137*	0.060	0.108
	(0.080)	(0.079)	(0.072)
SSA countries	1.284	2.789**	2.124*
	(1.276)	(1.171)	(1.216)
Paid school fees		0.144**	0.127**
		(0.063)	(0.063)
Saved		-0.028	
		(0.077)	
Capital regulatory index		0.215	
		(0.262)	
Boone indicator			-9.682*
			(5.172)
ATM per 1,000 km2		0.003***	
		(0.000)	
Bank branches per 1,000 km2			0.019***
			(0.004)
Constant	3.246**	-1.614	-0.640
	(1.608)	(3.488)	(1.960)
Observations	69	63	67
R-squared	0.074	0.311	0.268
Fisher	1.23	77.64***	4.93***

Note: This table presents OLS estimations of the adoption of mobile banking measured through the percentage of formal account owners that used mobile phone to make a transaction from their account on a set of country-level variables (including structural and latent demand for financial services). Robust standard errors are in brackets. *** Significance at the 1% level, ** Significance at the 5% level, * Significance at the 10% level.

Table A.5. Determinants of mobile banking adoption in Sub-Saharan Africa vs. Other developing countries.

	Sub-Saharan African countries	
	Mobile banking adoption	
A. Structural factors		
	(1)	(2)
GDP per capita (ln)	4.606***	
	(0.822)	
Population density (ln)	-0.136	-0.204
	(0.801)	(0.817)
Inflation	0.159	0.418**
	(0.166)	(0.181)
Primary education (ln)	2.331**	
	(0.962)	
Mobile phone subscription (ln)		6.562***
		(1.875)
Constant	-62.61***	-25.92***
	(15.78)	(8.602)
Observation	30	31
R-squared	0.454	0.299
Fisher	8.808***	4.231**

	Sub-Saharan African countries			
	Mobile banking adoption			
B. Outreach of financial services				
	(1)	(2)	(3)	(4)
GDP per capita growth	-0.181	-0.159	-0.725	-0.009
	(1.775)	(1.781)	(2.268)	(1.527)
Population (ln)	-0.298	-0.362	-0.803	
	(1.415)	(1.411)	(1.342)	
Inflation	0.153	0.157	0.187	0.065
	(0.221)	(0.222)	(0.279)	(0.164)
ATM per 1,000 km2	-0.009			
	(0.020)			
Bank branches per 1,000 km2		-0.027		
		(0.036)		
MM agent per 1,000 km2			0.018**	
			(0.008)	
Number of bank institution (ln)				2.465
				(3.603)
Constant	5.432	5.617	6.567*	-1.735
	(3.662)	(3.696)	(3.667)	(9.365)
Observation	29	29	26	29
R-squared	0.017	0.021	0.126	0.054
Fisher	0.23	0.56	2.11	0.31

	Sub-Saharan African countries				
	Mobile banking adoption				
C. Banking sector intermediation activities					
	(1)	(2)	(3)	(4)	(5)
GDP per capita (ln)	2.815*	2.865**	3.743***	2.754**	
	(1.382)	(1.161)	(1.103)	(1.334)	
Population density (ln)	-0.717	-0.430		-0.101	-0.755
	(1.056)	(0.824)		(1.013)	(0.883)
Inflation	0.236*	0.197	0.111		0.158
	(0.136)	(0.148)	(0.112)		(0.208)
Bank concentration	-0.068				
	(0.064)				
Boone indicator		-17.43*			
		(9.779)			
Capital regulatory index			0.999***		
			(0.303)		
Government owned bank				-0.017	
				(0.038)	
Bank cost to total asset					-0.270
					(0.527)
Constant	-13.31	-18.10**	-28.11***	-14.25	3.138
	(11.24)	(7.601)	(8.603)	(8.666)	(3.829)
Observation	29	30	29	29	31
R-squared	0.389	0.423	0.460	0.276	0.049
Fisher	3.209**	3.803**	5.112***	3.007**	0.332

	Other developing countries	
	Mobile banking adoption	
D. Structural factors		
	(1)	(2)
GDP per capita (ln)	0.412	
	(0.660)	
Population density (ln)	-1.013	0.136
	(0.788)	(1.106)
Inflation	0.123*	0.170**
	(0.070)	(0.080)
Primary education (ln)	-0.183	
	(0.301)	
Mobile phone subscription (ln)		3.748
		(2.968)
Constant	-0.627	-14.80
	(7.776)	(11.95)
Observation	35	38
R-squared	0.378	0.124
Fisher	2.718**	2.399*

	Other developing countries			
	Mobile banking adoption			
E. Outreach of financial services				
	(1)	(2)	(3)	(4)
GDP per capita growth	1.085	1.025	-0.263	0.563
	(1.121)	(1.134)	(0.861)	(1.179)
Population (ln)	-0.481	-0.555	-0.632	-1.609*
	(0.451)	(0.448)	(0.699)	(0.815)
Inflation	0.169	0.170		0.134
	(0.106)	(0.106)		(0.107)
ATM per 1,000 km2	0.003***			
	(0.000)			
Bank branches per 1,000 km2		0.020***		
		(0.002)		
MM agent per 1,000 km2			-0.000	
			(0.001)	
Number of bank institution (ln)				2.548
				(1.507)
Constant	2.413***	2.547***	5.463	-1.316
	(0.760)	(0.769)	(3.056)	(2.450)
Observation	33	34	15	34
R-squared	0.468	0.437	0.075	0.298
Fisher	333.95***	53.56***	0.78	2.40*

	Other developing countries				
	Mobile banking adoption				
F. Banking sector intermediation activities					
	(1)	(2)	(3)	(4)	(5)
GDP per capita (ln)	1.456**	1.636**	1.951**	2.638***	
	(0.583)	(0.796)	(0.744)	(0.564)	
Population density (ln)	0.110	0.0411		0.943***	-0.167
	(0.747)	(0.970)		(0.300)	(1.033)
Inflation	0.110**	0.067	0.012		0.094*
	(0.050)	(0.043)	(0.043)		(0.049)
Bank concentration	0.076*				
	(0.042)				
Boone indicator		1.200			
		(5.510)			
Capital regulatory index			-0.124		
			(0.186)		
Government owned bank				-0.008	
				(0.018)	
Bank cost to total asset					-0.427
					(0.385)
Constant	-13.70***	-10.41*	-12.46*	-16.64***	3.745
	(4.644)	(5.162)	(6.466)	(4.567)	(2.547)
Observation	37	37	34	34	37
R-squared	0.397	0.249	0.464	0.642	0.063
Fisher	4.343***	2.595*	6.338***	9.630***	1.233

Note: This table presents OLS estimations of the adoption of mobile banking measured through the percentage of formal account owners that used mobile phone to make a transaction from their account on a set of country-level variables (including structural and latent demand for financial services). Robust standard errors are in brackets. *** Significance at the 1% level, ** Significance at the 5% level, * Significance at the 10% level.

Table A.6. Determinants of mobile banking adoption in Sub-Saharan Africa vs. Other developing countries. (*Continued*).

	Sub-Saharan African countries			
	Mobile banking adoption			
A. Remittances				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	2.550***	5.137***	3.643***	
	(0.679)	(1.074)	(1.108)	
Population density (ln)	0.242	0.485	-0.909	-0.887
	(0.637)	(0.922)	(1.053)	(0.885)
Inflation	0.198*	0.0394	0.201	0.161
	(0.115)	(0.165)	(0.177)	(0.210)
Domestic remittances	0.142***			
	(0.031)			
Average cost of remittances		0.426		
		(0.249)		
Remittances inflow to GDP			-0.157	
			(0.244)	
Countries involve in cross-border remittances				0.493
				(2.360)
Constant	-22.16***	-32.91***	-23.26***	1.074
	(6.029)	(6.144)	(6.704)	(3.443)
Observation	31	18	26	31
R-squared	0.641	0.572	0.468	0.0429
Fisher	9.086***	23.18***	6.355***	0.400

	Sub-Saharan African countries			
	Mobile banking adoption			
B. Savings and access/usage of alternative financial services				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	3.229**	3.177**		
	(1.275)	(1.274)		
Population density (ln)	-0.137	-0.162	0.005	-1.190
	(1.007)	(0.943)	(0.648)	(0.829)
Inflation	0.268	0.271*	-0.045	0.161
	(0.158)	(0.148)	(0.108)	(0.155)
Saved	0.0160			
	(0.136)			
Saving club		-0.0153		
		(0.289)		
Bank account			0.242***	
			(0.051)	
Account at a formal financial institution				0.214***
				(0.075)
Constant	-20.30**	-19.27*	0.654	-4.679*
	(9.585)	(10.51)	(2.432)	(2.729)
Observation	31	31	30	31
R-squared	0.324	0.323	0.608	0.523
Fisher	2.581*	2.869**	11.19***	6.609***

	Sub-Saharan African countries			
	Mobile banking adoption			
C. Payment services				
	(1)	(2)	(3)	(4)
Population density (ln)	-0.825	-0.167	-0.813	-0.734
	(0.907)	(0.848)	(0.929)	(0.906)
Inflation	0.179	0.148	0.0857	0.135
	(0.189)	(0.156)	(0.137)	(0.192)
Receive agricultural payments	-0.064			
	(0.085)			
Receive government transfers		0.539***		
		(0.116)		
Paid school fees			0.217**	
			(0.087)	
Paid utility bills				0.180**
				(0.084)
Constant	3.656	-0.174	-3.550	-2.086
	(3.606)	(3.067)	(4.562)	(3.754)
Observation	31	31	31	31
R-squared	0.068	0.437	0.231	0.251
Fisher	0.437	8.189***	2.170	2.030

	Other developing countries			
	Mobile banking adoption			
D. Remittances				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	1.710**	0.800*	0.475	
	(0.695)	(0.441)	(0.565)	
Population density (ln)	0.143	0.168	-0.935	-0.052
	(0.770)	(0.220)	(0.929)	(1.050)
Inflation	0.127***	-0.0786	0.117*	0.128**
	(0.038)	(0.129)	(0.065)	(0.058)
Domestic remittances	0.0933**			
	(0.045)			
Average cost of remittances		0.110		
		(0.137)		
Remittances inflow to GDP			-0.006	
			(0.062)	
Countries involve in cross-border remittances				(Omitted)
Constant	-14.43***	-3.963	-3.757	2.518
	(4.844)	(3.292)	(3.702)	(2.489)
Observation	38	29	37	38
R-squared	0.454	0.287	0.338	0.054
Fisher	6.250***	2.133	2.906**	2.511*

	Other developing countries			
	Mobile banking adoption			
E. Savings and access/usage of alternative financial services				
	(1)	(2)	(3)	(4)
GDP per capita (ln)	1.695**	1.720**		
	(0.740)	(0.728)		
Population density (ln)	0.058	0.091	0.775	-0.165
	(0.944)	(0.923)	(0.642)	(0.620)
Inflation	0.116	0.127*	0.008	0.053*
	(0.076)	(0.067)	(0.047)	(0.030)
Saved	0.010			
	(0.059)			
Saving club		-0.072		
		(0.081)		
Bank account			0.057***	
			(0.012)	
Account at a formal financial institution				0.109***
				(0.033)
Constant	-11.50**	-10.26**	1.559	-1.636
	(4.950)	(4.444)	(1.227)	(1.572)
Observation	38	38	32	38
R-squared	0.278	0.288	0.594	0.525
Fisher	2.837**	3.129**	19.42***	17.34***

	Other developing countries			
	Mobile banking adoption			
F. Payments services				
	(1)	(2)	(3)	(4)
Population density (ln)	-0.010	0.198	-0.126	0.225
	(1.099)	(0.789)	(1.188)	(1.062)
Inflation	0.121**	0.066	0.126**	0.151***
	(0.058)	(0.091)	(0.053)	(0.054)
Receive agricultural payments	-0.0486			
	(0.059)			
Receive government transfers		0.197**		
		(0.076)		
Paid school fees			0.032	
			(0.068)	
Paid utility bills				0.053*
				(0.031)
Constant	3.360	0.847	1.560	-0.002
	(3.377)	(1.865)	(4.228)	(2.298)
Observation	38	38	38	38
R-squared	0.080	0.444	0.060	0.115
Fisher	2.961**	2.305*	2.081	2.911**

Note: This table presents OLS estimations of the adoption of mobile banking measured through the percentage of formal account owners that used mobile phone to make a transaction from their account on a set of country-level variables (including structural and latent demand for financial services). Robust standard errors are in brackets. *** Significance at the 1% level, ** Significance at the 5% level, * Significance at the 10% level.

Table A.7. Definition, expected sign and sources of variables.

Variable	Definition	Expected sign	Sources
Dependent variables			
Mobile money	Percentage of population (age 15+) that reports using mobile money services		GFI
Mobile banking	Used an account from a formal financial institution to make a transaction through a mobile phone (% age 15+)		GFI
Structural factors, Outreach of financial services and banking sector intermediation activities			
GDP per capita (ln)	Represent logarithm of Gross Domestic Product per capita (constant 2010)	Higher GDP per capita income is positively related to access to formal financial services (as is richer economies). However, mobile money can be seen as a full-fledged financial services in low income countries due to lower supply of traditional financial services.	WDI
GDP per capita growth	Represent Gross Domestic Product per capita growth	Idem as GDP per capita	WDI
Population (ln)	Logarithm of population, total/1,000,000	Larger population should spur more mobile money services due to scale and networking effect. We expect a positive sign	WDI
Population density (ln)	Logarithm of population density (people per sq. km of land area)/1,000	A scattered population may be difficult to reach with convenient access to mobile money services such as cash in/cash out functions. Hence, we expect a negative sign	WDI
Inflation	Inflation, consumer prices (annual %)	An increase in consumer price index could have a dampen effect on deposits in the formal financial system for fear of not being able to get them back quickly enough. This should promote the usage of mobile money, therefore we expect a positive sign	WDI
Primary education (ln)	Logarithm of number of enrolment in primary education, both sexes	Education have a positive impact on financial inclusion and financial management (). We expect a positive impact on mobile money	WDI
Mobile phone subscriptions (ln)	Reflect subscriptions to a public mobile telephone service. The indicator applies to all mobile cellular subscriptions that offer voice communications per 100 people (expressed Logarithm).	Mobile phone subscription is essential for the usage of mobile money services and constitutes potential future users of mobile money. Then we expect a positive effect on mobile money	GFD
SSA countries	It is a dummy variable that takes the value 1 for Sub-Saharan African countries, and 0 otherwise.	We want to examine if Sub-Saharan African countries present an environment favorable to mobile money adoption than in other countries. As it has been describe that Sub-Saharan Africa leads the industry of mobile money, we then expect a positive linkage with mobile money adoption	
ATM per 1,000 km2	Automated Teller Machines per 1,000 km2	Indicate the geographical coverage of banking system. They can be used in addition to mobile money agents (for mobile money users) for cash in/cash out functions. They may have a positive impact on mobile money.	IMF
Bank branches per 1,000 km2	Commercial bank branches per 1,000 km2	Indicate the geographical coverage of banking system. They can be used in addition to mobile money agents (for mobile money users), for cash in/cash out functions. They should have a positive impact on mobile money.	IMF
Number of bank institution (ln)	Number of bank institutions	In the scheme of mobile money providers, most include bank institutions that receive agreement to issue electronic money. Leading mobile network to build partnership with banks. Then we expect a positive sign	IMF
MM agent per 1,000 km2	Mobile money agents per 1,000 km2	Indicate the geographical coverage of mobile money system. They provide convenient way to access mobile money services through cash in/cash out functions. They should have a positive impact on mobile money.	IMF
Capital regulatory index	Indicates overall capital stringency + initial capital stringency	An increase in this indicator may leads to a restriction of bank intermediation activities that could increase financial exclusion. Then we expect a positive impact on mobile money adoption but a negative impact on mobile banking.	GBR
Government own bank	Indicates the extent to which the banking system's assets are government owned (percent)	An increase in this indicator may leads to a restriction of bank intermediation activities that could increase financial exclusion. Then we expect a positive impact on mobile money adoption but a negative impact on mobile banking.	GBR
Bank cost to total asset	Bank overhead costs to total assets (%) indicates the efficiency of the banking system. It represents the operating expenses of a bank as a share of the value of all assets held.	High cost of small loan and deposits is viewed as a reason of financial exclusion. It should have a positive effect on adoption of mobile money.	GFD
Bank concentration	Assets of 3 largest banks as a share of total commercial banking assets	An increase in this indicator may leads to high cost of bank intermediation activities that could increase financial exclusion. Then we expect a positive effect on mobile money adoption.	GFD
Boone indicator	Is a measure of degree of competition in the banking market. The more negative the Boone indicator is, the higher the level of competition is in the market.	Mobile money has been launched to improve competition in the banking system. Therefore, more competition in the banking system lead to mobile money adoption	GFD

Note: Global Financial Inclusion (GFI), World Development Indicators (WDI), Global Financial Development (GFD), Global Banking Regulatory (GBR), International Monetary Fund (IMF), International Finance Corporation (IFC).

Table A.7. Definition, expected sign and sources of variables. (*Continued*).

Variable	Definition	Expected sign	Sources
Remittances, Savings and access to/usage of alternative financial services and payment services			
Domestic remittances	Percentage of the population who report personally sending or receiving any money in the past 12 months from a relative or friend living in a different area of their country.	In developing countries where traditional remittance services are delayed and where people mainly rely on informal methods to remit that are no secured, mobile money may gain traction and rapid adoption.	GFI
Remittances inflow to GDP	Current transfers by migrants and wages and salaries earned by nonresident workers	Although remittances could facilitate financial inclusion, but channeled through formal system the high fees charged is deterrent for many people. So the remittances captured by formal channel may have lessen or negative impact mobile money adoption while it may impact positively mobile banking adoption	WDI
Average cost of remittances	Average of the total transaction cost in percentage for sending the local currency equivalent of US$ 200 charged by each single remittance service provider.	The cost of remittances through the formal financial system has been documented to be prohibitive. Hence, as mobile money lower the fee of money transfers, we expect a positive sign	WDI
Cross-border remittances	It is a dummy variable that takes the value 1 if the country is involved into cross-border remittances, and 0 otherwise. The countries participating in cross-border remittances are mainly from Sub-Saharan Africa.	We want to show whether the availability of cross-border money transfers through mobile money spur mobile money adoption. We then expect a positive sign	
Saved	Percentage of the population (age 15+) who report personally saving or setting aside any money for any reason and using any mode of saving in the past 12 months.	In developing countries, people lack appropriate tools for savings especially saving accounts. Thus, as mobile money provide a safe place for money storage we expect a positive sign	GFI
Saving club	Percentage of the population (age 15+) who report saving or setting aside any money in the past 12 months by using an informal savings club or a person.	In developing countries, people lack formal saving accounts leads people to rely on informal savings mechanisms that remain risky and often inappropriate. Thus, as mobile money provide a safe place for money storage we expect a positive sign	GFI
Bank account	Bank accounts per 100 adults	Mobile money appears as an alternative to the lack of bank account. However, as mobile money can be linked to bank account, then we expect a negative or positive effect on mobile money	WDI, IMF, and IFC
Account at a financial institution	Percentage of the population (age 15+) who report having an account at a bank or another type of financial institution.	Mobile money appears as an alternative to the lack of formal financial account. However, as mobile money can be linked to formal financial account, then we expect a negative or positive effect on mobile money	GFI
Receive agricultural payments	Percentage of the population (age 15+) who report personally receiving money from any source for the sale of agricultural products, crops, produce, or livestock (self- or family-owned) in the past 12 months.	According the risk associated with holding cash for payments mobile money appears as a better mean for transactions that is traceable and cheap. Thus, as the habit of individuals change the need of innovative and secure mean of payments may spur mobile money adoption.	GFI
Receive government transfers	Percentage of population (age 15+) who report personally receiving any financial support from the government in the past 12 months. Including payments for educational or medical expenses, unemployment benefits, subsidy payments, or any kind of social benefits.	According the cost associated with formal financial system for payments mobile money appears as a better mean for transactions that is traceable and cheap. Thus, government may need innovative and secure channel for payments that may spur mobile money adoption.	GFI
Paid school fees	Percentage of the population (age 15+) who report personally making regular payments for school fees in the past 12 months.	According the risk associated with holding cash for payments mobile money appears as a better mean for transactions that is traceable and cheap. Thus, as the habit of individuals change the need of innovative and secure mean of payments may spur mobile money adoption.	GFI
Paid utility bills	Percentage of the population (age 15+) who report personally making regular payments in the past 12 months for water, electricity, or trash collection.	According the risk associated with holding cash for payments mobile money appears as a better mean for transactions that is traceable and cheap. Thus, as the habit of individuals change the need of innovative and secure mean of payments may spur mobile money adoption.	GFI

Note: Global Financial Inclusion (GFI), World Development Indicators (WDI), Global Financial Development (GFD), Global Banking Regulatory (GBR), International Monetary Fund (IMF), International Finance Corporation (IFC).

Table A.8. Correlation matrix.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)
Mobile money	(1)	1																														
Mobile banking	(2)	0.55	1																													
GDP per capita (ln)	(3)	-0.19	0.38	1																												
GDP per capita growth	(4)	0.08	0.12	-0.13	1																											
Population (ln)	(5)	-0.00	-0.13	-0.15	0.01	1																										
Population density (ln)	(6)	-0.14	-0.14	-0.02	-0.13	0.27	1																									
Inflation	(7)	0.01	0.13	-0.03	-0.07	0.23	-0.01	1																								
Primary education (ln)	(8)	0.10	-0.14	-0.28	0.03	0.96	0.28	0.23	1																							
Mobile phone subscription	(9)	-0.15	0.29	0.79	-0.00	-0.25	-0.10	-0.22	-0.34	1																						
SSA countries	(10)	0.45	0.12	-0.54	0.02	-0.20	-0.28	-0.05	-0.11	-0.43	1																					
ATM per 1,000 km2	(11)	-0.02	0.28	0.33	-0.04	-0.12	0.43	-0.09	-0.24	0.20	-0.13	1																				
Bank branches per 1,000 km2	(12)	-0.06	0.24	0.35	-0.06	-0.12	0.51	-0.11	-0.15	0.20	-0.17	0.98	1																			
MM agents per 1,000 km2	(13)	0.03	-0.06	-0.26	-0.03	0.20	0.38	0.38	0.21	-0.18	-0.06	0.33	0.59	1																		
Number of bank institutions (ln)	(14)	0.02	0.09	0.39	0.02	0.59	0.41	0.04	0.52	0.31	-0.47	0.31	0.35	0.20	1																	
Bank concentration	(15)	-0.14	0.09	-0.15	-0.01	-0.44	-0.19	-0.10	-0.34	-0.11	0.24	0.16	0.09	-0.02	-0.53	1																
Boone indicator	(16)	-0.16	-0.10	-0.02	-0.02	-0.16	-0.06	-0.11	-0.11	-0.14	0.16	0.05	0.04	-0.10	-0.28	0.20	1															
Capital regulatory index	(17)	0.07	0.11	-0.01	-0.03	0.11	0.36	0.23	0.12	-0.03	-0.21	0.07	0.10	0.27	0.16	0.02	-0.05	1														
Government owned bank	(18)	-0.24	-0.20	0.02	0.25	0.43	0.14	0.29	0.45	-0.04	-0.27	-0.11	-0.09	0.19	0.36	-0.23	0.04	0.27	1													
Bank cost to total asset	(19)	0.27	-0.07	-0.45	0.01	-0.10	-0.13	0.20	-0.00	-0.42	0.52	-0.20	-0.24	0.02	-0.42	0.04	0.16	0.10	-0.11	1												
Domestic remittances	(20)	0.60	0.46	-0.27	0.09	-0.03	-0.26	-0.04	0.02	-0.15	0.57	-0.07	-0.14	-0.03	-0.23	0.04	0.00	0.02	-0.41	0.40	1											
Average cost of remittances	(21)	0.37	0.47	-0.26	-0.14	-0.15	-0.20	0.20	-0.07	-0.23	0.61	-0.19	-0.17	-0.15	-0.22	0.29	0.01	0.24	-0.08	0.30	0.45	1										
Remittance inflow to GDP	(22)	-0.19	-0.30	-0.12	-0.19	-0.21	0.41	-0.19	-0.22	-0.00	-0.33	0.20	0.23	-0.04	-0.10	-0.07	-0.11	0.08	-0.10	-0.12	-0.25	-0.31	1									
Cross-border remittances	(23)	0.38	0.04	-0.43	0.01	0.01	-0.08	-0.20	0.08	-0.28	0.50	-0.07	-0.11	-0.10	-0.15	0.07	0.04	0.02	-0.11	0.32	0.32	0.37	-0.13	1								
Saved	(24)	0.00	-0.10	-0.21	-0.10	0.08	-0.21	0.07	0.11	-0.13	0.24	-0.01	-0.02	-0.02	0.00	-0.08	-0.05	-0.24	0.06	0.12	0.08	0.26	-0.12	0.21	1							
Saving club	(25)	0.16	0.04	-0.11	-0.10	0.14	-0.09	0.01	0.20	-0.22	0.09	0.08	0.07	-0.28	0.11	-0.12	0.05	-0.23	-0.10	0.05	0.06	0.10	-0.04	0.13	0.25	1						
Bank account per 1,000 adults	(26)	-0.13	0.43	0.57	0.21	-0.09	-0.13	0.19	-0.21	0.37	-0.44	0.17	0.21	0.03	0.21	-0.06	-0.04	0.22	0.22	-0.29	-0.05	-0.18	-0.05	-0.27	-0.26	-0.04	1					
Account at a financial institution	(27)	-0.06	0.56	0.73	0.03	-0.04	0.17	0.14	-0.18	0.47	-0.40	0.37	0.41	-0.03	0.33	-0.09	-0.03	0.16	0.07	-0.34	-0.02	-0.04	-0.14	-0.30	-0.15	-0.12	0.71	1				
Receive agricultural payments	(28)	0.43	-0.02	-0.78	0.20	0.13	-0.09	-0.01	0.22	-0.63	0.61	-0.18	-0.24	0.13	-0.27	0.12	0.08	-0.15	-0.18	0.33	0.51	0.41	-0.15	0.43	0.25	0.27	-0.47	-0.52	1			
Receive government transfers	(29)	-0.07	0.45	0.51	-0.02	0.01	-0.09	0.14	-0.05	0.40	-0.31	0.22	0.21	-0.21	0.19	0.01	0.02	-0.06	-0.14	-0.30	0.15	-0.17	-0.15	-0.25	-0.06	-0.07	0.58	0.67	-0.41	1		
Paid school fees	(30)	0.34	0.29	-0.01	0.13	0.13	0.17	0.02	0.17	0.05	0.04	0.01	0.01	-0.00	0.14	-0.26	0.03	0.02	-0.12	0.09	0.42	-0.01	0.04	-0.07	0.07	-0.05	-0.12	0.18	0.13	0.16	1	
Paid utility bills	(31)	-0.27	0.11	0.70	0.09	0.03	0.03	0.01	-0.11	0.65	-0.71	0.09	0.13	-0.24	0.35	-0.24	-0.09	0.07	0.13	-0.45	-0.30	-0.51	0.02	-0.47	-0.23	-0.12	0.56	0.61	-0.63	0.52	0.15	1

DOES MOBILE MONEY AFFECT SAVING BEHAVIOR? EVIDENCE FROM A DEVELOPING COUNTRY

2.1. Introduction

In developing countries, limited access to formal financial institutions makes individuals and households rely mainly on informal networks to build up savings. Such informal saving mechanisms include saving in livestock or jewels, saving at home "under a mattress", saving with a neighbor or, in a more organized way, participating in a Rotating Savings and Credit Associations (ROSCAs)[19]. However, these informal saving devices provide an insurance which is well known to be risky, inappropriate and incomplete. For instance, to deal with unexpected events such as health deterioration, which is very common in sub-Saharan Africa, it is crucial to have access to liquid assets to benefit from appropriate medical services. Holding too much cash is not an appropriate solution at least for two reasons. First, this way of saving is subject to theft or "taxes" by friends or relatives for assistance. Second, savers face self-control problems through "temptation goods" that make it difficult for them to postpone an important part of their consumption (Banerjee and Mullainathan, 2010).

Our paper is at the intersection of different strands of the literature addressing mobile money, saving patterns, formal financial access and usage. More specifically, our main goal in this paper is to examine the impact of using mobile money as a commitment device on individuals' saving behavior. This investigation is relevant to policy agendas of governments and international organizations which aim at improving people's lives by developing financial inclusion. The growing financial innovation of mobile money such as the use of a cell phone as an electronic wallet (e-wallet) allows individuals to transfer purchasing power by using simple short messaging services (SMS) technology and to store value through cash in and cash out functions. Moreover, mobile money users may deposit funds for free but are taxed for withdrawals and transfers. Thus, by storing value in their mobile money account, people are insured against theft and unneeded expenditures because of the withdrawal and transfer fees which encourage them to cash out or transfer money only when the need arises[20]. In fact, money transfers between users are not only a simple deposit-transfer-withdraw transaction but some users keep the mobile money as savings (Mbiti and Weil, 2013). However, the cost of

[1]Rotating Savings and Credit Association (ROSCA) is a saving group involving many parties who know one another that meets on a regular basis. At each meeting, group members make a fixed mandatory contribution which goes into a "pot" that is then assigned to one of the members. For more details, see Ambec and Treich (2007), Dupas and Robinson (2013b) and Smets (2000).

[20] Therefore, the withdrawal and money transfer fees serve as a commitment device.

transferring money from users of mobile money to non-users is higher than the cost of withdrawals and debited to the user account. This pricing schedule may lead users to keep their mobile money or only transact with non-users in case of emergencies. Mobile money is also characterized by unique features that equip it with certain advantages such as mobiquity, affordability, speed, safety and security through a Personal Identification Number (PIN), especially the SIM card[21] that allows to lock the mobile money account at anytime, everywhere and without the risk of falsification. By using mobile money, individuals can easily exchange cash for e-money or vice-versa with mobile money agents across the country. Once the deposit is made, they can either keep it safe in the mobile phone as savings or transfer the balance via SMS to any other mobile phone in the country or overseas[22]. The recipient does not need to have a mobile money subscription and the mobile phone can be registered on a competing network. It is hence essential for mobile money users to have convenient access to cash in/out options in order for them to convert their cash into electronic money and vice versa. Moreover, certified agents have to hold sufficient balance of electronic money or cash, allowing retail agents to rebalance their liquidity (convert electronic money into cash, and vice versa) to ensure the efficiency of users' cash in/out functions.

Mobile money has recently risen to the forefront of development agendas in less developed countries. Although considerable research has been conducted in this field, most of it has focused on the case of M-PESA in Kenya[23]. Key findings that emerge from these previous investigations show that mobile money adoption reduces monetary and security costs of transferring money compared to traditional means of money transfers such as the use of Western Union, MoneyGram, or transport companies (Mbiti and Weil, 2011). In a similar vein, it is shown that by reducing transaction costs, mobile money adoption has substantial impact on the size and the frequency of remittances that ultimately allows households to smooth consumption and share risk (Jack and Suri, 2014). Mas and Mayer (2011) suggest and describe how mobile money can be used to create a safe saving account where individuals can deposit small amounts of money for

[21] The Subscriber Identification Module (SIM) card refers to a smart card inside mobile phones. It contains an encryption key that secures the user's PIN on entry. For more, see (Eijkman et al., 2010; Mbiti and Weil, 2011).
[22] Especially in Ivory Coast where a large community of Burkinabe lives. A recent study by Lonie et al. (2013) shows that there are about 6 millions of mobile money subscribers in Ivory Coast in December 2013. Mobile money is therefore an important channel which Burkinabe immigrants may use in order to send money at home.
[23] M-PESA was launched in 2007 and is considered as the most successful mobile money system in the world. Since its launch, M-PESA registration has grown exponentially from 21% in 2008 to 75% of the Kenyan adult population in November 2014 (The Economist, 2014). For more details, see CFSP (2013) and Jack and Suri (2011).

more immediate needs. Mas and Kumar (2008) describe how a mobile phone can be seen as an opportunity of delivering basic banking services to poor people who have less alternatives than rich people. In fact, a mobile phone can act as a virtual bank card by storing information about the user and the mobile money account into the subscriber identity module (SIM) card inside the phone. Thus, it can be used to initiate securely transactions request and authorization. Therefore, although it does not pay interest, storing mobile value in the phone provides the same benefits that a traditional bank saving account provides with an additional benefit in cash. Related to our investigation, Mbiti and Weil (2011) find that while M-PESA is mainly used for money transfers, it also serves as a storage of value by decreasing the use of informal saving mechanisms such as ROSCA. Along this line, Demombynes and Thegeya (2012) find empirically that individuals registered with M-PESA are more likely to save than those who are not registered with M-PESA. In a field experiment in Afghanistan Blumenstock, Callen and Koepke (2015) who show that the use of mobile money for salary payment results in cost savings for the employer, emphasize that it may have in the long term an impact on the total savings of employees. Other studies document analytically that people may prefer mobile money account to keep money for emergencies while for long-term savings, they would use tools that limit access to cash (such as bank accounts or participation into a ROSCA) (Mbarathi and Diga, 2014; Morawczynski and Pickens, 2009). In this paper, our aim is to empirically test these conjectures. We study the impact of mobile money adoption on individual saving behavior by distinguishing savings for immediate purposes (i.e. health shocks, financial shocks) from savings for long-term purposes which are rather predictable (i.e. to develop an activity).

Our choice to focus on savings cannot be overemphasized. Indeed, saving is one of the key aspects of financial practices that any individual has to assume himself. Savings help people manage vulnerabilities and build an asset base, which can be used to lessen the risk of incidence of adverse shocks (Hulme, Moore and Barrientos, 2009). Particularly in developing countries, people often face a variety of negative shocks related to ill-health or death of a family member which can overwhelm their means and hence hamper economic activity and development. This is why in such an environment, providing people with an appropriate saving technology can help them deal with unpredictable life events (Christen and Mas, 2009). In this regard, building on

recent empirical findings by Dupas and Robinson (2013b)[24], which show that simply providing a safe place to keep money is sufficient to increase preventative health savings, we investigate whether using mobile money can help individuals increase their propensity to save for health emergencies, particularly those with less access to formal financial instruments.

At the macroeconomic-level, saving rates are positively associated with future economic growth. Evidence, however, suggests that in less developed countries, people lack access to formal financial services (e.g. saving account), which hinders their propensity to save. The lack of banking infrastructure and its low coverage network as well as high transaction costs, financial illiteracy and the lack of information are often cited as the main causes of the low access to formal financial services (Allen et al., 2014; Dermish et al., 2012; Jack and Suri, 2014; Ondiege, 2010). The unbanked individuals are generally poor, live in rural area with precarious and irregular incomes, and often rely on microfinance and informal finance to realize their financial projects (Kendall, 2010; Mas and Mayer, 2011; Mas, 2010; Rutherford, 2002). Microfinance institutions play an important role in providing formal financial services to the excluded people (Ondiege, 2010). In many developing countries, they have made a critical contribution by providing first microcredits and later on microsavings and also by locating their branches in places neglected by banks. However, the cost of operating microfinance institutions remains very high leading to high transaction costs supported by customers. This is why people still need more access to appropriate financial products that meet their needs especially good saving and payment services including remittances and insurance (Beck et al., 2009; Karlan and Morduch, 2009).

Our paper contributes to the aforementioned literature in two main ways. First, our study is the first that empirically tests the impact of mobile money on saving patterns by distinguishing savings for unpredictable events and savings for anticipated events. More specifically, we examine whether mobile money users are more likely to save for health emergencies or save to develop an activity than mobile money non-users. Second, to the best of our knowledge the existent studies on mobile money only describe the potential impact of this new technology on

[24] Dupas and Robinson (2013b) perform a field experiment on 771 individuals in rural Kenya to test the effects of four innovative commitment saving devices through the "mental accounting". The Safe Box, the Lockbox, the Health Savings Account and the Health Pot were provided to four groups to buildup savings for preventative and emergencies health expenses. They find that simply providing a safe place to save was sufficient to increase health savings by 66%. They also report that earmarking was helpful when funds were put toward emergencies or for individuals that are frequently taxed by friends and relatives.

poor people financial management. Our detailed data set enables us to go further and test whether the use of mobile money has an impact on saving behavior of disadvantaged groups such as low and irregular incomes, rural, female and less educated. On the whole, the lack of empirical studies in this area may be due primarily to data scarcity (i.e. no readily available secondary databases) and costly collection of primary data. For our study, we use hand-collected data from a survey conducted in Burkina Faso, a country where many initiatives are increasingly implemented to improve the expansion of mobile money.

Using individual responses to a survey we conducted between May and June 2014 in Burkina Faso, we utilize the logistic model to study the impact of mobile money on people saving behavior. Our main results show that using mobile money services has a positive impact on the propensity of individuals to save for unpredictable events, such as health emergencies. We do, however, find no effect of mobile money on savings for anticipated objectives. By taking into account the outreach, i.e. existing disparities in the access and usage of formal financial services, our results show that mobile money increases the propensity of rural, female, less educated individuals and individuals with irregular income to save for health emergencies. These results taken together have important policy implications. By helping individuals build their savings to face unanticipated events, facilitating mobile money adoption appears to be an important way to improve financial inclusion.

The remainder of the paper is organized as follows. In the next section, we discuss the research framework. Section 3 describes our survey design and data collection. It also provides background information on the adoption of mobile money and the state of existing financial services in Burkina Faso. In section 4 we present our model specification and follow this with the results in section 5. Section 6 presents the discussion of potential mechanisms through which mobile money can affect saving behavior and we conclude in section 7.

2.2. Research Framework

One distinguishing feature that arises from the existing literature is that the adoption of mobile money may or may not affect saving behavior. Generally, its impact may depend on two important aspects: the purpose of saving (unpredictable events, short term vs. predictable, long

term) and the outreach based on exogenous characteristics (i.e. gender, location, education and incomes).

2.2.1. Mobile money adoption and saving for unpredictable and predictable events

In developing countries, people often have to rely on informal saving mechanisms to manage their finances, as an alternative, due to the lack of access to formal financial services such as saving accounts. Because of this, several initiatives have been undertaken either by private or government entities to promote branchless banking such as mobile money. In some cases though, as we discuss hereafter, informal saving mechanisms may fit the needs of the individuals to save for anticipated objectives and hence make less relevant the reliance on the innovation of mobile money.

For long term projects, informal saving mechanisms such as participating in savings groups (ROSCAs), or investing in land, jewels and livestock, may be considered convenient. Indeed, to deal with anticipated events like starting up or developing a business, people can easily sell their physical assets since the date of the event is preset. For individuals participating in ROSCAs, they can preset the startup date according to the date they are assigned to receive the pot, as many ROSCAs use a predetermined order to allocate the savings pot. Yet, these saving mechanisms involve high risk taking. For instance, some ROSCAs disband and often without warning. Moreover, holding illiquid assets expose individuals to loss or theft and assets depreciation (Christen and Mas, 2009; Mas, 2010; Morawczynski, 2009). In this context, we suppose that individuals may consider adopting mobile money as an alternative saving device because mobile money account is personal and relatively safe, and they can easily determine their own target to reach in order to realize their investment project. However, several studies show that planning for long term objectives requires less access to the money (Mbarathi and Diga, 2014; Morawczynski and Pickens, 2009). In the same vein, Dupas and Robinson (2013a) provide evidence that expanding savings access, especially bank accounts, increases business investment. Thus, using saving devices which restrict access to cash until a target date is attained would be more adequate to plan for anticipated objectives. Thereby, as mobile money increases access to cash, it may have less or no impact on saving for predictable events compared to saving for unanticipated events for which, as we argue below, mobile money may prove to be better-suited.

To deal with unpredictable events such as health emergencies, people need adequate saving instruments that facilitate access to cash. Selling land, jewels or animals quickly in response to adverse health shocks is not easy and may not always be reliable. Similarly, in the case where individuals participate in ROSCAs, since there is a typically predetermined order, it is impossible to access the money immediately when an emergency comes up. In such circumstances, some people turn to relatives for help. These relatives, however, may not have liquid savings and therefore would have to sell assets (Collins et al., 2009). Mobile money may thus be particularly prominent in this regard by providing easy access to cash for emergency purposes. This conjecture is supported by the findings of Dupas and Robinson (2013b) who show through a field experiment in Kenya that simply providing a safe place to keep money is sufficient to increase preventive health savings. This result highlights that to build savings for unpredictable events, individuals need a safe place which allows them to get back their money when the need arises. In this context, we expect that using mobile money should have a positive impact on individuals saving behavior for unanticipated events such as health emergencies. Some caution is, however, in order. The liquid savings option provided by the mobile money, accessible anywhere and anytime, could increase family assistance and hence, it may have a negative impact on individual savings. Moreover, the withdrawal tax feature of mobile money may help people resist unneeded expenditures on the one hand but it may discourage them to put money in their account and dismiss its effects on savings on the other hand. Our empirical investigation aims at determining which effect dominates over the other.

2.2.2. Mobile money adoption and the "triple whammy"

In their frequently cited book, *The portfolios of the poor*, Collins et al. (2009) highlight that in developing countries people not only have to cope with *(1)* low incomes but that these incomes are also *(2)* irregular and that *(3)* too few financial instruments are available to help individuals in their management. They term this the "*triple whammy*"[25]. Given the huge disparities in access to formal financial services that exist depending, among other things, on the location, gender, income or education of the population, it is crucial to take this dimension into consideration while examining the impact of mobile money adoption on the saving behavior.

[25] The "triple whammy": low incomes, irregularity; and a lack of tools (Collins et al. 2009, p.16).

a) Low, irregular vs. High, regular incomes

In less developed countries where a significant fraction of the population lives under the national poverty line, poor people incomes are not just low, but also they are often irregular. Moreover, it is shown that poor individuals, unlike rich people, are more likely to save their small amount of money through a variety of informal mechanisms (Banerjee and Duflo, 2007; Chowa, Masa and Sherraden, 2012; Christen and Mas, 2009; Collins et al., 2009; Mas, 2010) despite their risky nature. Recent research, however, describes how individuals have increasingly turned to mobile money as a storage device to keep smaller amounts of money (Morawczynski, 2009). Moreover, Demombynes and Thegeya (2012) highlight that aside from this, mobile money serves as a saving device which ensures safety against the dangers of theft and which is inaccessible to relatives. Therefore one may expect that, in the presence of good saving tools such as mobile money which is reliable, safe and affordable, individuals with low and/or irregular incomes would be inclined to rely on it to build their savings.

b) Low vs. High access to formal financial instruments

The location (rural vs. urban), gender (female vs. male) and the level of education are key determinants of accessibility to formal financial services. *Firstly*, the breakdown of financial infrastructure shows disparities between rural and urban areas. In most sub-Saharan African countries rural areas are the most populated, representing 60% of the total African population but where the activities of commercial banks remain underdeveloped (Dupas et al., 2012; Mas, 2010; Ondiege, 2010). Almost all formal financial institutions are concentrated in urban areas leaving rural areas underserved. People living in rural areas vs. urban areas have less access to a wide range of financial services to cope up with life events, both anticipated and unanticipated. Mobile money can potentially help bridge this gap as a growing number of people uses this new technology as an alternative to traditional banking. Morawczynski (2009) shows that in Kenya, people living in urban areas are less likely to use their M-PESA account to save because they have formal saving mechanisms to meet their saving needs. Other arguments include the fact that people may need to keep their money into a bank account to build a relationship with the financial institution to access credit in the future. In urban areas, the impact of mobile money on individuals' saving patterns - both unpredictable and predictable, should hence be minimal.

Furthermore, Dupas et al. (2012) show that in rural Kenya the lack of formal bank accounts is a serious obstacle for people to save. In this context, we expect that providing individuals in rural areas with access to mobile money services may increase their propensity to save (Aker and Mbiti, 2010; Allen et al., 2014; Christen and Mas, 2009; Dupas and Robinson, 2013b).

Secondly, all else being equal, women remain comparatively more excluded from the financial sector and hence, have less access to formal financial services such as saving accounts and loans than men (Demirgüç-Kunt, Klapper, and Singer, 2013). They are consequently found to rely mainly on informal mechanisms (ROSCAs, money-lenders …). Without a bank account, it is more difficult to build up savings and/or receive public benefits or remittances from family members living abroad (Demirgüç-Kunt et al. 2013). Dupas and Robinson (2013a) provide robust evidence that shows how women are more in need of formal saving devices than men. In a randomized field experiment in Kenya, they find that increasing access to basic savings bank account which does not pay interest, increases women savings while men's saving behavior is not impacted. This is why one may conjecture that women adoption of mobile money may have a comparatively greater impact on their saving behavior than men. Our investigation thus allows determining whether mobile money has the potential to cut back gender inequalities.

Finally, financial literacy or financial knowledge is yet to receive enough attention although there has been growing attention in the recent past. Recent research shows that across developed and developing countries the level of financial literacy remains very low (Karlan, Ratan and Zinman, 2014; Lusardi and Mitchell, 2014). Unsurprisingly, the unbanked population has relatively low level of education. Hence, it is difficult for them to understand various financial services that are available to them. This should partly explain their preference to use informal saving methods. Mobile money being affordable and easy to use, we can expect less educated people to adopt it for their saving purposes.

To sum up, we consider that if mobile money can significantly allow individuals to enhance their saving behavior, our research framework suggests the following questions:

(i) Does the use of mobile money increase the capacity of individuals to save, particularly for unpredictable events such as health emergencies?

(ii) To the extent that mobile money is affordable, easy to use and available anywhere throughout the country, do disadvantaged groups such as individuals with low and irregular incomes, rural, female and less educated individuals benefit from the use of mobile money to increase their savings?

2.3. Survey design and data collection

We answer these questions by using individual-level data on the usage of mobile money combining with socio-demographics information collected through a survey we designed and conducted in Burkina Faso in 2014. The lack of official administrative data on actual uses of mobile money, saving behavior, health expenditures and several other microeconomic data especially at regional level constraints us to rely on hand-collected information even if we acknowledge that self-reported data may entail biases and limit the generality of the findings. Prior to a detailed examination of the characteristics about the location and population considered in our survey, it is worth providing an overview of the state of existing financial services in Burkina Faso.

2.3.1. Background on mobile money and access to financial services in Burkina Faso

Burkina Faso is a low-income country with a GDP per capita estimated at just 761 USD and about 47% of its population live under the national poverty line as of 2013 (World Bank, 2015). The country's financial system is still in its infancy even in comparison to other African low-income countries[26]. There are about 13% of the population that have an account at a formal financial institution (bank account, post office, credit union and microfinance institutions); in contrast, this rate is around 35% in Ghana, 55% in Kenya and 69% in South Africa as of 2011 (Global Financial Inclusion Database, 2015). The access to a bank account remains limited in the country and the central bank (BCEAO) [27] estimates the bankarization rate at about 4.6% (BCEAO, 2011). In Burkina Faso, among individuals living in urban area, about 35% have a

[26] We provide in Appendix Table A.7. statistics on access to financial services for Burkina Faso, Sub-Saharan Africa and Low-income countries.
[27] BCEAO: Banque Centrale des Etats de l'Afrique de l'Ouest. It is the Central Bank of the eight countries including Burkina Faso, of West Africa Economic and Monetary Union (WAEMU).

formal financial account, while in rural area only 12% have formal financial account (Global Financial Inclusion Database, 2015). This disparity in the access to formal finance is not confined to the location, approximately 12% of female have an account at formal financial institution compared to 15% of male.

Over the course of the past decade, cell (or mobile) phone coverage and adoption in Burkina Faso have increased substantially. While about 0.20% of the population had access to mobile phone in 2000, the number of subscribers has increased to over 47% in 2011, and continued to rise dramatically in the past few years to reach 60% in 2012 and 65% in 2013 (Group Special Mobile Association intelligence, 2015). In addition to basic services of mobile phones (calls, SMS), other services have been introduced over the past two years, namely, mobile financial services or mobile money. In the country, there are three mobile operators Airtel, Telmob and Telecel, but only the first two offer mobile money services which were launched respectively in 2012 (Airtel Money) and 2013 (MobiCash).

Since the launch of mobile money, the number of registered users has continuously increased and has been multiplied by seventeen between 2011 and 2014[28] (Financial Access Survey, IMF, 2015). Ignoring multiple accounts held by individuals into each mobile money providers, this implies that about 5% of the adult population had gained access to mobile money in two years. Subscription to mobile money service is free of charge but requires an initial account balance of 500 FCFA (around $1 US). The network of agents plays a key role in the adoption and usage of mobile money by making the conversion from cash to e-money and vice versa, more accessible and efficient for customers. In this regard, the number of mobile money agents has increased substantially from 483 in 2012 to 3,688 in 2014 (Financial Access Survey, IMF, 2015). At any mobile money agent, depositing funds is free of charge whereas withdrawals are charged according to the amount. No interest is earned on account balances and mobile money providers do not make loans. Regarding money transfers, there is a fee[29] per SMS transfer according to the mobile money provider. Withdrawal and transfer fees are deducted from user's accounts and details given in the appendix A.6 indicate that fees increase with the amount and are highly penalizing for small amounts. Hence, this creates an incentive for small amounts owners

[28] The number of registered users grow from 70 509 in 2011, 134 583 in 2012, 828 727 in 2013 to reach 1 242 476 in 2014 (Financial Access Survey, IMF, 2015).

[29] In our case study, the pricing schedule used by mobile money providers is a combination of a tiered/banded pricing and percentage based pricing (Garg, 2011). For more details, see the Appendix A.6.

to keep it in their mobile money account in line with the commitment hypothesis at the core of this paper.

2.3.2. 3.2. Survey location and survey population

In May 2014, we undertook a survey of 500 randomly selected people across one region of Burkina Faso. The country has 13 regions divided into many rural and urban municipalities. Due to budgetary constraints that did not allow us to extend the survey throughout the entire territory, only the central region was considered for the sample frame. This region counts about 13% of Burkina's population and is divided into one urban municipality with 12 districts and six rural municipalities with 172 districts. It is the most populated region and where the supply of formal financial institutions and to some extent the supply of mobile money institutions[30] are relatively concentrated.

The survey location is determined on the basis of the following criteria: the first is the existence of at least one formal financial institution into retained municipalities -which we check through the national institute of statistics and demography (INSD) of Burkina Faso report on financial institutions[31]. The second criterion is the availability of mobile phone services that we assess through the availability of mobile operator signal. As stated above, the area covered by the sample frame is the central region and consists of one urban municipality, "Ouagadougou", and six rural municipalities among which only four have at least one formal financial institution. We then randomly select among the four, one municipality that is "Saaba"[32]. We finally randomly choose two districts for each municipality, i.e. two urban districts in Ouagadougou and two rural districts in Saaba.

To form our target population, we interview 125 individuals in each district by following an n-th individual starting from the center of the district along the main directions of walk in the district. The individuals interviewed in each district have to live in the concerned district to avoid

[30] The central region is the second after the western region where mobile money agents are concentrated (29% for central region and 45% for western region).
[31] Note that among the two districts of the rural municipality considered in our study, there is one district where formal financial institutions are inexistent.
[32] In the rural municipality, Saaba, only two formal financial institutions one microfinance and one credit union institutions are present.

double interview. We decided to have a balanced sample of users and non-users of mobile money because, as emphasized above, our aim is to capture the impact of mobile money on saving behavior. Thus, individuals are interviewed until we obtain half of the sample to be users of mobile money irrespective of the municipalities. However, there is no restriction regarding individual-level characteristics (gender, location, education level, level and types of incomes) in the sample.

A paper-based questionnaire was distributed to a total of 500 participants with 500 FCFA (about $1 US) unit of call time incentive. The questionnaire combined qualitative and quantitative questions to elicit in-depth information about users and non-users of mobile money including individuals' socio-demographic characteristics. All research variables were measured using multiple-item scales and based on previous studies (Demirguc-kunt and Klapper, 2012; International Finance Corporation, 2011) with some changes to tailor them to our context. Most of the items were coded on dichotomous responses and on 5-point Likert scale. Our respondents were interviewed from 20 May to 28 June 2014. Participants who use the mobile money through their own cell phone or another cell phone were classified as users while participants who did not use the mobile money were classified as non-users. At the end of the survey, our sample consisted of 405[33] respondents with 50.5% of mobile money users and 49.5% of non-users.

2.3.3. Data and summary statistics

Descriptive statistics (Table 1) show that most individuals in our sample, regardless of income levels saved. The share of individuals that reported saving is 92%, 89% of which saved for health emergencies while 54% saved to develop an activity. Regarding the gender, our sample is made of 51% of men and 49% of women. About 48% reported being married and the mean of age is about 31 years while 52% reported having at least one person in charge, and more than half of all individuals had at least secondary education level (more than six years of school). For the employment status, about 81% reported having a paid activity, while 16% were unemployed. More than half of all individuals had a monthly income ranging from 10,000 to 50,000 FCFA (around $20 to $100 US), and about 48% of all individuals had irregular income.

[33] We ended up with a final sample of 405 respondents due to mistakes made during the process by some interviewers and respondents alike.

Table 1. Data sample characteristics.

	Full sample	Mobile money users	Individuals that report saved
Saving behavior			
Save	91.60%	90.20%	
Save using mobile money account	17.53%	34.80%	19.14%
Save for health emergencies	81.98%	85.29%	89.49%
Save to develop an activity	49.14%	44.61%	53.64%
Gender			
Female	49.38%	49.02%	48.79%
Male	50.62%	50.98%	51.21%
Marital status			
Married	48.40%	54.90%	50.67%
At least one person in charge	52.10%	52.45%	54.18%
Age			
< 30	50.62%	48.53%	48.25%
>= 30	49.14%	51.47%	51.48%
Location			
Rural	52.10%	40.69%	47.98%
Urban	47.90%	59.31%	52.02%
Education level			
Less than secondary education level	41.73%	36.27%	42.59%
At least secondary education level	57.53%	63.73%	56.60%
Occupation / employment status			
Paid activity	80.99%	77.45%	83.56%
Unpaid activity (include students)	15.56%	18.14%	12.94%
Income level and type			
Income ranging from 10 000 to 50 000 FCFA	59.75%	43.63%	46.09%
Income more than 50 000 FCFA	40.25%	56.37%	53.91%
Irregular income	47.90%	50.00%	46.36%
Regular income	51.60%	49.51%	53.10%
Usage of mobile phone (or mobile technology)			
Mobile phone user	99.26%	99.02%	99.46%
Frequency of the use of mobile money			
Occasionally		53.43%	
Once a month		5.88%	
Several times a month		34.31%	
Once a week		2.45%	
Several times a week		10.29%	
Usage of mobile money services			
Send money transfers		65.69%	
Receive money transfers		79.41%	
Buy airtimes		71.08%	
Pay bills		0.98%	
Purchase goods and services		1.96%	

Source: Author's analysis of the survey data collected in May 2014 in Burkina Faso. Throughout, F CFA (Franc of the African Financial Community) refers to the local currency. The exchange rate during the survey period was about 500 F CFA = $1 US.

In our data, 99%[34] of the sample use a mobile phone. Regarding the frequency of use of the 204 mobile money users interviewed during the survey, 53% report using occasionally mobile money services. Majority of the mobile money users indicate to use the service to make person-to-person remittances: 79% receive transfers and 66% send transfers. Buying airtime stands at 71% of users, and a small share uses it to pay bills (about 1%) and services (about 2%). 90% of mobile money users report to have saved during the past 12 months and among those, 35% saved using mobile money. Breaking down the responses according to the purpose of saving, we find that 85% of users report having saved to cope with health emergencies and 45% to develop an activity.

2.4. Model specification

We use a logistic model to examine the impact of mobile money usage on individual saving patterns considering the following specification:

$$PROB\ \{y_i = 1\} = \Phi\left(\alpha_1 + \alpha_2 MMuser_i + \alpha_3 IC_i\right) \quad (1)$$

where Φ *is the cumulative distribution function of logistic distribution.*

In the equation (1), y_i is our dependent variable that characterizes individual saving behavior. It is a binary variable that alternatively stands for: save for unpredictable events, save for anticipated objectives, save for health emergencies and save to develop an activity[35]. These latter two dependent variables are measured through the following questions: "*During the past 12*

[34] This rate of mobile phone usage in our sample is higher than the rate of mobile phone subscription in Burkina Faso which stands at 65% as of 2013 and may raise questions about the generality of our findings. Therefore, we consider an alternative data survey collected at the country level provided by the Global Findex (2015) and find results that support our conclusions. Results are reported in Appendix Table A.5.1.

[35] Our first two alternative dependent variables: saving for unpredictable events and saving for anticipated shocks were constructed by aggregating the responses obtained about the objectives of individual's savings (Table 2). In our questionnaire we ask the following question *"During the past 12 months, did you save some of your money for education spending?"; "to develop an activity?"; "to repay a loan?"; "for a potential decrease in income?"; "to cope with health emergencies?"; "for a ceremony (wedding, funeral)?"* However, only saving for health emergencies and saving to develop an activity were mainly retained. This is consistent with previous studies on the importance of commitment devices on saving behavior which consider health emergencies (Dupas and Robinson 2013b; Mbarathi and Diga 2014) or savings for enterprise development (Ashraf et al. 2010; Dupas and Robinson 2013a). The relatively low response rate on the other objectives of savings also motivated us to focus on the two motives.

months, did you save some of your money to develop an activity?"; "*to cope with health emergencies?*" Other propositions were offered as well to the respondents but we retain saving for health emergencies and saving to develop an activity[36]. Thus, save for health emergencies takes the value one if respondent indicates save for health emergencies, and zero otherwise. Similarly, save to develop an activity equals to one if respondent saves to develop an activity, and zero otherwise[37]. $MMuser_i$ is the independent variable of interest that stands for the use of mobile money. It is a dummy variable equal to one if the individual reports using mobile money and zero otherwise. IC_i is a vector for controls (age, gender, marital situation, at least one person in charge, education level, location, occupation or employment status, level and type of income). We present in Table 2 the variables' definitions along with some summary statistics.

If both users and non-users of mobile money do not differ in terms of their propensity to save, the coefficient α_2 should not be significantly different from zero. If users of mobile money are more capable to save than non-users, then α_2 should be positive and statistically different from zero.

Mobile money usage could have different impact on saving for health emergencies and to develop an activity when considering individuals' characteristics. Therefore, we slightly modify our specification (1) and include interaction terms as follows:

$$PROB\left(y_i = 1\right) = \Phi\left(\beta_1 + \beta_2 MMuser_i + \beta_3 D_i + \beta_4 MMuser_i \times D_i + \beta_5 D_i \times IC_i' + \beta_6 IC_i'\right) \qquad (2)$$

Where, D_i is a dummy variable that stands alternatively for individuals' characteristics that we use to assess the impact of mobile money use on saving behavior for low vs. high income, irregular vs. regular income, rural vs. urban, female vs. male, and less vs. highly educated individuals. Accordingly, it takes the value 1 for disadvantaged individuals, i.e. low level of income, irregular income, rural, female and less educated individuals, and takes the value 0 respectively for high level of income, regular income, urban, male and highly educated individuals. IC_i' is our vector of controls excluding the individuals' characteristics considered for the dummy variable D_i.

[36] See footnote 17 about the rationale of this choice.
[37] For precise definitions of how we construct these dummies, see Table 2.

Table 2. Definitions of the variables.

Variable	Definition	Obs.	Mean
Mobile money user (MM user)	Reply to the question: Do you use mobile money services? Encoded as yes = 1, no = 0	405	0.50
Save for unpredictable events	Indicate when respondent's saving was for unpredictable purposes, encoded as (save for health emergencies, and/or save for an eventual decrease in income = 1, others = 0)	374	0.93
Save for health emergencies	Reply to the question: During the past 12 months, did you save to cope with health emergencies? Encoded as yes = 1, no = 0	374	0.89
Save for predictable events	Indicate when respondent's saving was for predictable events, encoded as (save for education, save to develop an activity, save to repay a loan and/or save for a ceremony such as wedding or funeral = 1, others = 0)	375	0.70
Save to develop an activity	Reply to the question: During the past 12 months, did you save to develop an activity? Encoded as yes = 1, no = 0	372	0.53
Individuals' characteristics			
Age	Indicate the age of respondent	404	30.55
Male	Indicate the gender of respondent, Encoded as Male = 1, Female = 0	405	0.51
Married	Indicate the marital situation of respondent, Encoded as Married = 1, Single = 0	405	0.48
At least one person in charge	Indicate if the respondent has or not dependent, Encoded as Having dependent = 1, otherwise = 0	401	0.53
Education	Indicate the education level of respondent, Encoded as Illiterate = 1, Primary = 2, Secondary = 3, University = 4	402	2.67
Rural	Indicate the location of respondent, Encoded as Rural = 1, Urban = 0	405	0.52
Occupation	Indicate the employment status of respondent, Encoded as (Employed, Entrepreneur, Merchant, Farmer) = 1, (Unemployed, Student) = 0	391	0.84
Income	Indicate the monthly income of respondent, encoded as Less than 10,000 FCFA = 1, 10,000 to 50,000 FCFA = 2, 50,000 to 150,000 FCFA = 3, 150,000 to 300,000 FCFA = 4, 300,000 to 500,000 FCFA = 5, More than 500,000 FCFA = 6	405	2.61
Irregular income	Indicate the type of income of respondent, encoded as Irregular = 1, Regular = 0	403	0.48

Note: Throughout, F CFA (Franc of the African Financial Community) refers to the local currency. The exchange rate during the survey period was about 500 F CFA = $1 US.

The coefficients of interest are both β_2 and the total effect given by the sum of $\beta_2 + \beta_4$. For instance, if β_2 is positive and significantly different from zero, then the use of mobile money increases the likelihood of advantaged individuals to save than those who do not use mobile money. Similarly, if disadvantaged individuals who use mobile money have more likelihood to save than those who do not use mobile money then, $\beta_2 + \beta_4$ should be positive and significantly different from zero.

To identify the causal effect in our equation of mobile money on saving choices, we must assume that the variable "mobile money user" is exogenous and uncorrelated with the error term. However, this may not be the case because, as stressed above, access to formal financial services is very limited in Burkina Faso. This lack of access may lead individuals to rely on informal mechanisms to manage their finances. Although mobile money was initially launched for money transfers, individuals may use it to save due to its convenience (safety and ease of access) even if it does not pay any interest (Demombynes and Thegeya, 2012; Dermish et al. 2012). The endogeneity problem suspected here stems from the simultaneous determination of the use of mobile money and saving choices of individuals. Thus, to control the possibility that individuals may decide to use mobile money with the expectation to save with it, we perform a standard IV method. Given that we have one potential endogenous variable, the use of mobile money, we need at least one instrumental variable. Therefore, we use one excluded instrument, the distance to the nearest mobile money proposed by Jack and Suri (2014). We assess this distance by using the answer to the following question: "*What distance did you travel to reach a mobile money agent?*" The responses are encoded on a 5-point Likert scale, 1 (less than 1 km), 2 (1 to 2 km), 3 (2 to 5 km), 4 (5 to 10 km) and 5 (more than 10 km). The underlying hypothesis of this instrument is that access to mobile money agents is required for cash in/out functions that allows for an effective use of mobile money. We expect the coefficient of this variable to have a negative sign as the further individuals are from mobile money agents, the harder it will be to access mobile money services, and this may reduce adoption/usage of mobile money. Table A.3.1 presents correlation matrix of variables used in a reduced-form equation for predicting mobile money use which results are reported in Table A.3.2. The coefficient associated with distance to the nearest mobile money agent is negative and significant. From the reduced-form estimation,

we perform a Chi-square Wald test[38] which confirms that our instrument is not weak. After predicting mobile money use, we replicate our estimations of equations (1) and (2) by replacing (*MM user)* by its predicted value and providing the Kleibergen-Paap LM test of underidentification that confirms the relevance of our instrument.

2.5. Results

Table 3 presents our results about the impact of using mobile money on the propensity to save for unpredictable events, to save for health emergencies, to save for predictable events and, to save in order to develop an activity (columns 1 to 4). To check the robustness of these findings we report in columns 5 to 8, the results obtained using the IV approach and a test statistic of endogeneity[39] which rejects the hypothesis of presence of endogeneity related to the use of mobile money. Across the columns 1 and 2, we find that the coefficient of the variable of interest (*MM user*) is positive and significantly different from zero. But in columns 3 and 4 this coefficient is not statistically significant. Thus, the propensity to save for unpredictable purposes and for health emergencies is respectively about 3[40] and 2.5 times higher for users of mobile money than non-users. This effect is by contrast not significant on individuals' propensity to build up savings for predictable events and savings to develop an activity. Thus, these results indicate that mobile money usage helps to build savings for health emergencies while there is no difference between users and non-users in their saving behavior for long term objectives such as to develop their activity. As highlighted in our research framework (section 2.1), these findings may support therefore the fact that as mobile money increases access to cash, individuals would use it for unanticipated events such as health emergencies. By contrast, they would prefer other means, perhaps relatively less liquid devices, to save for predictable events (or long term objectives)[41]. This is in line with Mbarathi and Diga (2014) and Morawczynski and Pickens (2009) who argue that people may use mobile money account for emergencies while for long-

[38] As we perform the IV regression using one excluded instrument, to assess the relevance of the instrument we report the chi-square Wald test statistic after the reduced-form estimation to take into account the critical value proposed by Stock and Yogo (2002) who suggest a test statistic critical value of 16.38.
[39] This endogeneity test is proposed by Baum, Schaffer and Stillman (2007) and its statistic is numerically equal to a Hausman test statistic under conditional hemoskedasticity.
[40] The coefficients reported in all our tables are the log odds of the use of mobile money on saving patterns. To obtain the odds ratio, we simply compute the exponential of log odds.
[41] In the next section, we discuss in detail the potential mechanisms or pathways behind these findings.

term savings, they would prefer tools that limit access to cash (such as bank accounts due to long distance or participation into a ROSCA).

Regarding our control variables, we find that only education matters when considering columns 1 and 2. The positive and significant coefficient associated with it indicates that increasing the education level has a positive and significant impact on the propensity to save for unpredictable purposes or for health emergencies.

Across the two remaining columns, particularly column 4, the reported results show that instead of mobile money usage, it is rather the socio-demographic characteristics that have significant impact on individual saving behavior for long term objectives such as to develop an activity. Precisely, we find *age*, *occupation* and *irregular income* to have a positive and significant impact on saving to develop an activity while *married*, *rural* and, counterintuitively, *education* have a negative and significant impact on saving to develop an activity. The negative and significant coefficient associated with age squared implies a hump-shape relationship between saving to develop an activity and age. This is consistent with the life-cycle hypothesis stressing that individuals spread their lifetime consumption over their lives by accumulating savings during earning years and maintaining consumption levels during retirement. Individuals' employment status (*occupation)* gives important information that may determine their saving behavior. Intuitively, individuals who have a paid activity are more inclined to save than unemployed people. The results show the coefficient associated with individuals' employment status positive and significant. This result implies as expected that individuals having a paid activity are more likely to save to develop an activity than those without a paid activity. As for the positive and significant impact associated with *irregular income*, it may reflect a precautionary saving behavior of individuals with irregular incomes who care about stabilizing their incomes. This is consistent with the permanent-income hypothesis assuming that people attempt to maintain a fairly constant standard of living even though their incomes may vary considerably.

Turning to the control variables that negatively affect saving to develop an activity, the significant and negative impact associated with the marital situation (*married)* may reflect the "size effect" which emphasizes that a household of more than one individual would have less propensity to save to develop an activity than a single individual. Regarding geographical

Table 3. Saving choices and mobile money[42].

					IV Results			
	Save for unpredictable purposes	Save for health emergencies	Save for predictable events	Save to develop an activity	Save for unpredictable events	Save for health emergencies	Save for predictable events	Save to develop an activity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
User of MM	1.091**	0.922**	-0.512	-0.142	0.879*	0.719*	-0.680*	-0.190
	(0.527)	(0.379)	(0.324)	(0.295)	(0.534)	(0.394)	(0.358)	(0.312)
Age	0.206	0.070	0.354**	0.438**	0.197	0.074	0.010	0.440**
	(0.286)	(0.261)	(0.160)	(0.181)	(0.285)	(0.255)	(0.186)	(0.180)
Age squared	-0.002	-0.000	-0.004	-0.006**	-0.002	-0.000	0.001	-0.006**
	(0.004)	(0.004)	(0.002)	(0.003)	(0.004)	(0.004)	(0.003)	(0.002)
Married	0.196	-0.084	-0.449	-0.936***	0.243	-0.046	-0.062	-0.922**
	(0.701)	(0.550)	(0.350)	(0.356)	(0.724)	(0.560)	(0.374)	(0.363)
Rural	0.0605	0.143	0.219	-0.949***	0.071	0.166	-0.761**	-0.942***
	(0.438)	(0.400)	(0.322)	(0.359)	(0.440)	(0.403)	(0.324)	(0.357)
Male	0.179	0.006	0.308	0.254	0.163	-0.009	-0.477	0.257
	(0.505)	(0.386)	(0.318)	(0.329)	(0.496)	(0.383)	(0.345)	(0.330)
Occupation	-0.262	0.896	0.528	2.842***	-0.254	0.860	0.647	2.842***
	(0.998)	(0.576)	(0.542)	(0.938)	(0.981)	(0.572)	(0.526)	(0.943)
Irregular income	-0.471	-0.113	1.544***	2.499***	-0.458	-0.099	1.383***	2.503***
	(0.547)	(0.451)	(0.318)	(0.376)	(0.532)	(0.441)	(0.336)	(0.376)
At least one person in charge	0.291	-0.036	0.0418	-0.014	0.301	-0.021	0.215	-0.009
	(0.411)	(0.331)	(0.291)	(0.284)	(0.405)	(0.328)	(0.304)	(0.283)
Education	0.629***	0.382*	-0.236	-0.610***	0.647***	0.405*	0.035	-0.604***
	(0.232)	(0.208)	(0.197)	(0.185)	(0.227)	(0.208)	(0.203)	(0.188)
Income	-1.376	-0.675	-1.771	-1.334	-1.287	-0.647	-2.646	-1.321
	(1.325)	(1.402)	(1.594)	(1.222)	(1.267)	(1.360)	(2.271)	(1.226)
Income squared	0.141	0.100	0.477	0.346*	0.129	0.098	0.632	0.345*
	(0.198)	(0.223)	(0.312)	(0.198)	(0.188)	(0.218)	(0.447)	(0.198)
Constant	-0.849	-0.830	-5.009*	-7.576**	-0.850	-0.939	2.473	-7.629**
	(4.020)	(3.801)	(2.961)	(3.242)	(4.023)	(3.729)	(4.053)	(3.238)
Observations	352	352	353	350	352	352	352	350
Pseudo R2	0.120	0.075	0.285	0.359	0.109	0.064	0.173	0.359
Wald $\chi2$ (H0: nullity of coefficients)	32.31***	23.08**	40.96***	71.39***	32.86***	18.44	42.13***	72.12***
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	25.47**	24.62**	93.51***	204.46***	23.44**	21.90**	96.32***	204.58***
% correct prediction (y=1)	77.91%	52.26%	75.96%	85.79%	78.53%	75.16%	76.66%	85.26%
% correct prediction (y=0)	61.54%	69.05%	73.85%	78.75%	61.54%	50.00%	72.31%	78.75%
Endogeneity test of MM user (H0: Exogeneity)					2.555	2.175	2.555	2.555
p-value					0.110	0.140	0.110	0.110
Kleibergen-Paap LM test (H0: Underidentification)					296.19	296.19	296.19	296.19
p-value					0.000	0.000	0.000	0.000

Note: Dependent variables: save for unpredictable purposes, save for health emergencies, save for predictable events and save to develop an activity are all dummies. Save for unpredictable purposes equal to 1 if respondents save for health emergencies and/or save for a potential decrease in income, and 0 otherwise. Save for health emergencies takes the value 1 if respondents indicate to save for health emergencies, and 0 otherwise. Similarly, save for predictable events equal to 1 if respondents save to develop an activity or, save for education or, save to repay a loan and/or save for a ceremony (such as wedding or funeral), and 0 otherwise. Save to develop an activity also takes the value 1 if respondents save to develop an activity, and o otherwise. The variable of interest, MM user is also a dummy that equal to 1 if respondents use mobile money, and 0 otherwise. The coefficients reported in the table are the log odds of the use of mobile money on saving patterns. To obtain the odds ratio, we simply compute the exponential of log odds. .Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

[42] The correlation matrix is provided in the Appendix A.1. Married and age which are highly correlated (0.61) were introduced alternately in the regression and we obtained similar results.

location (*rural*), compared to individuals living in urban area, those living in rural area have lower access to alternative means of saving for long term purposes as formal financial institutions are mainly concentrated in urban area. This is consistent with our results showing a negative and significant effect of *rural* on the likelihood of saving to develop an activity. As regards to our counterintuitive result which shows that *education* has a negative and significant impact on the propensity to save in order to develop an activity, one explanation may be that in our sample highly educated individuals are likely to be those who are still attending university while less educated individuals are likely to be employed suggesting that they will comparatively have more inclination to save to develop their activity. Moreover, highly educated individuals may have better access to credit in formal financial institutions than less educated individuals as they may be more financially literate. They are hence more likely to understand the various financial services available to them and do not face difficulties to fill out loan applications.

Our discussion in the research framework (section 2.2) also stressed how the impact of mobile money on saving behavior may depend on particular exogenous characteristics. Accordingly, in Table 4, we present our results obtained by distinguishing individuals on the basis of the level and the type of their incomes. Our assumption is that individuals with low or irregular incomes may find the innovation of mobile money convenient and hence rely more on it to save than people who benefit from high or regular incomes. Our reported results reject our hypothesis on low income but confirm that on irregular income. In fact, they show that for low income individuals, the use of mobile money has no effect on users' propensity to save for health emergencies and discloses a slight significant effect (at 10%)[43] but negative on user behavior to save for developing an activity. By contrast, as far as high income individuals are concerned, our results show a positive and highly significant coefficient of usage of mobile money on the propensity to save for health emergencies. These results may therefore suggest the existence of a "threshold income" effect beyond which the use of mobile money has a positive and significant impact on saving for health emergencies. Regarding the type of income, we find as expected that the coefficient associated with our variable of interest (*MM user*) is positive and significant only for individuals with irregular incomes indicating that the propensity to save for health emergencies is 8 times higher for mobile money users than for non-mobile money users.

[43] In Tables 4 and 5, IV results that take into account the potential endogeneity issue related to the use of mobile money are also reported in columns 5 to 8. The endogeneity test reveals that such an issue may exist only for female vs. male and less vs. highly educated individuals. We therefore comment the IV results only for those two cases.

Table 4. Saving choices and mobile money: Low, irregular vs. High, regular incomes.

					IV Results			
	Save for health emergencies		Save to develop an activity		Save for health emergencies		Save to develop an activity	
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MM user	1.824***		0.395		1.323**		0.181	
	(0.672)		(0.484)		(0.637)		(0.482)	
Low income	12.731*		8.462		12.064*		7.102	
	(6.788)		(7.175)		(6.786)		(7.051)	
MM user x Low income	-1.417*	0.407	-1.207*	-0.812*	-0.979	0.344	-1.030	-0.849*
	(0.841)	(0.505)	(0.658)	(0.447)	(0.837)	(0.543)	(0.672)	(0.469)
Controls included	YES		YES		YES		YES	
Low income x Controls included	YES		YES		YES		YES	
Observations	352		350		352		350	
Pseudo R2	0.120		0.422		0.101		0.420	
Wald $\chi2$ (H0: nullity of coefficients)	25.25				23.50		281.66***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	36.34**		234.84***		31.47*		234.10***	
% correct prediction (y=1)	86.77%		87.37%		74.19%		86.32%	
% correct prediction (y=0)	38.10%		76.25%		66.67%		76.88%	
Endogeneity test of MM user (H0: Exogeneity)					2.163		0.078	
p-value					0.141		0.780	
Kleibergen-Paap LM test (H0: Underidentification)					237.24		237.24	
p-value					0.000		0.000	

					IV Results			
	Save for health emergencies		Save to develop an activity		Save for health emergencies		Save to develop an activity	
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MM user	0.201		0.092		0.131		0.181	
	(0.539)		(0.416)		(0.580)		(0.450)	
Irregular income	-9.490		-18.824*		-8.608		-19.146*	
	(7.845)		(10.336)		(7.616)		(10.382)	
MM user x Irregular income	1.891**	2.092***	-0.807	-0.715	1.350	1.482**	-1.085	-0.904
	(0.907)	(0.729)	(0.677)	(0.533)	(0.840)	(0.607)	(0.670)	(0.497)
Controls included	YES		YES		YES		YES	
Irregular income x Controls included	YES		YES		YES		YES	
Observations	352		350		352		350	
Pseudo R2	0.155		0.430		0.133		0.432	
Wald $\chi2$ (H0: nullity of coefficients)	34.27*		112.06***		28.17		111.67***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	45.34***		238.70***		39.67**		239.68***	
% correct prediction (y=1)	87.10%		87.89%		87.10%		75.79%	
% correct prediction (y=0)	57.14%		77.50%		52.38%		92.50%	
Endogeneity test of MM user (H0: Exogeneity)					1.799		0.717	
p-value					0.180		0.397	
Kleibergen-Paap LM test (H0: Underidentification)					244.48		244.48	
p-value					0.000		0.000	

Note: Dependent variables: save for health emergencies and save to develop an activity. Save for health emergencies takes the value 1 if respondents indicate to save for health emergencies, and 0 otherwise. Save to develop an activity also takes the value 1 if respondents save to develop an activity, and o otherwise. The coefficients reported in the table are the log odds of the use of mobile money on saving patterns. To obtain the odds ratio, we simply compute the exponential of log odds. Robust standard errors are in brackets. Low income individuals are those with less than 50,000 F CFA (around $100US) per month. Irregular income individuals are those who specify having irregular income by answering the following question: "*Do you have regular or irregular income?*" The responses are encoded as irregular income = 1, and regular income = 0. Controls included: age, age squared, married, rural, male, occupation, irregular income, at least one person in charge, education level, income level and income squared. According to the individual-level characteristics used we remove respectively controls income level and income squared, and irregular income. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

We now consider our remaining set of characteristics that may influence how the usage of mobile money affects saving. Table 5 takes this into account and distinguishes individuals on the basis of their location, gender and education level[44]. It presents estimates of the impact of the use of mobile money on the propensity to save for health emergencies and saving to develop an activity by distinguishing individuals assumed to have low access from those assumed to have high access to formal financial instruments. Overall, the reported results indicate that while the use of mobile money does not make any difference in the saving behavior for relatively advantaged groups (urban, male and highly educated individuals), it does however increase the probability of saving for health emergencies for disadvantaged groups (rural in column 2, female and less educated individuals in columns 6). More precisely, our findings show that for individuals living in rural area, female or less educated, the propensity to save for health emergencies is respectively about 3, 6 and 4 times higher for mobile money users than for those who are not.

To sum up, our findings taken altogether show interestingly that mobile money technology may help bridge the gap between disadvantaged individuals who have less access to formal financial services and advantaged individuals and may hence foster financial inclusion. Indeed, mobile money appears to be attractive and appropriate for usually excluded groups (rural, female, individuals with less education and those who earn irregular incomes) to build their savings to face unexpected health emergencies[45].

[44] Less educated individuals are those who have primary education level at best (about six years of schooling) and highly educated individuals those with secondary education level or more.

[45] Alternatively, in appendix A.5, we use a survey data conducted on 1,000 people in Burkina Faso available in the Global Financial Inclusion Database (World Bank, 2015) in order to check the robustness of our main findings. While the GFI dataset allows us to replicate our core analysis, it does not however provide some key individual-level characteristics such as location or type of income.

Table 5. Saving choices and mobile money: Low vs. High access to formal financial instruments.

					IV Results			
	Save for health emergencies		Save to develop an activity		Save for health emergencies		Save to develop an activity	
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MM user	0.823		0.043		0.687		0.110	
	(0.544)		(0.468)		(0.587)		(0.533)	
Rural	-13.544		-29.023***		-14.329		-29.288***	
	(9.591)		(8.445)		(9.311)		(8.392)	
MM user x Rural	0.218	1.041*	-0.466	-0.424	0.064	0.751	-0.711	-0.600
	(0.763)	(0.535)	(0.650)	(0.451)	(0.805)	(0.551)	(0.696)	(0.449)
Controls included	YES		YES		YES		YES	
Rural x Controls included	YES		YES		YES		YES	
Observations	352		350		352		350	
Pseudo R2	0.108		0.431		0.098		0.432	
Wald $\chi2$ (H0: nullity of coefficients)	40.49**		495.98***		33.63*		494.89***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	33.30*		239.11***		30.60		239.85***	
% correct prediction (y=1)	84.84%		87.37%		77.42%		85.26%	
% correct prediction (y=0)	42.86%		79.38%		59.52%		81.25%	
Endogeneity test of MM user (H0: Exogeneity)					2.548		0.291	
p-value					0.110		0.590	
Kleibergen-Paap LM test (H0: Underidentification)					245.33		245.33	
p-value					0.000		0.000	

					IV Results			
	Save for health emergencies		Save to develop an activity		Save for health emergencies		Save to develop an activity	
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MM user	-0.017		-0.293		-0.340		-0.404	
	(0.580)		(0.439)		(0.609)		(0.462)	
Female	13.313*		-31.173***		12.863*		-31.064***	
	(6.827)		(7.375)		(6.714)		(7.347)	
MM user x Female	2.041**	2.024***	0.265	-0.027	2.186**	1.846***	0.390	-0.014
	(0.881)	(0.663)	(0.644)	(0.471)	(0.886)	(0.642)	(0.672)	(0.489)
Controls included	YES		YES		YES		YES	
Female x Controls included	YES		YES		YES		YES	
Observations	352		350		352		350	
Pseudo R2	0.147		0.388		0.137		0.388	
Wald $\chi2$ (H0: nullity of coefficients)	42.59***		395.49***		40.96**		397.64***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	43.31***		218.41***		40.67**		218.69***	
% correct prediction (y=1)	82.26%		86.32%		72.26%		86.32%	
% correct prediction (y=0)	47.62%		80.63%		71.43%		80.63%	
Endogeneity test of MM user (H0: Exogeneity)					2.871		0.522	
p-value					0.090		0.470	
Kleibergen-Paap LM test (H0: Underidentification)					234.34		234.34	
p-value					0.000		0.000	

					IV Results			
	Save for health emergencies		Save to develop an activity		Save for health emergencies		Save to develop an activity	
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MM user	0.321		0.036		0.115		0.395	
	(0.564)		(0.430)		(0.603)		(0.443)	
Less educated	-19.899**		-16.608**		-22.051***		-19.086**	
	(7.944)		(7.649)		(7.970)		(7.902)	
MM user x Less educated	1.404	1.725**	-0.405	-0.369	1.207	1.322**	-1.116	-0.721
	(0.905)	(0.708)	(0.696)	(0.547)	(0.896)	(0.663)	(0.708)	(0.553)
Controls included	YES		YES		YES		YES	
Less educated x Controls included	YES		YES		YES		YES	
Observations	355		353		352		350	
Pseudo R2	0.144		0.420		0.128		0.426	
Wald $\chi2$ (H0: nullity of coefficients)	250.04***		255.12***		317.95***		284.15***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	41.78***		231.74***		38.39**		236.76***	
% correct prediction (y=1)	88.50%		84.97%		76.45%		73.16%	
% correct prediction (y=0)	47.62%		81.88%		61.90%		90.00%	
Endogeneity test of MM user (H0: Exogeneity)					2.812		0.270	
p-value					0.094		0.603	
Kleibergen-Paap LM test (H0: Underidentification)					250.08		250.08	
p-value					0.000		0.000	

Note: Dependent variables: save for health emergencies and save to develop an activity. Save for health emergencies takes the value 1 if respondents indicate to save for health emergencies, and 0 otherwise. Save to develop an activity also takes the value 1 if respondents save to develop an activity, and o otherwise. The coefficients reported in the table are the log odds of the use of mobile money on saving patterns. To obtain the odds ratio, we simply compute the exponential of log odds. Standard errors are in brackets. Less educated individuals are those with primary education level or less (about six years of schooling at best). Controls included: age, age squared, married, rural, male, occupation, irregular income, at least one person in charge, education level, income level and income squared. According to the individual-level characteristics used we remove respectively controls rural, male and education level. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

2.6. Why mobile money does increase saving for health emergencies? Discussion of potential mechanisms

One of our main results shows that a simple use/adoption of the mobile money technology increases people propensity to save for health emergencies. This result naturally raises the following question: Why does using mobile money has a positive and significant impact on the propensity to save for health emergencies? – Is it due to the safety, low cost of services, quality and/or accessibility of the mobile money? Since our data do not enable us to conclusively answer this question, we instead discuss in this section some conjectures as to possible answers.

We see two possible reasons why mobile money users are more likely to save for health emergencies than non-users. The *first* is that to save for health emergencies individuals need a saving account that allows them to avoid unneeded expenditures. Individuals hardly resist the temptation to spend on unnecessary items money they have at hand (Banerjee and Mullainathan 2010) which reduces their propensity to face healthcare expenses. The *second* explanation may be that people traditionally rely on saving mechanisms that require high degree of commitment (i.e. ROSCA) whereas saving for unpredictable events requires easy access to liquidity. Indeed, to liquidate land or livestock quickly and costlessly when a shock were to occur is not possible. Therefore, to deal with unanticipated illness shocks people need to save outside these illiquid assets. Mobile money provides people with an individual account that allows them to deposit it for free and securely. The networks of mobile money agents who insure cash in and cash out services allow users to access cash when the need arises. The mobile money providers, however, charge individuals 1% of the withdrawn amount. It is assumed that when individuals decide to save through their mobile money account, this involves implicitly their willing to support withdrawal fees. These fees may therefore play as a commitment which benefits individuals with self-control issues to buildup savings by avoiding unneeded expenditures.

Shefrin and Thaler (1988) show that self-control problems, as a part of a broader set of time-inconsistent preferences, play a key role when studying saving behavior. Self-control implies that the trade-off between short term gratification and long term benefits entails a conflict that manifests through temptations. Individuals usually face “temptation goods” which give utility in the present but not in the future, and “non-temptation goods” which give utility both in the present and the future (Banerjee and Mullainathan, 2010). When people, particularly from

poor countries such as Burkina Faso that we study, spend their money in "temptation goods" such as cigarettes, coffee, and alcohol, it becomes more difficult for them to put aside a portion of their money. Thus, reducing temptation through a commitment saving product should increase savings and consequently increase savers' financial capacity to face unpredictable events. However, the effectiveness of a saving product in overcoming these barriers depends on the type of commitment it provides. Dupas and Robinson (2013b) show that simply providing a saving technology with a soft commitment such as a box with a lock and key allows people to buildup savings for health emergencies. Meanwhile, Ashraf, Karlan and Yin (2010) find that providing individuals with a high commitment saving product affect people savings. They show that saving product that restricts withdrawals until people reach a specific goal or a specified month when large expenditures were expected, for example the beginning of school or Christmas, increased individuals' savings. These findings appear to reflect that soft commitment saving devices may be adequate to plan for unexpected events while a high commitment may be necessary for long term planning savings.

To provide evidence on the potential mechanisms through which mobile money users may have more propensity to save for health emergencies than non-users, we consider our model (2) and use the following specification:

$$PROB\{y_i = 1\} = \Phi(\lambda_1 + \lambda_2 MMuser_i + \lambda_3 Motiv_i + \lambda_4 MMuser_i \times Motiv_i + \lambda_5 Motiv_i \times IC_i + \lambda_6 IC_i) \quad (3)$$

where Φ is the cumulative distribution function of logistic distribution.

We consider the same dependent variable as in equation (2) where y_i stands here only for save for health emergencies. IC_i is similar to the vector for controls in equation (1). $Motiv_i$ is our proxy of the independent variable of interest that we define as individuals' motivations to continue using or start using the mobile money. It derives from the following question *"What are the reasons that could motivate you to continue using or start using the mobile money?"* Each respondent rates the following five motivations: "A safe place to make deposits"; "Low cost of money transfers"; "Possibility of money transfers throughout the country"; "Possibility of money transfers within the sub-region (Ivory Coast)"; "An increase in the number of mobile money agents" using a 5-point Likert scale ranging from 1 (Not at all important) to 5 (Very important). We compute a dummy variable for each motivation which takes the value zero when the rating is

1 or 2 (not at all important and not important), and takes the value one when the rating is 3, 4 or 5 (moderately important, important or very important)[46]. The coefficients of interest are λ_2 and the total effect given by $\lambda_2 + \lambda_4$. If λ_2 and $\lambda_2 + \lambda_4$ are positive and significant, then mobile money increases propensity to save for health emergencies irrespective of the strength of the motivation. If λ_2 is not significant but $\lambda_2 + \lambda_4$ is positive and significant, then mobile money increases this propensity only for users with strong motivation.

Our findings (Table 6) show that the coefficients of interest (total effect) related to the perception of mobile money as a safe place to make deposits and possibility to transfer money within the sub-region are positive and significant (columns 2 and 8)[47]. These findings imply that perception of mobile money as a safe place to make deposits and capable of facilitating money transfers within the sub-region (especially Ivory Coast) may be the channels through which the use of mobile money positively impacts the likelihood to save for health emergencies. By contrast, both coefficients of interest related to the perceptions of mobile money as lowering cost of transfers being positive and significant (columns 3 and 4), it implies that for this motivation, differences in the perception do not distinguish mobile money users' propensity to save for health emergencies.

Overall, our findings suggest that one of the main reasons why mobile money users are more likely to save for health emergencies is because of safety that mobile money provides. These results support the findings of Dupas and Robinson (2013b) which indicate that providing people with a safe place to save increases savings for health emergencies. In addition, the possibility to easily transfer money within the sub-region, especially Ivory Coast, is also a factor that may explain the gap between mobile money users and non-users propensity to save for health emergencies[48]. This is consistent with the findings of Jack and Suri (2014) who show that mobile money increases the likelihood of receiving remittances from greater distances for illness shocks.

[46] Table A.2. presents descriptive statistics of the proxy for the five dummy variables.
[47] Considering the IV approach, we obtain similar conclusions. The results are available upon request.
[48] Mobile money transfers within the sub-region especially Ivory Coast is then an important channel for the large community of Burkinabe immigrants to help family members in case of emergency. For more detail see footnote 4.

Table 6. Impact of usage and perception of mobile money on saving for health emergencies.

	Full sample									
	Save for health emergencies									
	(1)	Total effect (2)	(3)	Total effect (4)	(5)	Total effect (6)	(7)	Total effect (8)	(9)	Total effect (10)
MM user	0.548		3.574**		0.811		-0.060		1.460	
	(1.074)		(1.648)		(1.890)		(1.001)		(1.226)	
Safe place to make deposits	-6.184									
	(6.949)									
MM user x Safe place	0.799	1.347**								
	(1.230)	(0.600)								
Low cost of money transfers			-0.073							
			(0.922)							
MM user x Low cost			-0.688	2.886**						
			(0.423)	(1.242)						
Transfers throughout Burkina Faso					-0.203					
					(0.815)					
MM user x Transfers throughout Burkina Faso					0.004	0.816				
					(0.491)	(1.415)				
Transfer within the sub-region (CI)							-10.356			
							(8.182)			
MM user x Transfer within the sub-region (CI)							1.757	1.697***		
							(1.169)	(0.603)		
Increase mobile money agent									-1.162	
									(0.863)	
MM user x Increase mobile money agent									-0.202	1.258
									(0.380)	(0.877)
Controls included	YES		YES		YES		YES		YES	
Motivation x Controls included	YES		YES		YES		YES		YES	
Observations	351		350		351		351		351	
Pseudo R2	0.175		0.145		0.126		0.164		0.134	
Wald $\chi2$ (H0: nullity of coefficients)	49.79***		43.30**		39.17**		42.13**		43.45**	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	50.52***		43.18**		38.05**		47.87***		40.20**	
% correct prediction (y=1)	72.49%		72.40%		70.55%		84.47%		66.02%	
% correct prediction (y=0)	71.43%		66.67%		64.29%		61.90%		71.43%	

Note: Dependent variable: Save for health emergencies, is a dummy that takes the value 1 if respondents indicate to save for health emergencies, and 0 otherwise. Robust standard errors are in brackets. Controls included: age, age squared, married, rural, male, occupation, irregular income, at least one person in charge, education level, income level and income squared. Table A.2 in the Appendix gives definitions and summary statistics of the independent variables.
*** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Moreover, we examine and confirm the evidence regarding the high propensity of mobile money users to receive money transfers compared to non-users (Appendix Table A.4). One can therefore conjecture that mobile money users may cope with emergencies not only through savings but also through incoming remittances.

2.7. Conclusion

In Burkina Faso as well as in other less developed countries, limited access to formal financial services lead people to rely mainly on informal finance. In the presence of predominant use of informal savings mechanisms, self-insurance against unexpected life events such as health shocks can be unmet. This may lower productivity which in turn negatively impacts the economic activity and growth. In this context, providing people with a convenient device to save can reduce their vulnerabilities to health emergencies. In low income countries, financial access have important implications on people well-being and poverty reduction.

The objective of this paper is to analyze the impact of mobile money as a commitment device on saving behavior. We use an original dataset from a survey we conducted in Burkina Faso using 50% of mobile money users and 50% of non-users. Our results are consistent with previous findings on the effects of commitment devices on the propensity to save for health emergencies. In line with Dupas and Robinson (2013b), we find that the use of mobile money increases the likelihood of individuals to save for health emergencies. Indeed, mobile money users are more prone to save for unexpected health shocks than non-users, while there is no difference between users and non-users of mobile money to save for predictable events. Taking into account disparities in financial access, we show that mobile money increases the propensity of rural, female, less educated and individuals with irregular income to save for health emergencies. In our further investigations, we address the issue about the possible mechanisms or pathways through which using mobile money helps increase the propensity to save for health emergencies. We find that safety and the possibility to transfer money within the sub-region associated with mobile money to count among possible explanations.

The potential for mobile technology and mobile money specifically to transform the lives of the poor, while palpable, is so far little documented. Governments and especially Central

Banks in developing countries have done a lot in this sense to increase the supply of mobile money services throughout the country. However, despite these efforts, mobile money adoption remains low in some countries such as Burkina Faso compared to the success in Kenya or that of the neighbor Ivory Coast. This low adoption may stem from the existing inconsistencies of legal and regulatory framework of electronic money system in Burkina Faso (Musuku et al., 2011). Hence, putting in place consistent policy and regulatory reforms that cover all mobile money services and providers may foster mobile money system development and improve formal financial inclusion. Moreover, specific strategies are needed to increase the access and usage of mobile money. One leverage on which Central Banks may act is through the expansion of electronic money issuers and retailer agents. By doing so, it may reinforce competitiveness in the financial system and hence reduce costs and increase efficiency. The involvement of governments in the development of mobile money can also increase the confidence of the population to adopt this new financial innovation. More specifically, partnerships could be established between governments and mobile money issuers for employee's payments and for the collection of taxes. The traceability of the various operations conducted through mobile money could also be put forward for the credibility of this new system.

Nevertheless, a key outstanding question left for future investigation is what this innovative savings product would do to existing use of financial mechanisms such as the use of informal and formal finance. An empirical study of De Koker and Jentzsch (2013) on the role of transparency in the usage of formal or informal finance in eight African countries finds that a share of the population continues to use informal services despite being "financially included" customers. Hence, an increase in access to formal services such as mobile banking does not necessarily result in an immediate reduction of usage of informal services. Future research is needed to provide evidence on the role of mobile money as a complement or substitute of formal and/or informal finance.

Appendix

Table A.1. Correlation matrix for the full sample.

	Save for unpredictable purposes	Save for health emergencies	Save for predictable events	Save to develop an activity	MM user	Age	Age squared	Married	Rural	Male	Occupation	Irregular income	At least one person in charge	Education	Income	Income squared
Save for unpredictable purposes	1															
Save for health emergencies	0.769	1														
Save for predictable events	-0.006	0.076	1													
Save to develop an activity	-0.108	-0.043	0.535	1												
MM user	0.146	0.151	-0.090	-0.086	1											
Age	0.074	0.125	0.208	0.184	-0.027	1										
Age squared	0.069	0.115	0.200	0.154	-0.045	0.990	1									
Married	0.066	0.089	0.132	0.102	0.131	0.607	0.579	1								
Rural	0.010	0.064	-0.055	0.041	0.146	0.251	0.245	0.226	1							
Male	0.028	0.027	0.020	0.031	0.007	0.267	0.254	0.107	0.032	1						
Occupation	-0.048	0.083	0.256	0.390	-0.078	0.430	0.384	0.348	0.159	0.115	1					
Irregular income	-0.081	-0.006	0.211	0.472	0.043	0.100	0.080	0.106	0.302	-0.096	0.197	1				
At least one person in charge	0.036	0.002	0.061	0.056	0.107	-0.003	-0.009	0.024	-0.030	-0.008	0.047	0.015	1			
Education	0.143	0.074	-0.051	-0.336	0.162	-0.148	-0.139	-0.169	-0.227	0.017	-0.391	-0.358	-0.013	1		
Income	-0.002	0.069	0.206	0.179	0.071	0.441	0.426	0.358	-0.052	0.271	0.342	-0.131	0.055	0.127	1	
Income squared	0.007	0.070	0.201	0.172	0.070	0.427	0.417	0.349	-0.078	0.255	0.297	-0.145	0.063	0.135	0.977	1

Table A.2. Summary statistics and variables description (*Mechanisms*)

Variable	Definition	Obs.	Mean
Proxies of motivations of continue using or start using the mobile money			
Safe place to make deposits	Indicate respondent's perception of mobile money as safe place to make deposits, encoded as (Moderately important, important, and very important) = 1, (Not at all important and not important) = 0	402	0.91
Low cost of transfers	Indicate respondent's perception of mobile money as lowering cost of money transfer, encoded as (Moderately important, important, and very important) = 1, (Not at all important and not very important) = 0	402	0.92
Transfers throughout Burkina Faso	Indicate respondent's perception of mobile money as allowing money transfers throughout Burkina Faso, encoded as (Not at all important) = 1, (Not important) = 2, (Moderately important) = 3, (Important) = 4, (Very important) = 5	403	0.91
Transfers within the sub-region (Ivory Coast)	Indicate respondent's perception of mobile money as allowing money transfers from the sub-region, especially from Ivory Coast, encoded as (Moderately important, important, and very important) = 1, (Not at all important and not very important) = 0	402	0.84
Increase the number of mobile money agents	Indicate respondent's perception of an increase of mobile money agents, encoded as (Moderately important, important, and very important) = 1, (Not at all important and not very important) = 0	403	0.80

Table A.3.1. Correlation matrix (Reduced form).

	Save for health emergencies	MM user	Distance	Age	Age squared	Married	Rural	Male	Occupation	Irregular income	At least one person in charge	Education	Income	Income squared
Save for health emergencies	1													
MM user	0.151	1												
Distance	-0.096	-0.888	1											
Age	0.125	-0.027	0.043	1										
Age squared	0.115	-0.045	0.060	0.990	1									
Married	0.089	0.131	-0.070	0.607	0.579	1								
Rural	0.064	0.146	-0.088	0.251	0.245	0.226	1							
Male	0.027	0.007	0.009	0.267	0.254	0.107	0.032	1						
Occupation	0.083	-0.078	0.069	0.430	0.384	0.348	0.159	0.115	1					
Irregular income	-0.006	0.043	-0.030	0.100	0.080	0.106	0.302	-0.096	0.197	1				
At least one person in charge	0.002	0.107	-0.097	-0.003	-0.009	0.024	-0.030	-0.008	0.047	0.015	1			
Education	0.074	0.162	-0.126	-0.148	-0.139	-0.169	-0.227	0.017	-0.391	-0.358	-0.013	1		
Income	0.069	0.071	-0.043	0.441	0.426	0.358	-0.052	0.271	0.342	-0.131	0.055	0.127	1	
Income squared	0.070	0.070	-0.047	0.427	0.417	0.349	-0.078	0.255	0.297	-0.145	0.063	0.135	0.977	1

Note: Distance is our excluded instrument, the distance to the nearest mobile money agent, that we measure using a 5-point Likert scale, 1 (less than 1 km), 2 (1 to 2 km), 3 (2 to 5 km), 4 (5 to 10 km) and 5 (more than 10 km).

Table A.3.2. Reduced-form regression for predicting mobile money use.

	Full sample
	Mobile money user
Distance	-4.596***
	(0.744)
Age	0.052
	(0.343)
Age squared	-0.002
	(0.005)
Married	2.484***
	(0.939)
Rural	2.101**
	(1.006)
Male	0.116
	(0.747)
Occupation	-0.788
	(0.878)
Irregular income	0.428
	(0.679)
At least one person in charge	-0.457
	(0.584)
Education	1.580***
	(0.510)
Income	0.817
	(1.602)
Income squared	-0.218
	(0.272)
Constant	6.950
	(5.389)
Observations	382
Pseudo R2	0.866
Wald $\chi 2$ (H0: nullity of coefficients)	80.50***
Likelihood ratio test $\chi 2$ (H0: nullity of coefficients)	490.70***
Wald $\chi 2$ (of the coefficient of the excluded instrument)	38.21***
% correct prediction (y=1)	96.37%
% correct prediction (y=0)	96.83%

Note: Dependent variable: MM user is a binary variable. It takes the value 1 if respondents use mobile money, and 0 otherwise. The excluded instrument is the distance to the nearest mobile money agent that is measure using a 5-point Likert scale, 1 (less than 1 km), 2 (1 to 2 km), 3 (2 to 5 km), 4 (5 to 10 km) and 5 (more than 10 km). The Wald test statistic indicates the relevance of our excluded instrument. Stock and Yogo (2002) suggest a test statistic critical value of 16.38. Robust standard errors are in brackets. Controls included: age, age squared, married, rural, male, occupation, irregular income, at least one person in charge, education level, income level and income squared.
*** Significant at the 1% level, ** Significant at the 5% level, Significant at the 10% level.

Table A.4. Receiving money transfers and mobile money. Full sample.

		IV Results
	Receiving money transfers	
	(1)	(2)
MM user	1.828***	2.140***
	(0.287)	(0.319)
Age	0.351***	0.352**
	(0.136)	(0.137)
Age squared	-0.005***	-0.005***
	(0.002)	(0.002)
Married	-0.018	-0.055
	(0.313)	(0.317)
Rural	-1.086***	-1.173***
	(0.310)	(0.322)
Male	0.117	0.095
	(0.261)	(0.266)
Occupation	-1.148**	-1.154**
	(0.523)	(0.527)
Irregular income	0.768**	0.762**
	(0.313)	(0.315)
At least one person in charge	0.086	0.054
	(0.248)	(0.252)
Education	0.127	0.093
	(0.160)	(0.155)
Income	2.353**	2.444***
	(0.914)	(0.944)
Income squared	-0.361**	-0.378**
	(0.150)	(0.155)
Constant	-8.391***	-8.530***
	(2.397)	(2.422)
Observations	374	374
Pseudo R2	0.202	0.220
Wald $\chi 2$ (H0: nullity of coefficients)	63.81***	65.69***
Likelihood ratio test $\chi 2$ (H0: nullity of coefficients)	123.19***	131.99***
% correct prediction (y=1)	74.90%	77.82%
% correct prediction (y=0)	66.67%	70.37%
Endogeneity test of MM user (H0: Exogeneity)		2.297
p-value		0.130
Kleibergen-Paap LM test (H0: Underidentification)		296.19
p-value		0.000

Note: Dependent variable: Receiving money transfers is a dummy variable that equal 1 if respondents receive money transfers, and 0 otherwise. Robust standard errors are in brackets. Controls included: age, age squared, married, rural, male, occupation, irregular income, at least one person in charge, education level, income level and income squared. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

A.5. Impact of mobile money on individuals' saving behavior using an alternative source of data.

We use a survey data conducted on 1,000 people in Burkina Faso available in the Global Financial Inclusion Database (World Bank, 2015) in order to check the robustness of our main findings on the impact of the use of mobile money on individuals' saving behavior. While the database has the advantage of covering the whole country[49], it remains limited in providing individual-level characteristics such as location or type of income but allows us to replicate our core analysis.

Table A.5.1 presents the results of the impact of the use of mobile money on saving behavior using a logit model that mimics our equations (1) and (2) and two dependent variables for save for emergency and save to develop an activity. While the survey does not precisely identify savings for health emergencies, we define a proxy, save for emergency, indicating how individuals cope with an emergency. This proxy is a dummy variable that equals to one if respondents indicate that it is very possible to come up with emergency funds through savings, and equals to zero otherwise. For the second dependent variable, save to develop an activity, we define a proxy that indicates if individuals save to start, operate, or grow a business or farm. This proxy is also a dummy that equals to one if respondents indicate that they saved to start, operate, or grow a business or farm, and equals to zero otherwise. We control for age, gender, education level, and income quintile. Due to lack of data, we only examine the heterogeneity of effects of mobile money on individuals' saving behavior by considering low vs. high income, female vs. male, and less vs. highly educated individuals.

Overall, consistent with our findings, the results show that the use of mobile money increases the propensity of individuals to save for emergencies. The results also show that mobile money increases the propensity to save for emergencies especially for female and less educated individuals supporting our findings on disadvantaged groups.

[49] Individual probability weights are used to make the sample nationally representative.

Table A.5.1. Saving choices and mobile money: using Global Financial Inclusion Database.

	Save for health emergencies						
	Full sample	Low vs. High income		Female vs. Male		Less vs. Highly educated	
			Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MM user	0.945**	0.829**		0.357		0.389	
	(0.378)	(0.405)		(0.450)		(0.473)	
Individuals' characteristics		1.323		-1.685		-0.585	
		(1.705)		(1.963)		(1.956)	
MM user x Individuals' characteristics		0.215	1.044	1.123	1.480**	0.910	1.299**
		(0.802)	(0.692)	(0.780)	(0.637)	(0.765)	(0.601)
Controls included	YES	YES		YES		YES	
Individuals' characteristics x Controls included	NO	YES		YES		YES	
Observations	846	846		846		846	
Pseudo R2	0.078	0.071		0.082		0.085	
Wald $\chi 2$ (H0: nullity of coefficients)	43.26***	47.60***		44.00***		70.98***	
Likelihood ratio test $\chi 2$ (H0: nullity of coefficients)	166.44***	160.24***		170.35***		172.92***	
	Save to develop an activity						
	Full sample	Low vs. High income		Female vs. Male		Less vs. Highly educated	
			Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MM user	0.425	-0.433		0.987*		0.929**	
	(0.473)	(0.474)		(0.586)		(0.473)	
Individuals' characteristics		-1.543		-3.091		0.487	
		(2.367)		(2.656)		(4.245)	
MM user x Individuals' characteristics		2.016**	1.583**	-1.392	-0.405	-0.802	0.127
		(0.921)	(0.789)	(1.005)	(0.816)	(0.875)	(0.736)
Controls included	YES	YES		YES		YES	
Individuals' characteristics x Controls included	NO	YES		YES		YES	
Observations	999	999		999		999	
Pseudo R2	0.096	0.099		0.102		0.098	
Wald $\chi 2$ (H0: nullity of coefficients)	55.40***	44.43***		56.94***		81.45***	
Likelihood ratio test $\chi 2$ (H0: nullity of coefficients)	82.24***	84.66***		87.40***		83.71***	

Note: Dependent variables: save for emergency and save to develop an activity are all dummies. Save for emergency equals to 1 if respondents indicate coming up with emergency funds through savings, and 0 otherwise. Save to develop an activity equals to 1 if respondents indicate save to start, operate, or grow business or farm, and 0 otherwise. The variable of interest, MM user is a binary variable that takes the value 1 if respondents has mobile money account, and 0 otherwise. To obtain the odds ratio, we simply compute the exponential of log odds. Robust standard errors are in brackets. Controls included: age, age squared, female, education level, income quintile and income quintile squared. According to the individual-level characteristics we remove respectively controls income quintile and income quintile squared, female and education level. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

A.6. Transaction fees of mobile money services

Table A.6.1 Fees associated with mobile money cash in / cash out functions and transfers services as of 2013.

Mobile Money	Services	Minimum amount	Maximum amount	Fees (FCFA)
Cash in	*(deposits)*	500	5 000 000	0
Cash out	*(withdrawals)*	500	5 000	350
		5 001	25 000	600
		25 001	50 000	900
		50 001	100 000	1 500
		100 001	200 000	2 000
		200 001	5 000 000	1%
Transfers	*Mobile money user to Mobile money user*	500	10 000	100
		10 001	50 000	200
		50 001	100 000	400
		100 001	300 000	600
		300 001	5 000 000	0,20%
	Mobile money user to Non mobile money user	1 000	5 000	600
		5 001	25 000	900
		25 001	50 000	1 400
		50 001	100 000	2 000
		100 001	200 000	3 000
		200 001	5 000 000	1,50%

Note: This payment system is a combination of a tiered/banded pricing and a percentage based pricing. Throughout, F CFA (Franc of the African Financial Community) refers to the local currency. The exchange rate during the survey period was about 500 F CFA = $1 US.

Table A.7. Access to financial services.

	Burkina Faso	Sub-Saharan Africa	Low income
Account (% age 15+)			
All adults	14.4	34.2	27.5
Women	12.6	29.9	23.9
Adults belonging to the poorest 40%	8.9	24.6	19.4
Adults living in rural area	13.0	29.2	24.8
Financial institution account (% age 15+)			
All adults	13.4	28.9	22.3
Mobile account (% age 15+)			
All adults	3.1	11.5	10.0
Domestic remittances in the past year (% age 15+)			
Sent remittances	18.5	28.7	18.3
Receive remittances	26.7	37.2	25.6
Savings in the past year (% age 15+)			
Saved at a financial institution	8.7	15.9	9.9
Saved using a savings club or person outside the family	18.0	23.9	16.3
Saved any money	50.8	59.6	46.5
Saved for a farm or business	15.3	22.7	16.7

Source: Global Financial Inclusion (Global Findex) Database, World Bank, 2015. Account denotes the percentage of respondents who report having an account (by themselves or together with someone else) at a bank or another type of financial institution or report personally using a mobile money service in the past 12 months.

MOBILE MONEY ADOPTION AND ITS CONSEQUENCES ON USAGE OF FORMAL AND INFORMAL FINANCIAL SERVICES: EVIDENCE FROM A SURVEY

3.1. Introduction

The financial services needs of lower-income people in Africa, which have long been excluded from the formal finance, are receiving an increasing attention from researchers, governments, international organizations and even bank institutions. It is argued that well-functioning financial systems serve a vital purpose, offering savings, credit, payments and risk management products to people with a wide range of needs (Demirgüç-Kunt and Klapper, 2012). In this context, several initiatives have been implemented such as microfinance and post offices or credit unions as suppliers of basic bank services to increase people access to formal finance. Access to formal finance enables households to anticipate, adapt to and/or recover from the effects of shocks in a manner that protects their livelihoods, reduces chronic vulnerability and facilitates growth (Gash and Gray, 2015). However, access to formal financial institutions remains very low in Sub-Saharan Africa. The low network of formal financial institutions, the location of retail outlets in urban areas and the population density are factors among others that explain why poor people living far from financial institutions are less likely to access and use formal financial services (Allen et al., 2014; Beck et al., 2009; Demirgüç-Kunt and Klapper, 2012; Dermish et al., 2012).

Financial exclusion can be defined as a process serving as an obstacle to a social category of the population to have access to formal financial services (Conroy, 2005; Mohan, 2006). It reflects the lack of access of disadvantaged people to appropriate services and formal financial products at low costs, safely and securely. The failure or inequality of access to formal financial services occurs because the informal sector, although risky, remains the main channel through which the majority of population makes deposits[50]. The informal deposit mechanisms consist of deposits at home, accumulation of jewelry or livestock, reliance to deposits collectors or local money-lenders, and/or participating in a rotating savings and credit associations (ROSCAs). The predominance of informal sector in collecting deposits is an important indicator of the inefficiency of formal financial institutions to satisfy the financial needs of the population. Considerations such as gender, geographic isolation or low population density, documentation requirement, and the high cost of formal financial services play an important role in explaining the low access to formal finance in developing countries.

[50] The terminology deposit used throughout the paper stands for payments, transfers and/or savings.

For developing countries, financial development and deepening are likely to have important implications for economic growth and the effectiveness of monetary policy (Carpenter and Jensen, 2002). There is a massive effort underway to harness technology to overcome barriers that prevent poor people to access banking services. In this way branchless banking[51] and mobile money are particularly prominent to potentially improve financial inclusion. As an inclusion instrument, mobile money may be used as an alternative of informal and formal financial services by financially excluded individuals due to the affordability, safety and convenience it provides. The mobile money innovation refers to the use of a mobile phone to perform financial transactions such as remittances, payment of bills, purchase of goods and services, and also savings through cash in and cash out functions. In this regard, the development challenge in promoting financial inclusion lies in the design of financial technologies to meet the needs of the unbanked population.

The use of informal and formal financial instruments to manage finances may affect individuals' inclination to adopt mobile money. Formal financial instruments refer to bank, credit union and microfinance accounts while informal instruments refer to rotating savings and credit associations (ROSCA), deposits at home or under mattress, with a neighbor or in livestock. In developing countries, individuals usually integrate a variety of informal and formal deposit instruments to meet their financial needs. Despite being risky, informal deposit mechanisms are important as they provide financial services that are not covered by the formally regulated and supervised financial services (De Koker and Jentzsch, 2013).

The development strategies of microfinance institutions entail the reduction of the gap in access to formal financial services between urban and rural areas with the priority to reach first disadvantaged groups especially women. Thus, microfinance institutions appear as a substitute of bank institutions particularly for people without access to basic formal financial services and individuals located in remote areas. The formal financial services are subject to laws, regulations and prudential supervision and provide additional advantages to both individuals and the economy. Promoting inclusive finance is critical to enhance efficiency and welfare by facilitating access to appropriate financial services by poor individuals (Sarma and Pais, 2011). It is well

[51] Branchless banking refers to new distribution channels that allow financial institutions and other commercial actors to offer financial services outside traditional bank premises (Dermish et al., 2012).

known that financial development or inclusive financial system requires a transition from the informal to the formal finance. New technologies can particularly help to solve problems arising from weak institutional infrastructure (Klein and Mayer, 2011). Therefore, mobile money can play this key role by providing avenues for secure and safe deposit practices and by facilitating access and usage of a whole range of formal financial services.

In developing countries where access to financial services is very limited, the adoption of mobile money appears as an alternative to formal financial services for disadvantaged individuals. Mobile money not only reduces transaction costs but also greatly increases individuals convenience for cash deposits and withdrawals, and minimizes the need of costly physical infrastructure as well as branch networks (Kendall et al., 2014). There are many non-financial institutions/actors in partnership with licensed banks involved in the supply of mobile money services such as mobile operators (M-Pesa in Kenya and Tanzania), m-payment or e-money issuers (WIZZIT in South Africa, Eko in India) (Mas, 2009). The success of mobile money also relies on retail networks or mobile money agents that interact with mobile money providers and also guarantee the conversion of cash into electronic money and vice versa for customers. Thus, the widespread of mobile money agents who, by the way, must hold sufficient liquidity or e-money to ensure the efficiency of the conversion between e-money and cash, is hence essential for mobile money users to have convenient access to cash in/out options.

A substantial amount of research mainly focuses on the potential implications of mobile money for financial development in developing countries but little investigates its effects on existing informal and/or formal financial services. Dermish et al. (2012) argues that branchless banking takes the advantage of increasingly mobile networks to bring banking services into every day retail stores, thereby alleviating the lack of banking infrastructure in the area where poor people live and work. Mobile money has the potential to enhance the relationship between banks and their clients as customers can guide banks to what their needs are. This may in return allow banks to provide them the right formal financial products (Mas, 2012). Indeed, mobile money allows the excluded from formal financial system to perform financial transactions relatively cheaply, securely and reliably (Demirguc-kunt and Klapper, 2012; Dermish et al., 2012; Mbiti and Weil, 2011). In this perspective, mobile money can be considered as a stepping stone to formal financial services by increasing the likelihood of individuals to use formal deposit

accounts. Mbiti and Weil (2011) show that M-PESA adoption in Kenya reduces monetary and security costs of transferring money compared to traditional tools of money transfers such as Western Union, MoneyGram or transport companies. They also show how M-PESA serves as a storage of value by decreasing the use of informal saving mechanisms such as ROSCA. In the same vein, Morawczynski and Pickens (2009) argue analytically that individuals use M-PESA as a substitute for informal methods of savings, especially keeping money at home. By contrast, De Koker and Jentzsch (2013) who use household surveys conducted in eight African countries find that holding a bank account is not negatively associated with the probability of using informal finance. More specifically, they show that an increase in the access to formal financial services including usage of mobile banking for receipt of salary or income payments has not resulted in a reduction of usage of informal financial services such as membership of savings club.

Our paper contributes to the existing literature in three main ways. First, we test the comparative advantages of mobile money by examining the relative characteristics of both formal and informal financial services (compared to mobile money) that may lead individuals to use mobile money account to make deposits. Second, we analyze the potential of mobile money to enhance formal financial access as a channel that brings out individuals from informal to formal deposit mechanisms. Specifically, we test the capacity of mobile money to increase the likelihood of individuals participating in informal financial mechanisms to make deposits using formal financial instruments, more precisely bank or credit union accounts. Third, as the unbanked are more likely to be individuals with low and irregular incomes, those who live in rural area far from formal financial institutions, or socially excluded like female and less educated, we analyze whether mobile money increases their likelihood to use formal deposit instruments. Hence, we test empirically the effect of the use of mobile money on their likelihood to make deposits in formal financial institutions, namely bank and credit union accounts. Deposits can help smooth low and irregular income patterns and meet individuals spending objectives such as school fees and health expenses. For people who make deposits through informal methods, money security is often a challenge because the manager who collects all members' contributions can be subject to loss or thief. Thus, the need for the safety offered by formal financial institutions is essential. As mobile money provides individuals with a free electronic account that allows them to deposit money, it can be seen as a stable springboard to the path to formal financial inclusion.

To study which comparative advantages explain the mobile money adoption and its effects on the use of informal and formal deposit instruments, we consider a Sub-Saharan African country, Burkina Faso, where mobile money has been recently introduced with the support of government and private sector and met an increasing and rapid adoption by the population.. In fact, Burkina Faso is a country where informal finance dominates the formal system and some initiatives has been implemented to promote access to formal financial services. Mobile money services were introduced in 2012 (Airtel money) and 2013 (MobiCash) and involve licensed commercial banks[52] (Ecobank and BICIAB) in partnership with mobile operators (Airtel and Telmob), and electronic money (e-money) issuers (Inovapay). In this paper, we take advantage of a survey that we conducted between May and June 2014 in Burkina Faso and use a logistic model (as our data are mostly qualitative) to conduct our empirical analysis

Considering the reasons of individuals' usage of mobile money, our results show that the relative higher liquidity and privacy of mobile money compared to both formal and informal financial services and the relative easier access of mobile money compared only to informal financial services are factors that drive individuals' preference to use mobile money services, We then find that mobile money has no effects for our entire sample on the propensity of deposits using informal or formal financial instruments. However, if we focus only on participants in informal mechanisms, we find that mobile money increases their likelihood to make deposits using bank accounts. These results confirm that mobile money has the capacity to improve access to formal finance of individuals using informal mechanisms even if they might as well continue to use informal financial mechanisms. We find similar results when we distinguish disadvantaged from advantaged individuals. Mobile money increases the likelihood of female, irregular income and less educated individuals to make deposits using bank account and in particular credit union account for less educated individuals. Overall, our findings are relevant to understand and identify the behavior of individuals toward different deposit instruments in order to formulate policies for enhancing financial inclusion and poverty reduction.

The paper is organized as follows. In section 2 we present the relative drivers of the adoption of mobile money and its impact on the usage of existent financial services. Section 3

[52] The Central Bank (BCEAO) provides agreement to only financial institutions (commercial banks, e-money issuers) and supervises e-money activities. The compensation of e-money is necessarily held by the commercial banks.

provides the background on mobile money adoption and financial access in Burkina Faso, and also describes our data collection and summary statistics. Section 4 displays our methodology and this with the econometric results in section 5. In section 6 we tackle the potential endogeneity issue and selection bias. We conclude in section 7.

3.2. Research questions

According to the existent literature, mobile money can foster financial inclusion by improving access to basic formal financial services[53]. The changes may not only stem from the way individuals conduct their financial transactions such as remittances but also in their choices of deposit methods. Nevertheless, these effects may also depend on individuals' demographic and socioeconomic characteristics (level and type of income, location, gender, and education level) and their perception of the financial instruments available.

People make deposits for different reasons such as transfers, payments, insurance against emergencies, investment, and social obligation and derive ingenious, often costly mechanisms for those purposes. Individuals are very strategic when cultivating their savings portfolios as a wide range of deposit instruments ranked from informal, semi-formal to formal financial instruments are available to them (Carpenter and Jensen, 2002; Morawczynski, 2009; Robinson and Wright, 2001). The technology of mobile money, which is considered as a new channel to provide financial services, may play a key role in the choices of deposit instruments that people use. In fact, the literature distinguishes two ways through which mobile financial technology affects the usage of existent financial services: the *transformative model* that entails access to formal financial products including transfers and payment through mobile money by the excluded from the formal financial system and the *additive model* indicating the usage of mobile phone as another channel to access an existing formal account (Mas and Porteous, 2015; Porteous, 2006). Our aim is to go beyond this mutually exclusive vision of both models in developing countries

[53] Note that in this article, we distinguish mobile money from formal financial services. The expression formal financial institutions refers to traditional formal financial institutions (such as banks and credit unions) and do not include mobile money which is analyzed separately although it is considered as formal financial services in Burkina Faso.

and assess the potential effects of mobile money on individuals' financial behavior in a country where informal and formal finances co-exist.

3.2.1. What makes mobile money preferable over traditional deposit instruments?

In this section, we address advantages of mobile money relative to other deposit mechanisms which may explain why people prefer using it compared to informal and formal instruments. The choice of using mobile money account to make deposits may stem from the relative advantages that individuals perceive in terms of safety, costs, ease of use, proximity, and possibility of transfers. But other mechanisms could be at work especially individuals' socio-economic characteristics such as gender, education, marital situation, living place or income.

To investigate why people may prefer mobile money, we base our analysis on the five attributes usually cited as factors that lead individuals' choices of deposit instruments between informal and formal financial methods (Allan et al., 2013; Kendall, 2010; Kendall et al., 2011). The *first* is about *access* to formal and informal financial services that represent an important barrier of access to financial services. In developing countries formal institutions require one or more documents necessary to open an account that many people lack such as passports, driver licenses, pays slips or proofs of residence (Beck et al., 2009). Moreover, there are some account maintenance fees or minimum deposit requirements that may be equivalent to 50% of GDP per capita for instance. However, to join an informal deposit mechanism requires approval from the group through substantial screening before deciding whether the individuals can be admitted or not. Indeed, individuals with unpredictable income may be unlikely to make the regular contribution required to members. The introduction of mobile money may solve these barriers related to both formal and informal deposit mechanisms. In fact, to access mobile money services required individuals to own her/his national identity card and a SIM card of the mobile operator provider of mobile money. Furthermore, the access of mobile money may follow three-phase process namely knowledge, possession and use/adoption (Fall et al., 2015). Thus, individuals must know what it is mobile money before owning (possession) and using (adoption) it. As individuals themselves invest in mobile phone/SIM card, they may find mobile money more accessible compared to formal and informal financial mechanisms. The *second* is the *risk*

associated with both formal and informal deposit instruments. Informal deposit mechanisms (e.g. ROSCAs) are found to be quite risky and often incur losses (as members can disband without warning), and proceed outside of the scope of the formally regulated and supervised financial system. While formal deposit instruments which are regulated and supervised financial services tend to be less risky than informal deposit instruments, they are not immune from risk, failure and fraud (Kendall, 2010). Mobile money has the advantage to be secure as it involves banks (in partnership with mobile operators) that are formally regulated and supervised. Moreover, all financial transactions performed through mobile money account are traceable. In this situation, mobile money as well as formal deposit instruments can be preferred as a deposit account according to the relatively high risk associated with informal financial mechanisms. The *third* is the *cost* of financial services that may play a critical role in the choices of deposit instruments. In general, formal financial institutions charge higher fees of transactions and account maintenance to their customers, and the minimum balance requirement leads individuals to prefer informal deposit options that have the advantage to be at lower costs. However, informal deposit mechanisms such as ROSCAs often charge high costs when members face emergencies and need to move ahead in the queue to access their deposits. Thus, as mobile money offers competitive costs compared to both informal and formal finance, this may motivate individuals to use mobile money as a deposit account. The *fourth* is associated with the level of *liquidity* that informal and formal deposit mechanisms provide. For both deposit instruments, liquidity refers to the accessibility or the rapidity with which individuals can access their deposits. In developing countries, accessing deposits made in a formal financial institution is often tedious given the long distance people have to travel to reach an agency and the time they would spend in long queues. Similarly, when participating in a rotating savings groups, members cannot access their deposits when needed according to the preset order for the pot assignment. Therefore, mobile money account appears to be comparatively more appropriate to make deposits given the large network of mobile money agents throughout the country that insures the conversion of electronic money into cash (and vice versa) and allows people to access their deposits when the need arises. The *fifth* relates to the *privacy* of financial services that is associated with informal and formal financial deposit instruments. Privacy is a desirable quality for financial instrument that helps individuals resist the temptation to spend out deposits to assist family or friends (Collins et al., 2009). However, savings groups based on social relationship use social pressure to motivate

Table 1. Comparison of informal, mobile money and formal deposit instruments.

Motivations or reasons	Informal mechanisms	Mobile Money	Formal Institutions (Banks and DFS)
Access	Groups exist everywhere, but are often stratified by gender, ethnic groupings, religion or social status. There may be screening, thus groups do not take on risky members. For instance, those with irregular incomes might be excluded. No education level required. Regular contribution to the pot is required (each month, for example).	No education level required, but knowledge of the use of mobile phone is necessary. No restrictions. Owning a SIM and ID cards are required. No minimum deposit, no account maintenance fees.	Literacy required. No one is excluded, no formal restrictions. Owning ID card is needed. Minimum deposit in the account is required with regular fixed fees for account maintenance.
Risk	Members are subject to disband without warning; they are also subject to covariant risks whereby large shocks could cause default of the group.	Formal deposit guarantee prohibited. All the cash in exchange for electronic money is held by the bank. Sometimes network problems occur.	Formal deposit guarantee prohibited. Some episodes of failure remain in the minds of individuals.
Cost	No fees. Contributions and receiving the pot are made on the basis of meeting. But, high fees are charged to move ahead in the queue.	Relative small fees. Withdrawals, money transfers and payments are charged (relatively lowly) but deposits are free of charge.	High costs of transactions. Withdrawals are charged according to the amount but deposits are free of charge.
Liquidity	Typically, order of payout is fixed. It is difficult for individuals to move ahead in the queue (when more than one member faces emergencies).	Funds may be withdrawn and deposited at the near mobile money agents or respective banks agencies/Constraints due to agent cash or e-money shortage.	Aside long distance, funds may be withdrawn and deposited at agencies.
Privacy	Based on social relationships, share problem with others. Development of community-level solidarity, Social pressure to make regular deposits. Can be used for predictable purposes and in a lesser manner for unpredictable events.	Account is personal, deposit decisions are made on individual basis. Appropriate for unpredictable purposes.	Account is personal, deposit decisions are made on individual basis. Can be used for predictable purposes and in a less manner for unpredictable events.

Source: Authors' analysis. DFS refers to Decentralized Financial System or Microfinance institutions.

members to make regular deposits and often lead members to share problems with others. Moreover, as there is a preset order for the pot assignment all members are informed about who receive the pot. Therefore, after receiving the pot individuals may face many losses by lending the money to family and friends which often do not pay back. By contrast, formal deposit accounts as well as mobile money accounts are safe and personal (as the account is password protected), and allow individuals to determine their own frequency to make deposits. In this way, it seems that privacy may lead individuals to prefer mobile money to informal deposit mechanisms while it may not affect the choice between mobile money and formal financial instruments.

In table 1, we present features of informal, mobile money and formal financial services in a comparative analysis of their relative characteristics in terms of access, risk, cost, liquidity and privacy. Considering access related to each type of deposit instruments, mobile money presents more advantages than other financial services. Mobile money has flexible terms of access while it

requires individuals to have an ID card and to own a SIM card of the mobile operator provider of mobile money services. The liquidity level associated with mobile money is relatively high (accessible anytime and anywhere) compared to those of formal financial instruments, even informal mechanisms as individuals participating in informal saving club have to wait the date they are assigned to receive the pot to get back their deposits. Although participating in informal saving clubs involves high costs for moving ahead to receive the pot in case of emergency, there are no fees of transactions compared to mobile money and formal financial transactions. Informal mechanisms entail more risk than other financial services. For instance, in a saving group, the member who collects each member contributions can be subject to losses or theft, also some savings groups disband without warning the members. Therefore, formal financial accounts as well as mobile money accounts appear more secure and safer than informal financial mechanisms. The mobile money account, through the SIM card, is protected by a PIN (Personal Identification Number) code and all the mobile money deposits (e-money) are held in local currency in the licensed bank. According to the privacy, each deposit instrument presents some advantages and disadvantages. Mobile money and formal deposit instruments have the advantage to be personal and managed by the account owner, while informal deposit mechanisms are based on social relationships implying sharing problems with other members. Furthermore, mobile money appears to be more convenient for accumulating deposits for immediate needs than informal and formal instruments whereas it is the opposite for predictable objectives. While the attributes of alternative/traditional financial services may motivate individuals to use mobile money as a deposit instrument, mobile money may also impact individuals' financial behavior through their choices of combination of deposit instruments.

3.2.2. What are the potential effects of mobile money on the use of traditional deposit instruments?

Less than a quarter of adults in Sub-Saharan Africa have access to formal financial services (International Finance Corporation, 2013). The frequent reasons cited for not using formal financial services include the lack of enough money, the fixed fees and high costs of opening and maintaining accounts, distance and insufficient documentation (Beck et al., 2008;

Demirgüç-Kunt and Klapper, 2012; Honohan and Beck, 2007; Kendall, 2010; Mas, 2010). Indeed, weak financial institutions and the cost of maintaining sufficient physical financial branches in remote areas where unbanked are located also explain the low level of access and usage of formal financial services. Thus, mobile money appears to have the potential to overcome these barriers by facilitating individuals' access to financial services through their mobile phones. In this situation, mobile money may act as a substitute of formal financial services especially for poor people and in unbanked locations.

Additionally, poor people have access, if any, only to informal financial services to manage their finances. For instance, they stash cash at home or under matrass, leaving money with a trusted neighbor, loaning funds to relatives or build assets as buying livestock or jewels. Some individuals pay deposits collectors or deposit their money with local money-lenders (Banerjee and Duflo, 2007). Others voluntarily form savings groups such as rotating savings and credit associations (ROSCAs) that meet at regular intervals and that allow members living or working near each other to lend their deposits to each other on a rotating basis and where each member makes sure that the others make deposits or contribute to the pot. However, when participating in a ROSCA as the order of receipt is typically determined in advance, it is difficult to get deposits when more than one member has specific needs. In addition, rotating savings groups are often functioning outside the scope of the formally regulated and supervised financial system. They involve local tradition as well as mutual trust that members reciprocally place in each other and the agreements underlying these mechanisms are generally verbal and in the case of breach of the agreement, enforcement is informal. Therefore, we assume that disadvantaged individuals may use mobile money as a substitute of informal deposit mechanisms because mobile money is personal, allows individuals to access a safe deposit account without a required minimum balance and to perform financial transactions at relatively low costs and more securely.

A well-developed formal financial system is critical to provide individuals with deposit instruments that allow them to smooth income and consumption over time and make efficient investments in health, education and business. Formal financial services refer generally to services such as lending and savings facilities, payments and remittances services. The institutions involved in formal financial sector differ from countries and consist of banks, post banks, credit unions, and insurance companies and are subject to laws, regulations and prudential

supervision (Demirgüç-kunt and Levine, 2008; De Koker and Jentzsch, 2013; Pande et al., 2012). The agreement between formal financial institutions and their customers are typically governed by formal written contracts, often in the form of standard agreements and are, at least theoretically, enforceable in court. Despite their advantages, access and usage of formal financial services remain limited in developing countries as stated above (section 2.1). In fact, individuals may spend time and money to travel long distance to reach financial branches for deposits or withdrawals (Beck et al., 2008; Christen and Mas, 2009). This situation may induce account owners to decrease the usage of their accounts leading to inactive or dormant accounts. Thus, mobile money may solve these problems by acting as a complement deposit instrument for already account owners. Moreover, several studies document that accessing formal financial instruments help individuals to make deposits securely, increases their productive investment, private expenditures and allows them to build a relationship with the formal institutions to access credit in the future (Dermish et al., 2012; Dupas and Robinson, 2013; Morawczynski, 2009; Shem et al., 2012). Therefore, increasing individuals' access to mobile money may help individuals build strong resilience by providing them additional secured means of deposits and enhance their livelihoods strategies.

Furthermore, in developing countries, individuals use a combination of a variety of deposit mechanisms to manage their incomes and to meet their financial needs (Carpenter and Jensen, 2002; Gash and Gray, 2015; Kendall, 2010; De Koker and Jentzsch, 2013; Morawczynski, 2009). The usage of mobile money as a deposit instrument seems to depend on the degree of commitment it provides. As informal deposit mechanisms are illiquid, individuals participating in informal financial mechanisms may additionally use mobile money that is more liquid and seems to be convenient for short term deposits and appropriate to face unpredictable life events. We assume that while informal deposit mechanisms remain risky, the use of mobile money may not lead to an immediate reduction of participating in informal mechanisms. Therefore, one may consider that mobile money may be use in addition to informal financial mechanisms that are illiquid and may be appropriate for long term deposits.

To sum up, the rapid adoption of mobile money and its relative advantages compared to the informal and formal financial mechanisms raise the following questions that our paper aims to investigate:

(i) *What are the factors related to traditional informal and formal deposit instruments that may lead individuals to use mobile money?*

(ii) *How mobile money may impact the usage of the informal and formal deposit instruments?*

3.3. Financial access strands and data collection

3.3.1. Background on mobile money, formal and informal systems in Burkina Faso

Burkina Faso is one of the poorest countries in Sub-Saharan Africa, with a GDP per capita at around 761 USD and with 44.6 percent of the population living on less than $2/day international poverty line (Gash and Gray, 2015). Access to formal financial services in Burkina Faso, as in most low-income countries, remains limited. In fact, formal and informal financial mechanisms co-exist in the country. While growing, the formal systems remain largely dominated by the informal sector as most of the population access financial services from it (Gash and Gray, 2015). The formal financial sector is still in its infancy and comprises of 13 commercial banks, and 4 financial societies including insurance, lending and leasing institutions. The network of bank branches that consists of around 244 branches and 305 ATM (BCEAO, 2014) is concentrated in urban areas and mainly serves individuals with high and regular income.

The existence of an extensive population involving in informal deposit mechanisms represents an important opportunity for formal financial intermediaries. In this context, decentralized financial systems (DFS) or microfinance institutions including credit unions, post offices and cooperatives play an important role in providing excluded individuals with financial services such as deposit accounts, loans, insurances and financial transactions including payments, pensions and money transfers. They represent an important channel for mobilizing individual savings and reaching the excluded from the banking sector especially small/medium enterprises and disadvantaged individuals with tools of deposits and facilities to access credit (Gash and Gray, 2015; Nair and Kloeppinger-Todd, 2007; Thieba, 2013). There is around 64

decentralized financial systems[54] with 285 main agencies and 349 sub-agencies throughout the country (AP/SFD-BF, 2014).

All these formal financial institutions (banks and decentralized financial institutions) are monitored and supervised by the Central Bank (BCEAO) and the Ministry of Economy and Finances through State Treasury. According to the Global Findex[55] (Global Financial Inclusion Database, 2015) around 13% of population in Burkina Faso have an account at a formal financial institutions. It also reports that while 51% declare to have saved in the past years only 9% did it in formal financial institutions compared to 42% who used informal mechanisms of which 18% saved using a savings club or a person outside the family. This report illustrates the predominance of the informal mechanisms in the country.

To promote financial inclusion in the WAEMU, of which Burkina Faso is one of the eight member countries, the BCEAO cheered several initiatives[56] on the issue of electronic money to take advantage of the opportunities of new technologies. Thus, the Central Bank allows the entrance in the banking system of new players such as issuers of electronic money and especially mobile network operators in partnership with banks to offer mobile money services. The Central Bank provides agreement for the activity of mobile money to banks and electronic money issuers. In Burkina Faso, there are two mobile money services: "Airtel Money" launched in 2012 by the licensed bank EcoBank-Burkina in partnership with Airtel a mobile operator, and "MobiCash" launched in 2013 by the licensed bank BICIAB in partnership with the mobile operator Telmob. The subscription to mobile money services requires people to have a SIM card of the mobile operator and a national ID card. Although there is no fee to access mobile money account, an initial deposit of 500 FCFA (about $1 US) is required. Individuals owning a mobile money account have the possibility to link their mobile money account to their bank account (in the respective licensed banks) that pays interest on account balances. Since the launch of mobile money, the takeoff remained modest around 5% of the adult population which can be explained by the idea of Mas and Porteous (2015) that the usage of new platforms as mobile money can

[54] These data include the RCPB (le Réseau des Caisses Populaires du Burkina Faso), a credit union that provides formal financial services that cover all the 45 provinces of the country with 185 counters in 2013. For more details, see the RCPB website: www.rcpb.bf.
[55] The data are collected for the year 2014.
[56] These initiatives include internet banking, prepaid card, and in particular the mobile money to increase competitiveness in the banking sector.

accelerate dramatically but rapid takeoff may not be the norm and overcoming customer caution and resistance to change will take patience and experimentation. All the electronic money issued has a counterparty of the same value held in a "trust" account at the licensed bank for the security of mobile money owners. The network of mobile money agents, that insures the conversion of mobile money into cash and vice versa, has expanded since the launch of mobile money services from 483 in 2012 to 3,688 in 2014 (Financial Access Survey, IMF, 2015).

3.3.2. Data collection and summary statistics

Data collection

We use a hand-collected data from a survey that we designed and conducted in May 2014 that consists of 500 randomly selected individuals across the central region of Burkina Faso. The target population includes 50% of users and 50% of non-users of mobile money[57] and allows us to capture the impact of mobile money on the choices of deposit instruments made by users compared to non-users.

Summary statistics

The descriptive analysis (Table 2) of the choices of deposit instruments reveals that 49% of individuals make deposits using credit union account, 42% participate in informal deposit mechanisms, 40% use bank account and 40% use their mobile money account. Regarding the gender, female have less likely to use bank account to make deposits with 42% compared to male with 58%. Yet, female are more engaged in informal mechanisms for deposits with about 64% compared to 36% for male stressing out the disadvantage of female to access formal financial account for deposits compared to male. According to the living place, individuals located in rural areas are less likely to make deposits using bank account because bank institutions are more concentrated in urban than in rural areas. We show that among individuals that make deposits using bank account 43% are located in rural areas while 57% are urban. However, as an

[57] For details about how the survey was designed and conducted; e.g.: the randomization procedure and the population targeting, please see Ky et al. (2015, section 3.2., p.13).

alternative to bank institutions, credit unions and mobile money are more accessible due to their availability in remote areas across the country. In our sample, there is 60% of users of mobile money for deposits located in rural compared to 40% in urban areas. By contrast, we find that the use of informal deposits mechanisms is more common in urban than rural areas that may stem from the fact that in urban areas people are more likely to get stable and predictable income than in poor rural areas. The data show that among users of informal deposits mechanisms 70% are urban compared to 30% of rural. The level and type of incomes also drive some differences in the choices of deposit instruments. Across deposit instruments considered, there are around 27% of low income[58] compared to 73% of high income who use bank account and 40% compared to 60% for mobile money account. Nonetheless, low income individuals have more likely to use informal mechanisms to make deposits than high income individuals with respectively 61% of low income compared to 39% of high income. Regarding the type of income, individuals with unpredictable income are less likely to use bank account than regular income individuals. Thus, there is 30% of irregular income individuals making deposits using bank account compared to 70% of regular income.

Considering the combination of deposit instruments, our statistics reveal that among individuals that make deposits using a bank account, 51% use a credit union account, 49% use mobile money account and 33% participate in informal deposit mechanisms. Indeed, individuals who use a credit union account to make deposits tend to also use informal deposit mechanisms 48%, then mobile money account 43% and bank account 41%. Individuals using mobile money account to make deposits are more likely to be formal included individuals with 53% that use a credit union account, 48% use a bank account and 35% informal deposit mechanisms. Finally, among individuals who use informal deposit mechanisms a large part use credit union account 56%, while 34% use mobile money account and 31% use bank account.

[58] Low income consist of income ranging from 10,000 to 50,000 FCFA; and high income consist of income more than 50,000 FCFA.

Table 2. Data sample characteristics: choices of deposit instruments.

	Full sample	Mobile Money user	Individuals that report			
			Deposit using bank	Deposit using credit union	Deposit using MM	Deposit using informal
Full sample		50%	40%	49%	40%	42%
Gender						
female	49%	49%	42%	51%	45%	64%
male	51%	51%	58%	49%	55%	36%
Marital situation						
Married	48%	55%	58%	53%	58%	40%
Single	51%	45%	42%	47%	42%	60%
At least one person in charge	52%	52%	57%	56%	58%	57%
Age						
< 30	51%	49%	39%	48%	47%	63%
>= 30	49%	51%	61%	52%	53%	37%
Education level						
Less than secondary education level	42%	36%	20%	42%	35%	44%
At least secondary education level	58%	64%	80%	58%	65%	56%
Living place						
Rural	52%	59%	43%	52%	60%	30%
Urban	48%	41%	57%	48%	40%	70%
Occupation/employment status						
Paid activity	81%	77%	84%	87%	79%	83%
Unpaid activity (include student)	16%	18%	16%	13%	21%	17%
Income level and type						
Income ranging from 10,000 to 50,000 FCFA	49%	44%	27%	42%	40%	61%
Income more than 50,000 FCFA	51%	56%	73%	58%	60%	39%
Irregular income	48%	50%	30%	55%	52%	45%
Regular income	52%	50%	70%	45%	48%	55%
Usage of mobile technology						
Mobile phone user	99%	99%	99%	100%	99%	99%
MM user	50%	/	58%	50%	98%	43%
Usage of deposit instruments						
Formal	89%	95%				
Bank	40%	46%		41%	48%	31%
Credit Union	49%	49%	51%		53%	56%
Mobile Money	40%	78%	49%	43%		34%
Informal	42%	36%	33%	48%	35%	

Source: Authors' analysis of the survey data collected in May 2014 in Burkina Faso. Throughout, F CFA (Franc of the African Financial Community) refers to the local currency. The exchange rate during the survey period was about 500 F CFA = $1 US.

3.4. Model specification

To provide evidence on *the reasons described above (section 2.1), namely the attributes of formal and informal financial mechanisms that may motivate the use mobile money account to make deposits*, we use our sample of mobile money users and consider the following logistic model specification:

$$PROB\ \{DMM_i = 1\} = \Phi(\lambda_1 + \lambda_2\ \text{Re}\ lative_attribute_{i,j,m} + \lambda_3 X_i) \qquad (1)$$

where Φ *is the cumulative distribution function of logistic distribution.*

In equation (1), DMM_i, deposits made using mobile money account, is the dependent variable. It is a binary variable that indicates the response of individual (*MM user*) i to the following question: *"During the past 12 months, did you deposit your money in your mobile money account?"* It is encoded as one if the mobile money user i response is YES, and encoded zero if the response is NO. X_i is a vector of control variables (age, marital situation, location, gender, occupation or employment status, at least one person in charge, education level, level and type of income). $\text{Re}\ lative_attribute_{i,j,m}$ is the independent variable of interest calculated based on the access[59], risk, cost, illiquidity and privacy related to mobile money, formal and informal financial mechanisms and that may influence the decision to make deposits in the mobile money account. In fact, we compare individuals' perceptions of risk, cost, illiquidity and privacy associated with formal and informal financial mechanisms to those related to the mobile money. Thus, we compute our set of relative attribute[60] as follows:

$$\text{Re}\ lative_attribute_{i,j,m} = \frac{Attribute_{i,j}}{Attribute_{i,m}} \qquad \text{(for } cost\ and\ risk\text{)}$$

$$\text{Re}\ lative_attribute_{i,j,m} = \frac{Attribute_{i,m}}{Attribute_{i,j}} \qquad \text{(for } access,\ liquidity\ and\ privacy\text{)}$$

[59] Note that we do not compute the relative access of mobile money compared to informal mechanisms due to lack of data.

[60] All the variables are measured on a 5-point Likert scale ranging from one (low) to five (high). Summary statistics are reported in Table 3.

Where i stands alternately for: access, risk, cost, liquidity and privacy; j stands for: formal and informal financial mechanisms; and m stands for mobile money. For instance, to obtain the relative attribute *risk or cost* related to formal financial institutions compared to those of mobile money, we divide individual perception of risk or cost related to formal financial methods by her/his perception of risk or cost related to mobile money account. While for the relative attribute *access, liquidity or privacy* we divide the level of access, liquidity or privacy related to mobile money compared to those of formal and informal mechanisms. Hence, the relative access, liquidity and privacy obtain are ranging from low (meaning higher access, liquidity and privacy) to high (lower access, liquidity and privacy). In Table 3 we report definitions of variables along with some summary statistics.

From the estimation of our equation (1), a positive coefficient of risk or cost implies that the level of risk or cost associated with formal or informal mechanisms drive individuals preference to use mobile money. While a negative coefficient of access, liquidity or privacy reflects that lower access, liquidity or privacy related to formal or informal mechanisms lead individuals to use mobile money.

The use of mobile money may in turn has an impact on individuals' portfolio of financial instruments especially in a country where both informal and formal financial services co-exist. For the purpose of this paper, it is worthwhile to distinguish banks from credit union as formal financial institutions for at least two reasons: *first*, the network of bank branches is concentrated in urban areas and mainly serves individuals with high and regular income as it is costly to collect small and irregular income through physical infrastructure (Dermish et al., 2012). By contrast, credit union institutions' coverage of the country is comparatively large and mainly target disadvantaged individuals or those located in remote areas[61]. In this context, we may assume that the use of mobile money differently affect the way individuals use their credit union or banking accounts depending on their demographic and socioeconomic characteristics. *Secondly*, while there is no link between the mobile money account and credit union account, the issuers of mobile money services are licensed banks (Ramada-Sarasola, 2012). Mobile money is therefore fully embedded within the banking services sector although the mobile money account is

[61] Details about the differences in coverage and client targeting between bank and credit union institutions in Burkina Faso are provided in the above section 3.1.

managed by a third party; usually mobile network operators. In the case of Burkina Faso, the model of mobile money allows already banked individuals to make transactions between their mobile money account and their banking account which may increase their likelihood to make deposits in their banking account. In this context mobile money account appears to serve as a complement of the bank deposit account especially for individuals with high and regular income, male, highly educated and located in urban area where banks are concentrated (Allan et al., 2013; Demirgüç-Kunt et al., 2013; Karlan et al., 2014; Morawczynski, 2009; Triki and Faye, 2013). However, Morawczynski (2009) shows that some individuals may not use mobile money as a deposit account because they already access and use other deposit mechanisms that meet their needs. In addition, some banked individuals find mobile money account not appropriate for big deposits, and others may want to build a relationship with the bank institution to access credit in the future. Thus, its effects may be lesser or null on the behavior of individuals who already have access to a bank deposit account.

Thus, we examine *the impact of mobile money usage on individuals' choices of deposit instruments* by using a logistic model specified as follows:

$$PROB\left\{y_i = 1\right\} = \Phi\left(\alpha_1 + \alpha_2 MMuser_i + \alpha_3 X_i\right) \qquad (2)$$

where Φ *is the cumulative distribution function of logistic distribution.*

In the model (2), y_i stands for our dependent variable that characterizes individuals' choices of deposit instruments. It is dummy variable that alternatively stands for: deposit using formal[62] instruments, deposit using a bank account, deposit using a credit union account, deposit using a mobile money account and deposit through informal mechanisms. These dependent variables, except deposit using formal instruments, are measured using the following questions: "*During the past 12 months, did you make deposits using a bank account?"; "using a credit union account?"; "using a mobile money account?"; "participating in informal mechanisms?*"

[62] In this paper, formal deposit instruments are a combination of bank and credit union accounts. This variable takes the value one if the respondent reports to make deposits using a bank account and/or a credit union account, and takes the value zero otherwise.

Table 3. Definitions of variables.

Variable	Definition	Obs.	Mean
Mobile money user (MM user)	Reply to the question: Do you use mobile money services? Encoded as yes = 1, no = 0	405	0.50
Deposit using mobile money account	Reply to the question: During the past 12 months, did you deposit your money using your mobile money account? Encoded as yes = 1, no = 0	401	0.41
Deposit using formal institutions	Indicate when respondents deposit their money using formal institutions, encoded as (deposit using banks and/or credit unions) = 1, others = 0	402	0.69
Deposit using bank account	Reply to the question: During the past 12 months, did you deposit your money using a bank account? Encoded as yes = 1, no = 0	402	0.40
Deposit using credit union account	Reply to the question: During the past 12 months, did you deposit your money using a credit union account? Encoded as yes = 1, no = 0	402	0.50
Deposit using informal mechanisms	Reply to the question: During the past 12 months, did you deposit your money using informal mechanisms? Encoded as yes = 1, no = 0	402	0.42
Participating in informal mechanisms	Reply to the question: During the past 12 months, did you participate in informal mechanisms? encoded as yes = 1, no = 0	402	0.45
Factors related to formal financial mechanisms compared to mobile money			
Access to mobile money/Formal	Indicate the perception of access to mobile money compared to formal mechanisms, encoded as (higher access) = 0.2, (Lower access) = 5	398	1.21
Risk of formal/mobile money	Indicate the perception of risk associated with formal mechanisms compared to mobile money, encoded as (lower) = 0.33, (Higher) = 3	150	1.03
Cost of formal/mobile money	Indicate the perception of costs associated with informal mechanisms compared to mobile money, encoded as (Lower) = 0.5, (Higher) = 4	150	1.46
Liquidity of mobile money/formal	Indicate the perception of liquidity associated with mobile money compared to informal mechanisms, encoded as Lower (Liquid) = 0.33, Higher (Illiquid) = 2	151	0.67
Privacy of mobile money/formal	Indicate the perception of privacy associated with mobile money compared to informal mechanisms, encoded as Lower (Higher privacy) = 0.2, Higher (Lower privacy) = 5	361	1.04
Factors related to informal financial mechanisms compared to mobile money			
Relative risk of informal/mobile money	Indicate the perception of risk associated with informal mechanisms compared to mobile money, encoded as (lower) = 0.33, (Higher) = 5	95	1.76
Cost of informal/mobile money	Indicate the perception of costs associated with informal mechanisms compared to mobile money, encoded as (Lower) = 0.33, (Higher) = 5	94	1.11
Liquidity of mobile money/informal	Indicate the perception of liquidity associated with mobile money compared to informal mechanisms, encoded as Lower (Liquid) = 0.2, Higher (Illiquid) = 1.5	94	0.64
Privacy of mobile money/informal	Indicate the perception of privacy associated with mobile money compared to informal mechanisms compared, encoded as Lower (Higher privacy) = 0.2, Higher (Lower privacy) = 2.5	369	0.88
Individuals' characteristics			
Age	Indicate the age of respondent	404	30.55
Male	Indicate the gender of respondent, Encoded as Male = 1, Female = 0	405	0.51
Married	Indicate the marital situation of respondent, Encoded as Married = 1, Single = 0	405	0.48
At least one person in charge	Indicate if the respondent has or has not dependent, Encoded as Having dependent = 1, otherwise = 0	401	0.53
Education	Indicate the education level of respondent, Encoded as Illiterate = 1, Primary = 2, Secondary = 3, University = 4	402	2.67
Rural	Indicate the location of respondent, Encoded as Rural = 1, Urban = 0	405	0.52
Occupation	Indicate the employment status of respondent, Encoded as (Employed, Entrepreneur, Merchant, Farmer) = 1, (Unemployed, Student) = 0	391	0.84
Income	Indicate the monthly income of respondent, encoded as Less than 10,000 FCFA = 1, 10,000 to 50,000 FCFA = 2, 50,000 to 150,000 FCFA = 3, 150,000 to 300,000 FCFA = 4, 300,000 to 500,000 FCFA = 5, More than 500,000 FCFA = 6	405	2.61
Irregular income	Indicate the type of income of respondent, encoded as Irregular = 1, Regular = 0	403	0.48

Note: Throughout, F CFA (Franc of the African Financial Community) refers to the local currency. The exchange rate during the survey period was about 500 F CFA = $1 US.

All these variables[63] are dummies and each variable takes the value one if respondent reports YES, and zero if respondent reports NO. $MMuser_i$ is the independent variable of interest that stands for the use of mobile money. It is a binary variable that takes the value one if the respondent indicates using mobile money, and zero otherwise. X_i represents the same set of control variables used in equation (1) (age, marital situation, location, gender, occupation or employment status, at least one person in charge, education level, level and type of income).

If mobile money users are more (less) likely to make deposits using a given deposit instrument (informal and/or formal) than non-users, the coefficient α_2 should be positive (negative) and statistically different from zero implying that the mobile money account acts as a complement (substitute) of this deposit instrument.

3.5. Results

Table 4 presents the results of the impact of the relative attribute of respectively formal and informal deposit mechanisms compared to mobile money on the likelihood of individuals to make deposits in the mobile money account. Considering factors related to formal financial institutions, the results show that the relative access, cost, liquidity and privacy have significant impact on the use of mobile money. Thus, individuals who find mobile money easier to access than formal financial services, are more likely to use mobile money account for deposits than those who do not. In addition, individuals associating higher cost to formal financial services compared to mobile money have greater likelihood to use mobile money account for deposits. Moreover, individuals who consider higher liquidity and privacy related to mobile money compared to formal financial instruments, have greater propensity to make deposits in the mobile money account. Therefore, individuals may prefer to use mobile money account for deposits than formal financial institutions due to the relative low fees of transactions and the convenience that mobile money provides. Regarding the relative attribute of mobile money compared to informal financial mechanisms, we find that liquidity and privacy are attributes that appear to matter. Individuals who relate mobile money to higher liquidity and privacy compared to informal financial methods may prefer the first to make their deposits.

[63] Table 3 reports definitions of variables along with some summary statistics.

Table 4. Factors affecting the choices of making deposit using mobile money account[64].

	Sample of mobile money users								
	Deposit using mobile money account								
	Relative attribute of formal/mobile money					Relative attribute of informal/mobile money			
	Access	Risk	Cost	Liquidity	Privacy	Risk	Cost	Liquidity	Privacy
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Relative attribute	-1.106**	0.252	4.135***	-3.338***	-2.225**	0.694	1.178	-3.649**	-1.935**
	(0.524)	(0.784)	(1.327)	(0.967)	(0.916)	(0.427)	(1.213)	(1.611)	(0.823)
Controls included	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	189	145	145	145	171	73	72	72	178
Pseudo R2	0.193	0.110	0.303	0.2023	0.1474	0.383	0.373	0.3951	0.1776
Wald $\chi2$ (H0: nullity of coefficients)	35.53***	17.07	25.96**	31.67***	26.03***	27.25***	26.78***	19.82**	38.86***
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	48.51***	426.02***	451.12***	437.99***	401.23***	487.73***	487.29***	489.21***	392.14***
% correct prediction (y=1)	83.22%	97.52%	96.69%	95.87%	97.84%	92.31%	92.16%	90.20%	96.45%
% correct prediction (y=0)	62.50%	8.33%	45.83%	25.00%	15.63%	61.90%	61.90%	66.67%	27.03%

Note: Dependent variables: deposit using mobile money account is a dummy that takes the value 1 if respondents make deposit using mobile money account, and 0 otherwise. Robust standard errors are in brackets. We use a logistic model specify in equation (3). Controls included: age, age squared, married, rural, male, occupation, irregular incomes, at least one person in charge, education level, incomes level and incomes squared. Table 3 gives definitions and summary statistics of the attributes of formal and informal financial mechanisms that consist of access, risk, cost, liquidity and low privacy. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

These findings support the fact that making deposits using informal mechanisms such as savings groups makes difficult the access to money when a need arises. Furthermore, the fees related to formal account and the low level of branches might also lead individuals to choose other deposit instruments. In fact, Christen and Mas (2009) describe that informal savings remain unreliable and illiquid and that the channel of mobile phone to offer financial services may provide more convenience to people finances management. Kendall et al. (2011) argue that formal financial institutions are loath to enhance banking infrastructure to serve poor people with greater deposit need at cheaper costs. They document that mobile money have the potential to solve these barriers by giving a cheaper way to offer financial services, that is available, at low cost and liquid through a dense network of outlets. Thus, individuals may prefer mobile money account that is personal, cheap and appropriate to avoid unneeded expenditures and to access their deposits when the need arises. As individuals use their mobile money account to make deposit, this could affect the combination of existent financial instruments that they may use.

[64] We also analysis the impact of individuals' characteristics on deposits using mobile money account. The results are reported in Appendix Table A.5.

Table 5 presents estimates of the consequences of the use of mobile money on individuals' choices of deposit instruments. As a starting point, we simply analyze the propensity of mobile money users compared to non-users to make deposits using formal and/or informal financial mechanisms. Across the columns, we find a significant impact of mobile money only in column 4. Expectedly, we find that mobile money users are more likely to make deposits in mobile money account than non-users. Indeed, Mbiti and Weil (2011) and Mas and Mayer (2011) description of the mobile money account emphasize that it is used to make deposits for forward payments or future purposes. However, we find no difference in the likelihood of mobile money users compared to mobile money non-users to make deposits in formal institutions (for both banks and credit unions) or using informal deposit mechanisms. Prior the detail of the next step of our investigation, we briefly discuss hereafter our control variables, i.e. the effect of socioeconomic characteristics on individuals' choices of deposit instruments.

Regarding deposit using formal financial institutions (columns 1 to 3), we find that a household of more than one individual, *married*, has higher likelihood to make deposits using formal instruments especially credit union account than a single individual. We also find that a higher education level increases the propensity of individuals to make deposits using formal financial institutions, especially bank. Similarly, a higher income[65] increases the propensity to make deposits using formal financial institutions especially credit union account. The reported results also show that *irregular income* individuals have lower likelihood to make deposits in banks but are more likely to make deposits in credit union and mobile money accounts than regular income individuals. In column 4, the results show that individuals who are married, male, irregular income and highly educated individuals have more propensity to make deposits using mobile money account. Whereas, individuals with paid activity have lower propensity to make deposit using mobile money account than without paid activity. In column 5, the results indicate that while individual with paid activity are more likely to make deposit using informal mechanisms, rural, male and high education level individuals have lower propensity to make deposit using informal mechanisms.

[65] The variable *income* is included in a nonlinear form (income and income squared) to highlight how an increase in the income affects individuals choices of deposit instruments. Our results show that after a certain threshold, an increase in the income leads individuals to diversify their deposits in other instruments possibly to lessen the risk related to each type of deposit instruments.

Table 5. Choices of deposit instruments and mobile money adoption.

	Full sample				
	Deposit using formal financial institutions			Deposit using mobile money	Deposit using informal mechanisms
	Bank and/or Credit union	*Bank*	*Credit union*		
	(1)	(2)	(3)	(4)	(5)
MM user	-0.165	0.374	-0.111	5.167***	-0.233
	(0.283)	(0.298)	(0.236)	(0.610)	(0.266)
Age	-0.038	0.115	-0.094	-0.034	-0.0264
	(0.154)	(0.159)	(0.129)	(0.218)	(0.136)
Age squared	0.001	-0.001	0.001	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Married	0.901**	0.293	0.587**	1.270***	-0.054
	(0.374)	(0.396)	(0.284)	(0.425)	(0.310)
Rural	0.268	-0.450	-0.149	0.246	-1.941***
	(0.303)	(0.318)	(0.238)	(0.389)	(0.281)
Male	-0.054	-0.097	-0.180	0.661*	-0.997***
	(0.274)	(0.280)	(0.227)	(0.367)	(0.256)
Occupation	0.157	-0.205	-0.032	-1.224**	0.665*
	(0.461)	(0.508)	(0.407)	(0.593)	(0.403)
Irregular income	-0.276	-0.960***	0.756***	0.731*	-0.0460
	(0.307)	(0.302)	(0.250)	(0.382)	(0.283)
Person in charge	0.299	0.338	0.305	0.132	0.400
	(0.263)	(0.274)	(0.215)	(0.356)	(0.249)
Education	0.840***	1.141***	0.123	0.475*	-0.298*
	(0.190)	(0.233)	(0.145)	(0.252)	(0.166)
Income	2.921***	0.415	2.101**	1.790	-0.732
	(0.704)	(1.201)	(1.018)	(1.123)	(0.959)
Income squared	-0.341***	0.144	-0.310*	-0.273	0.0470
	(0.112)	(0.225)	(0.183)	(0.190)	(0.166)
Constant	-6.504***	-8.226***	-2.076	-6.997**	3.744
	(2.430)	(2.747)	(2.243)	(3.249)	(2.423)
Observations	379	379	379	378	379
Pseudo R2	0.1975	0.3359	0.0488	0.5893	0.211
Wald $\chi 2$ (H0: nullity of coefficients)	63.97***	77.95***	23.79**	114.07***	89.81***
Likelihood ratio test $\chi 2$ (H0: nullity of coefficients)	128.93***	200.71***	57.56***	331.92***	138.57***
% correct prediction (y=1)	68.28%	66.45%	58.85%	94.16%	78.40%
% correct prediction (y=0)	76.58%	86.61%	62.03%	84.38%	63.13%

Note: Dependent variables: deposit using formal financial institutions, deposit using a bank account, deposit using a credit union account, deposit using a mobile money account and deposit using informal mechanisms are all dummies. Deposit using formal financial institution equals 1 if respondents make deposit using bank account and/or credit union account, and 0 otherwise. Deposit using a bank account equals to 1 if respondents make deposit using bank account, and 0 otherwise. Deposit using a credit union account equals to 1 if respondents make deposits using a credit union account, and 0 otherwise. Deposit using a mobile money account equals to 1 if respondents make deposits using mobile money account, and 0 otherwise. Deposit using informal mechanisms equals to 1 if respondents make deposits using informal mechanisms, and 0 otherwise. The variable of interest, MM user is also a dummy that equals to 1 if respondents use mobile money, and 0 otherwise. The coefficients reported in the table are the log odds of the use of mobile money on the choices of deposit instruments. To obtain the odds ratio, we simply compute the exponential of log odds. Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Globally, we do not find evidence of the effects of the use of mobile money on making deposit using formal financial institutions or informal mechanisms. Despite this lack of effects related to the use of mobile money, we consider in further analysis individuals participating in informal mechanisms to genuinely show to what extent mobile money may bring out individuals from informal deposit mechanisms toward formal deposit instruments.

To do so, we investigate whether *the use of mobile money increases the likelihood of participants in informal deposit mechanisms to make deposits in formal financial institutions, both banks and credit unions*. We modify our equation (1) by including interaction terms of participating in informal financial mechanisms as follows:

$$PROB\{y_i = 1\} = \Phi(\beta_1 + \beta_2 MMuser_i + \beta_3 PIM_i + \beta_4 MMuser_i \times PIM_i + \beta_5 PIM_i \times X_i + \beta_6 X_i) \quad (3)$$

where Φ *is the cumulative distribution function of logistic distribution.*

In the model (3), y_i is our three dummy dependent variables that characterize individuals' choices of formal deposit instruments that alternatively stands for: deposit using formal instruments, deposit using a bank account and deposit using a credit union account[66]. $MMuser_i$ represents the use of mobile money. PIM_i is a binary variable that stands for participating in informal mechanisms. We measure this variable using the following question: *"During the past 12 months, did you participate in an informal financial mechanism?"* It takes the value one when the individual participates in informal mechanisms, and zero otherwise. X_i is the same vector of control variables used in equation (1) that we also interact with the participation in informal deposit instruments. The coefficient of main interest is given by the total effect of being mobile money user and participating in informal deposit mechanisms ($\beta_2 + \beta_4$).

Table 6 presents the results. We find that while mobile money has no impact on deposits in formal institutions and credit union account (columns 2 and 6), it increases the likelihood of mobile money users participating in informal mechanisms to make deposits using a bank account

[66] We also consider as a dependent variable deposit using mobile money account. The results are reported in Appendix Table A.5.

Table 6. Choices of deposit instruments and mobile money adoption: individuals participating in informal financial mechanisms

	Full sample					
	Deposit using formal financial institutions					
	Bank and/or credit union		*Bank*		*Credit union*	
		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)
MM user	-0.432		-0.338		-0.222	
	(0.537)		(0.415)		(0.338)	
Participating in informal mechanisms	1.360		-12.17*		-3.286	
	(5.794)		(6.789)		(5.427)	
MM user x Participating in informal mechanisms	0.211	-0.220	1.801***	1.463***	0.0584	-0.163
	(0.682)	(0.420)	(0.685)	(0.546)	(0.518)	(0.392)
Participating in informal mechanisms x Controls	YES		YES		YES	
Controls	YES		YES		YES	
Observations	377		377		377	
Pseudo R2	0.271		0.417		0.134	
Wald $\chi2$ (H0: nullity of coefficients)	93.87***		76.88***		62.52***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	166.40***		243.53***		104.64***	
% correct prediction (y=1)	84.33%		85.16%		67.19%	
% correct prediction (y=0)	63.30%		79.73%		68.65%	

Note: Dependent variables: deposit using formal financial institutions, deposit using bank account, deposit using credit union account are all dummies. Deposit using formal financial institution equals 1 if respondents make deposits using bank account and/or credit union account, and 0 otherwise. Deposit using bank account equals to 1 if respondents make deposits using bank account, and 0 otherwise. Deposit using credit union account equals to 1 if respondents make deposits using credit union account, and 0 otherwise. The variable of interest, MM user is also a dummy that equal to 1 if respondents use mobile money, and 0 otherwise. The coefficients reported in the table are the log odds of the use of mobile money on the choices of deposit instruments. To obtain the odds ratio, we simply compute the exponential of log odds. .Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

by 4[67] times compared to non-users. The results suggest therefore that mobile money may improve formal financial access and acts as a channel through which individuals may access the bank account. Thus, individuals participating in informal may use mobile money in addition to their existent usage of informal financial services. However, further investigations may be needed to examine whether mobile money would bring out individuals using informal finance toward formal finance. Our findings also confirm the previous discussion which emphasizes that the linkage between mobile money account and bank account may play a role in the choices of deposit instruments. Accordingly, the use of mobile money impacts more the use of a bank account than a credit union account as mobile money users can easily make deposits in their bank account with their mobile phone. Moreover, credit union institutions being more widespread and comparatively more accessible than banks, mobile money is more useful to access the bank accounts.

We now move to the effects of mobile money on the barriers to formal financial access by taking into account individuals' characteristics such as the low and unpredictable income of poor people, the remoteness or lack of formal financial infrastructures (rural/urban), gender discrimination (female/male) and the lack of financial literacy (less educated/highly educated). With regard to this investigation, we test whether *mobile money affects the usage of informal and formal deposit instruments by disadvantaged individuals and how it can be considered as a springboard toward formal finance*. We then modify our specification (3) and include individuals' characteristics as follows:

$$PROB\left(y_i = 1\right) = \Phi\left(\gamma_1 + \gamma_2 MMuser_i + \gamma_3 D_i + \gamma_4 MMuser_i \times D_i + \gamma_5 D_i \times X'_i + \gamma_6 X'_i\right) \qquad (4)$$

where Φ *is the cumulative distribution function of logistic distribution.*

Where D_i is a dummy variable that stands alternatively for individuals' characteristics that we use to examine the effects of mobile money on deposits using formal financial instruments taken as a whole as well as bank and credit union accounts considered separately for low vs. high income, irregular vs. regular income, rural vs. urban, female vs. male, and less vs. highly educated individuals. X'_i is our vector of controls from which we remove individuals' characteristics considered for the dummy D_i.

[67] The coefficients reported in all our tables are the log odds of the use of mobile money on the choices of deposit instruments. To obtain the odds ratio, we simply compute the exponential of log odds.

Table 7. Choices of deposit instruments and mobile money adoption: Low, irregular vs. High, regular income.

	Full sample							
	Deposit using formal financial institutions						Deposit using informal mechanisms	
	Bank and/or credit union		*Bank*		*Credit union*			
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MM user	1.084**		0.665		0.234		-0.057	
	(0.514)		(0.409)		(0.354)		(0.432)	
Low income	11.017**		-2.053		8.509*		8.994*	
	(5.521)		(5.770)		(4.989)		(4.961)	
MM user x Low income	-1.866***	-0.782**	-0.642	0.023	-0.810	-0.576	-0.348	-0.406
	(0.633)	(0.368)	(0.618)	(0.464)	(0.509)	(0.366)	(0.564)	(0.362)
Low income x Controls	YES		YES		YES		YES	
Controls	YES		YES		YES		YES	
Observations	379		379		379		379	
Pseudo R2	0.220		0.326		0.111		0.267	
Wald $\chi2$ (H0: nullity of coefficients)	68.34***		96.51***		46.53***		598.65***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	139.01***		195.74***		90.09***		167.73***	
% correct prediction (y=1)	82.46%		81.29%		61.98%		85.80%	
% correct prediction (y=0)	66.67%		75.89%		72.73%		63.13%	

	Full sample							
	Deposit using formal financial institutions						Deposit using informal mechanisms	
	Bank and/or credit union		*Bank*		*Credit union*			
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MM user	-0.057		-0.228		0.157		0.233	
	(0.465)		(0.433)		(0.333)		(0.385)	
Irregular income	-7.209		9.075		-21.111***		-9.444*	
	(6.559)		(6.822)		(6.990)		(5.143)	
MM user x Irregular income	-0.073	-0.130	1.340*	1.112**	-0.354	-0.198	-0.545	-0.312
	(0.608)	(0.393)	(0.699)	(0.548)	(0.498)	(0.371)	(0.553)	(0.397)
Irregular income x Controls	YES		YES		YES		YES	
Controls	YES		YES		YES		YES	
Observations	379		379		379		379	
Pseudo R2	0.253		0.390		0.121		0.273	
Wald $\chi2$ (H0: nullity of coefficients)	71.07***		108.54***		45.18***		97.68***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	154.38***		228.23***		95.33***		170.75***	
% correct prediction (y=1)	71.27%		70.97%		67.19%		82.72%	
% correct prediction (y=0)	80.18%		87.50%		67.38%		66.82%	

Note: Dependent variables: deposit using formal financial institutions, deposit using bank account, deposit using credit union account are all dummies. Deposit using formal financial institution equals 1 if respondents make deposits using bank account and/or credit union account, and 0 otherwise. Deposit using bank account equals to 1 if respondents make deposits using bank account, and 0 otherwise. Deposit using credit union account equals to 1 if respondents make deposits using credit union account, and 0 otherwise. With the interactions, the total effect is given by the sum of the coefficient of the interaction term plus the coefficient of the use of mobile money (MM user), and the *p-value* obtain through the Wald test is reported below. Low income individuals are those with less than 50,000 F CFA (around $100US) per month. Irregular income individuals are those who specify having irregular income by answering the following question: "Do you have regular or irregular income?" The responses are encoded as irregular income = 1, and regular income = 0. The coefficients reported in the table are the log odds of the use of mobile money on the choices of deposit instruments. To obtain the odds ratio, we simply compute the exponential of log odds. Controls included: age, age squared, married, rural, male, occupation, irregular incomes, at least one person in charge, education level, incomes level and incomes squared. According to the subsamples we remove respectively controls incomes level and incomes squared, and irregular incomes. Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

In Table 7 we report estimates of the effects of mobile money on the choices of deposit instruments for individuals with different levels and types of income. The coefficients of interest are γ_2 and the total effect given by $\gamma_2+\gamma_4$. Considering the level of income, the results indicate that making deposits in formal financial institutions is twice as likely for users of mobile money with low income as non-users, while the likelihood to make deposits in formal financial institutions for mobile money users with high income is 3 times higher compared to non-users. Hence, in this case, mobile money may act as a substitute of formal deposit instruments for low income mobile money users while it may act as a complement for those with a comparatively high income. Considering the type of income, we find that the likelihood to make deposits in a bank account for mobile money users with irregular income is 3 times higher compared to non-users. Our findings suggest that for irregular income individuals mobile money acts as a complement of a bank account.

We turn now to the remaining set of individuals' demographic and socio-economic characteristics that appear to be barriers to the access of formal financial deposit instruments. In Table 8, we present the effect of mobile money on individuals' choices of deposit instruments on the basis of their location, gender and level of education. Considering individuals supposed to have a relatively high access to formal institutions (urban, male and highly educated), the results show that the likelihood to make deposits in a bank account for users of mobile money located in urban area is 2 times higher compared to non-users. This result implies that individuals located in urban area may use mobile money as a complement to their bank account. By contrast, we find that for highly educated individuals, both users and non-user of mobile money have the same likelihood of not making deposits in a credit union account. Indicating that the use of mobile money does not lead highly educated individuals to use credit union account.

Regarding the group of disadvantaged individuals, whereas mobile money has no effect on the likelihood of rural to make deposits in formal financial institutions, it increases the likelihood of female to make deposits using a bank account by almost 4 times, and the likelihood of less educated individuals to make deposits in bank and credit union accounts by respectively 3 and 2 times, compared to non-users.

Table 8. Choices of formal deposit instruments and mobile money adoption: Low vs. High access to formal finance

	Full sample							
	Deposit using formal financial institutions						Deposit using informal mechanisms	
	Bank and/or credit union		*Bank*		*Credit union*			
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MM user	-0.337		0.764*		-0.260		-0.101	
	(0.401)		(0.402)		(0.344)		(0.358)	
Rural	-5.907		7.381		-7.703		-9.813	
	(6.652)		(6.883)		(5.261)		(7.335)	
MM user x Rural	0.280	-0.056	-0.864	-0.100	0.268	0.008	-0.177	-0.278
	(0.584)	(0.424)	(0.612)	(0.461)	(0.490)	(0.348)	(0.592)	(0.471)
Controls	YES		YES		YES		YES	
Rural x Controls	YES		YES		YES		YES	
Observations	379		379		379		379	
Pseudo R2	0.212		0.386		0.089		0.262	
Wald $\chi2$ (H0: nullity of coefficients)	70.70***		98.20***		32.62*		91.95***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	135.42***		226.54***		78.69***		164.98***	
% correct prediction (y=1)	67.54%		70.97%		67.19%		87.04%	
% correct prediction (y=0)	79.28%		87.05%		61.50%		59.91%	

	Full sample							
	Deposit using formal financial institutions						Deposit using informal mechanisms	
	Bank and/or credit union		*Bank*		*Credit union*			
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MM user	-0.085		-0.564		-0.233		-0.518	
	(0.478)		(0.427)		(0.343)		(0.438)	
Female	4.882		15.911***		-6.709		-9.288*	
	(5.023)		(5.842)		(4.762)		(4.806)	
MM user x Female	-0.124	-0.210	1.840***	1.276**	0.258	0.025	-0.089	-0.190
	(0.610)	(0.379)	(0.704)	(0.559)	(0.497)	(0.359)	(0.527)	(0.377)
Controls	YES		YES		YES		YES	
Female x Controls	YES		YES		YES		YES	
Observations	379		379		379		379	
Pseudo R2	0.210		0.390		0.086		0.280	
Wald $\chi2$ (H0: nullity of coefficients)	76.44***		101.94***		40.86**		125.00***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	134.57***		228.64***		77.04***		174.52***	
% correct prediction (y=1)	68.66%		74.84%		65.63%		83.95%	
% correct prediction (y=0)	77.48%		84.82%		63.64%		67.74%	

	Full sample							
	Deposit using formal financial institutions						Deposit using informal mechanisms	
	Bank and/or credit union		*Bank*		*Credit union*			
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MM user	-0.612		0.574		-0.650**		-0.223	
	(0.440)		(0.365)		(0.323)		(0.362)	
Less educated	9.476*		11.630*		6.083		-9.288*	
	(5.331)		(6.943)		(5.155)		(4.806)	
MM user x Less educated	1.206**	0.594	0.448	1.021*	1.378***	0.727**	-0.089	-0.312
	(0.585)	(0.385)	(0.674)	(0.567)	(0.492)	(0.371)	(0.527)	(0.383)
Controls	YES		YES		YES		YES	
Less educated x Controls	YES		YES		YES		YES	
Observations	382		382		382		382	
Pseudo R2	0.224		0.339		0.104		0.223	
Wald $\chi2$ (H0: nullity of coefficients)	223.01***		270.09***		193.02***		247.39***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	139.58***		199.31***		83.01***		142.25	
% correct prediction (y=1)	69.00%		64.97%		69.59%		78.40%	
% correct prediction (y=0)	80.18%		85.78%		63.30%		65.45%	

Note: Dependent variables: deposit using formal financial institutions, deposit using bank account, deposit using credit union account are all dummies. Deposit using formal financial institution equals 1 if respondents make deposits using bank account and/or credit union account, and 0 otherwise. Deposit using bank account equals to 1 if respondents make deposits using bank account, and 0 otherwise. Deposit using credit union account equals to 1 if respondents make deposits using credit union account, and 0 otherwise. With the interactions, the total effect is given by the sum of the coefficient of the interaction term plus the coefficient of the use of mobile money (MM user), and the *p-value* obtain through the Wald test is reported below. Less educated individuals are those with primary education level or less (about six years of schooling at best). The coefficients reported in the table are the log odds of the use of mobile money on the choices of deposit instruments. To obtain the odds ratio, we simply compute the exponential of log odds. Controls included: age, age squared, married, rural, male, occupation, irregular incomes, at least one person in charge, education level, incomes level and incomes squared. According to the subsamples we remove respectively controls rural, male and education level. Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Overall, our results show that mobile money can transform individuals' financial behavior by helping them overcome barriers to access formal deposits instruments especially for formally excluded individuals. Our findings are consistent with the complementarity and substitutability effects of mobile money that display different effects on individuals' use of bank and credit union deposit accounts. For disadvantaged individuals who have been documented to have less access to formal deposit instruments, we find the complement effect of mobile money to be at work. In fact, for irregular income, female and less educated individuals, mobile money increases their likelihood to access a bank account, and in particular a credit union account for less educated individuals. The results are consistent with the fact that credit union institutions are more widespread and affordable for disadvantaged people than bank institutions. Although the linkage between mobile money account and bank account may lead individuals toward bank institutions, our results show that mobile money decreases low income individuals' likelihood to make deposits using formal institutions. Considering advantaged individuals, we find that both complementarity and substitutability effects of mobile money affect their use of financial deposit instruments. For individuals with high income and those located in urban area that are supposed to have high access to formal deposit instruments, the complement effect dominates. The use of mobile money increases their likelihood to make deposits in a bank account that may stem from their proximity with bank institutions. Our results also reveal a substitution effect of mobile money on highly educated individuals through a decrease in their likelihood to use credit union account to make deposits. Moreover, highly educated individuals who use mobile money may prefer a bank account than a credit union account because of the existing linkage between both mobile money and bank accounts. In this context, one may argue that mobile money leads advantaged individuals to use a bank account instead of a credit union account, while for disadvantaged individuals a credit union account appears as an alternative or a complement of a bank account. Our results taken together show that mobile money appears as a stepping stone toward formal financial institutions for disadvantaged individuals.

3.6. Endogeneity, selection bias and sample representativeness issues

In this section, we address three potential issues, namely the sample selection bias, the endogeneity problem, and sample representativeness.

3.6.1. Heckman correction of sample selection bias

Our analysis of the effect of relative attribute associated with formal or informal deposit instruments compared to mobile money by considering restricted sample as regards to mobile money users (Table 4, section 5) may be subject to sample selection bias. In order to correct this possible presence of bias, we perform the strategy of Heckman correction of sample selection bias. To do so, we first analyze factors that impact the use of mobile money by considering the following specification:

$$PROB\left\{MMuser_i = 1\right\} = \Phi\left(\delta_1 + \delta_2 Dis\ \tan ce_i + \delta_3 X_i\right) \qquad (5)$$

where Φ is the cumulative distribution function of logistic distribution.

In equation (5), $MMuser_i$, the use of mobile money, is a binary dependent variable that takes the value one if the individual uses mobile money services and zero otherwise. $Dis\ \tan ce_i$ is the distance to the closest mobile money agent. We measure this distance by using the response to the following question: "*What distance did you travel to reach a mobile money agent?*" It takes the value 1 for less than 1 km, 2 for 1 to 2 km, 3 for 2 to 5 km, 4 for 5 to 10 km and 5 for more than 10 km. X_i is our same vector of controls in equation (1) (age, marital situation, location, gender, occupation or employment status, at least one person in charge, education level, level and type of income).

Second, we use the estimated coefficients to compute the inverse Mills' ratio (IMR) that we include in our equation (1) specified in section 4.

$$IMR_i = -\frac{\phi\left(\hat{\delta}_1 + \hat{\delta}_2 Dis\ \tan ce_i + \hat{\delta}_3 X_i\right)}{\Phi\left(\hat{\delta}_1 + \hat{\delta}_2 Dis\ \tan ce_i + \hat{\delta}_3 X_i\right)}$$

Where ϕ is the probability density function, and Φ the cumulative distribution function of the logistic distribution.

Insert Table 9 here

Results are reported in Table 9. Our findings show that the coefficient associated with the newly included inverse Mills' ratio is not significant indicating the absence of sample bias in our estimations[68]. The results are similar to our previous findings that the access, liquidity and privacy related to mobile money compared to formal financial instruments are attributes that may lead mobile money users to make deposits in the mobile money account. Likewise, cost associated with formal financial methods compared to those related to mobile money is a factor that may lead mobile money users to make deposits in the mobile money account. The results also show liquidity and privacy related to mobile money compared to those of informal financial methods are a factors that may also lead mobile money users to make deposits in the mobile money account.

3.6.2. Endogeneity issue

In order to confirm that the observed differences in the choices of deposit instruments between mobile money users and non-users and among subgroups (individuals participating in informal mechanisms, low/high income, irregular/regular income, rural/urban, female/male, less/high educated) are genuinely due to the use of mobile money, we replicate the estimations reported in section 5 (Tables 5 to 8) using a standard IV (instrumental variables) method.

In fact, we have assumed that the effects of the use of mobile money on individuals' choices of deposit instruments are independent given the control variables included in the regressions. Therefore, the estimated coefficients are valid only if the use of mobile money is not correlated with the error term. Furthermore, making deposits in any of financial instruments considered in our analysis may be related to the decision of individuals to use mobile money and as a deposit instrument. Thus, banked individuals may use mobile money with the intention to easily make deposits in their bank account, while unbanked people may use it because of lack of

[68] We also estimate our equation (1) by including the inverse Mills' ratio and considering our full sample. We find the coefficient associated with the inverse Mills' ratio to be insignificant which allows us to rule out the existence of the sample selection bias. The results are not reported in the paper for brevity but available upon request.

convenient ways to make deposits. To address this potential endogeneity issue resulting from simultaneous effects, we resort to a standard instrumental variables approach. Following Jack and Suri (2014), we use the distance to the closest agent as an excluded instrument for the use of mobile money and simply consider our model (5) presented above.

Insert Table 10 here

Table 10 presents the results of the reduced form for predicting the use of mobile money (*MM user*). As expected, the coefficient of the distance to the nearest agent is negative and significant, implying that the further the mobile money agent is, the harder it may be for individuals to access and use mobile money services. Consequently, individuals have more likelihood to use mobile money if the distance from the nearest retail agent is relatively shorter. We report Chi-square Wald test for the weakness of the instrument. The test statistic is 38.21 and significant at 1% allowing us to confirm that our instrument is not weak[69]. Thus, after predicting the use of mobile money (MM user), we replicate the earlier estimations (Tables 5 to 8) by replacing *MM user* by its predicted value *Pr (MM user)* and provide a test statistic of endogeneity[70] that does not reject the null hypothesis of exogeneity of mobile money use. We also report Kleibergen-Paap LM test of underidentification that confirms the relevance of our instrument.

Insert Tables 11, 12, 13 and 14 here

In Tables 11, 12, 13 and 14, we replicate our estimations presented in section 5 (Tables 5 to 8) using the predicted value of mobile money use. The findings are consistent with our previous results. The use of mobile money increases the likelihood of individuals to make deposits in formal financial accounts including mobile money account while there is no evidence on making deposit using informal mechanisms. The results are also consistent when considering

[69] The Chi-square Wald test is reported to take into account the critical value proposed by Stock and Yogo (2002) who suggest a test statistic critical value of 16.38 when there are one endogenous variable and one excluded instrument.

[70] This endogeneity test is proposed by Baum, Schaffer and Stillman (2007) and its statistic is numerically equal to a Hausman test statistic under conditional hemoskedasticity.

disadvantaged individuals as mobile money increases their likelihood to make deposits using formal financial instruments.

3.6.3. Use of an alternative source of data

We also analyze the robustness of our main results on the impact of mobile money on the choices of deposit instruments by considering the Global financial Inclusion survey data (World Bank, 2015) available for 1,000 individuals in Burkina Faso as of 2014. Although this dataset may have the advantage to be nationally representative, it remains limited in providing critical variables to replicate our analysis. For instance, it does not contain information about deposits in bank, credit union or mobile money accounts. Thus, instead of choices of deposit instruments, we consider choices of saving instruments made by individuals by comparing users to non-users of mobile money. Due to these limitations, the results should be considered as simply suggestive.

Insert Tables 15 and 16 here

Tables 15 and 16 report the results of the effects of mobile money on the choices of saving instruments using a logistic model. We replicate our equations (1), (2) and (3) by considering alternatively two binary dependent variables due to the lack of data. The first is *saved using an account at a formal financial institution* that equals to one if the respondent reports to have saved using an account at a formal financial institution, and zero otherwise. The second is *saved using informal saving club* that takes the value one if the respondent indicates using informal saving club, and zero otherwise. The control variables included are: age, gender, level of education, and income quintile. The data allows us to replicate estimations of the impact of mobile money on the choices of saving instruments for only low vs. high income, female vs. male, and less vs. highly educated individuals.

Overall, while there is no impact of the use of mobile money on the choice of informal savings club, the results confirm our main findings that mobile money improves individuals' access to formal financial services. In addition, we find that for individuals participating in

informal saving club, the use of mobile money increases their likelihood to save using an account at a formal financial institution. The results are also consistent when considering low income, female and less educated individuals (not reported but available upon request), the use of mobile money increases their likelihood to save using an account at a formal financial institution.

3.7. Conclusion

This paper examines the reasons of mobile money adoption and its consequences on the usage of existent informal and formal financial instruments, and especially it's potential to enhance financial access for disadvantaged individuals. In developing countries, the predominance of informal deposit mechanisms associated with the underdeveloped formal financial system raises questions about the effect that the growing technology of mobile money may have on the improvement of financial access. The paper addresses this issue. We use an original dataset obtained from a survey we conducted in Burkina Faso in May 2014, and find the relative higher access, liquidity and privacy of mobile money compared to formal financial services lead individuals to use mobile money. In addition, higher cost of formal financial services compared to mobile money also motivate individuals to use mobile money. Moreover, lower liquidity and privacy associated with informal financial mechanisms compared to mobile money also drive the usage of mobile money. Regarding the consequences of the introduction of mobile money on existent financial services, we find in a preliminary step that the use of mobile money has no impact on deposit using informal and formal financial instruments. But it expectedly increases the propensity to use mobile money account to make deposits. In a next step, we find that the use of mobile money increases the propensity of individuals who participate in informal mechanisms to make deposits using formal financial instruments - bank accounts. In further investigations, we show that among disadvantaged groups, mobile money usage increases the likelihood of female, individuals with irregular income and those who are less educated to make deposits in bank and credit union accounts.

Inadequate access to formal financial services is widespread in Burkina Faso. Mounting evidence suggests that various socioeconomic constraints depress deposits even among those with access (Allan et al., 2013; Kendall, 2010; Kendall et al., 2011). In settings where the

technology of mobile money exists, bridging the gap in individuals' access to formal financial services is not overstating. However, the banking system regulations need to be adjusted to take into account the new scalable technology-enabled business models. In fact, in Burkina Faso, mobile money is operated in a partnership basis between banks and mobile network operators that explain the impact of mobile money on the use of bank account but also render difficult the supervision of mobile money services. Moreover, the agreement of the Central Bank (BCEAO) for the issue of e-money is extended to decentralized financial system (DFS). While more expanded throughout the country than banking institutions, none of decentralized financial system (credit unions, post offices and cooperatives) offers mobile money services that may limit the impact of mobile money on their usage. Thus, it is critical for the Central Bank to encourage the adoption of mobile money by the decentralized financial system to increase the supply and usage of mobile money services. Indeed, the Central Bank and the "Autorité de régulation des communications électroniques" have to provide together a strong and adequate regulation and supervision framework that supports the wide range of services, especially deposit services that can be provided through mobile money. Although mobile money services are mobiquity (mobility and ubiquity), mobile money providers have inclination to concentrate their services in locations where formal activities are already available especially in urban areas. Government and policymakers may act through specific strategies to motivate mobile money providers to reach remote areas to ensure access to basic formal financial services throughout the country. Expanding mobile money agent networks by facilitating retail stores to expand mobile money businesses especially in rural areas may help reduce the gap in formal financial access between urban and rural areas. Policies that focus on and motivate female, less educated and informal savings groups' access to and usage of mobile money services should also be encouraged. More specifically, promoting the creation of an informal savings groups linked to individuals' mobile money account and that allows transactions between both accounts may reduce the need of cash exchanges that is less secure and favor electronic money. Thus, mobile money may in turn bring out individuals from informal financial methods toward formal financial institutions by increasing the likelihood of individuals to access/use bank and credit union accounts. However, our results should be interpreted with caution given the lack of data on the amount allocated to each financial instrument. Further thorough works are needed to extend the analysis with more detailed data.

Heckman correction of sample selection bias.

Table 9. Factors affecting the choices of making deposits using mobile money account.

	Sample of mobile money users								
	Deposit using mobile money account								
	Relative attribute of formal/mobile money					Relative attribute of informal/mobile money			
	Access	Risk	Cost	Liquidity	Privacy	Risk	Cost	Liquidity	Privacy
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Relative attribute	-1.060**	0.194	4.065***	-3.285***	-2.192**	0.685	1.210	-4.137**	-1.963**
	(0.521)	(0.736)	(1.348)	(0.985)	(0.940)	(0.432)	(1.151)	(1.684)	(0.849)
Inverse Mills' Ratio	-11.40	-36.54	-28.73	-40.26	-11.38	-12.45	-9.238	-24.97	-15.51*
	(7.773)	(40.90)	(22.89)	(47.44)	(7.337)	(9.402)	(13.64)	(18.49)	(8.130)
Controls included	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	189	145	145	145	171	73	72	72	178
Pseudo R2	0.201	0.136	0.324	0.229	0.157	0.396	0.378	0.410	0.190
Wald $\chi 2$ (H0: nullity of coefficients)	38.38***	19.30	27.90***	33.56***	28.25***	27.69***	26.60***	18.60*	40.38***
Likelihood ratio test $\chi 2$ (H0: nullity of coefficients)	50.17***	429.40***	453.87***	105.75***	67.14***	488.84***	487.68***	154.78***	58.67***
% correct prediction (y=1)	83.22%	90.08%	90.91%	96.69%	96.40%	82.69%	80.39%	90.20%	96.45%
% correct prediction (y=0)	65.00%	37.50%	66.67%	29.17%	21.88%	80.95%	80.95%	66.67%	29.73%

Note: Pr (MM user) is the independent variable of interest that is the predicted value of mobile money use that we obtain from the reduced form estimation in Table 9. Robust standard errors are in brackets. In columns 4 and 8, we add the variable MM user used in the interaction terms in the controls variables. We use a logistic model specify in equation (3). Controls included: age, age squared, married, rural, male, occupation, irregular income, at least one person in charge, education level, incomes level and incomes squared. Table 3 gives definitions and summary statistics of the attributes of formal and informal financial mechanisms that consist of risk, cost, illiquidity and low privacy. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Results of robustness tests

Table 10. Reduced form analysis of the use of mobile money.

	Full sample
	Adoption/usage of mobile money
Distance to the nearest mobile money agent	-4.596***
	(0.744)
Age	0.052
	(0.343)
Age squared	-0.002
	(0.005)
Married	2.484***
	(0.939)
Rural	2.101**
	(1.006)
Male	0.116
	(0.747)
Occupation	-0.788
	(0.878)
Irregular income	0.428
	(0.679)
At least one person in charge	-0.457
	(0.584)
Education	1.580***
	(0.510)
Income	0.817
	(1.602)
Income squared	-0.218
	(0.272)
Constant	6.950
	(5.389)
Observations	382
Pseudo R2	0.866
Wald $\chi 2$ (H0: nullity of coefficients)	80.50***
Likelihood ratio test $\chi 2$ (H0: nullity of coefficients)	490.70***
Wald $\chi 2$ (of the coefficient of the excluded instrument)	38.21***
% correct prediction (y=1)	96.37%
% correct prediction (y=0)	96.83%

Note: Dependent variables: the use of mobile money. The use of mobile money is a dummy variable that equals to 1 if respondents use mobile money, and 0 otherwise. The excluded instruments are distance to the nearest agent and the capacity to perform monetary transactions using cell phone. Robust standard errors are in brackets. We use a logistic model specify in equation (4). *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Table 11. IV Results. Choices of deposit instruments and mobile money adoption. Full sample.

	Full sample				
	Deposit using formal financial institutions			Deposit using mobile money	Deposit using informal mechanisms
	Bank and/or credit union	*Bank*	*Credit union*		
	(1)	(2)	(3)	(4)	(5)
Pr(MM user)	-0.177	0.386	-0.149	4.406***	-0.279
	(0.298)	(0.323)	(0.253)	(0.444)	(0.286)
Age	-0.037	0.113	-0.092	-0.036	-0.024
	(0.155)	(0.159)	(0.129)	(0.203)	(0.136)
Age squared	0.001	-0.001	0.001	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Married	0.902**	0.296	0.595**	1.071***	-0.042
	(0.373)	(0.398)	(0.285)	(0.407)	(0.310)
Rural	0.274	-0.456	-0.142	0.255	-1.933***
	(0.303)	(0.322)	(0.239)	(0.348)	(0.281)
Male	-0.056	-0.094	-0.179	0.583*	-0.997***
	(0.274)	(0.280)	(0.227)	(0.338)	(0.256)
Occupation	0.155	-0.205	-0.038	-0.991*	0.660
	(0.461)	(0.508)	(0.407)	(0.533)	(0.402)
Irregular income	-0.278	-0.956***	0.759***	0.686*	-0.047
	(0.307)	(0.302)	(0.251)	(0.354)	(0.283)
At least one person in charge	0.301	0.336	0.309	0.074	0.406
	(0.263)	(0.275)	(0.216)	(0.328)	(0.249)
Education	0.841***	1.141***	0.127	0.488**	-0.293*
	(0.190)	(0.232)	(0.146)	(0.234)	(0.166)
Income	2.919***	0.418	2.103**	1.616	-0.727
	(0.704)	(1.187)	(1.020)	(1.082)	(0.960)
Income squared	-0.340***	0.143	-0.310*	-0.246	0.046
	(0.112)	(0.221)	(0.183)	(0.185)	(0.167)
Constant	-6.513***	-8.206***	-2.097	-6.154**	3.712
	(2.431)	(2.733)	(2.244)	(3.049)	(2.427)
Observations	379	379	379	378	379
Pseudo R2	0.1975	0.3356	0.0491	0.5014	0.2109
Wald $\chi 2$ (H0: nullity of coefficients)	63.71***	77.92***	23.76**	146.50***	89.69***
Likelihood ratio test $\chi 2$ (H0: nullity of coefficients)	128.94***	200.58***	57.69***	287.04***	138.78***
% correct prediction (y=1)	82.46%	67.10%	59.90%	87.66%	77.16%
% correct prediction (y=0)	58.56%	86.61%	62.03%	82.59%	63.13%
Endogeneity test of MM user (H0: Exogeneity)	0.079	0.413	0.400	8.853	0.223
p-value	0.7787	0.5202	0.5272	0.0029	0.6369
Kleibergen-Paap LM test (H0: Underidentification)	296.19	296.19	296.19	296.19	296.19
p-value	0.000	0.000	0.000	0.000	0.000

Note: Pr (MM user) is the independent variable of interest that is the predicted value of mobile money use that we obtain from the reduced form estimation in Table 9. Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Table 12. IV Results. Choices of deposit instruments and mobile money adoption. Individuals participating in informal financial mechanisms.

	Full sample					
	Deposit using formal financial institutions					
	Bank and/or credit union		*Bank*		*Credit union*	
		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)
Pr(MM user)	-0.500		-0.219		-0.191	
	(0.542)		(0.432)		(0.351)	
Participating in informal mechanisms	1.536		-12.229*		-3.129	
	(5.814)		(6.719)		(5.440)	
Pr(MM user) x Participating in informal mechanisms	0.263	-0.238	1.681**	1.462**	-0.121	-0.312
	(0.719)	(0.472)	(0.737)	(0.597)	(0.563)	(0.440)
Participating in informal mechanisms x Controls	YES		YES		YES	
Controls included	YES		YES		YES	
Observations	377		377		377	
Pseudo R2	0.272		0.414		0.134	
Wald $\chi 2$ (H0: nullity of coefficients)	92.95***		77.99***		63.22***	
Likelihood ratio test $\chi 2$ (H0: nullity of coefficients)	166.61***		242.10***		104.84***	
% correct prediction (y=1)	84.70%		85.16%		67.19%	
% correct prediction (y=0)	63.30%		79.73%		68.11%	
Endogeneity test of MM user (H0: Exogeneity)	0.029		0.011		0.001	
p-value	0.864		0.917		0.980	
Kleibergen-Paap LM test (H0: Underidentification)	251.09		251.09		251.09	
p-value	0.000		0.000		0.000	

Note: Pr (MM user) is the independent variable of interest that is the predicted value of mobile money use that we obtain from the reduced form estimation in Table 9. Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Table 13. IV Results. Choices of deposit instruments and mobile money adoption: Low, irregular vs. High, regular income.

	Full sample							
	Deposit using formal financial institutions						Deposit using informal mechanisms	
	Bank and/or credit union		*Bank*		*Credit union*			
	(1)	Total effect (2)	(3)	Total effect (4)	(5)	Total effect (6)	(7)	Total effect (8)
Pr(MM user)	1.031*		0.687		0.146		-0.240	
	(0.544)		(0.431)		(0.373)		(0.465)	
Low income	10.816**		-2.141		8.598*		8.993*	
	(5.497)		(5.749)		(4.998)		(5.015)	
Pr(MM user) x Low income	-1.781***	-0.751*	-0.650	0.037	-0.672	-0.526	-0.142	-0.382
	(0.669)	(0.390)	(0.667)	(0.509)	(0.541)	(0.392)	(0.607)	(0.390)
Low income x Controls	YES		YES		YES		YES	
Controls	YES		YES		YES		YES	
Observations	379		379		379		379	
Pseudo R2	0.215		0.326		0.109		0.267	
Wald $\chi2$ (H0: nullity of coefficients)	68.41***		97.20***		45.79***		608.76***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	137.11***		195.57***		89.02***		167.73***	
% correct prediction (y=1)	80.60%		81.29%		62.50%		86.42%	
% correct prediction (y=0)	67.57%		75.89%		71.12%		63.59%	
Endogeneity test of MM user (H0: Exogeneity)	0.003		0.203		0.099		0.514	
p-value	0.953		0.653		0.753		0.473	
Kleibergen-Paap LM test (H0: Underidentification)	237.24		237.24		237.24		237.24	
p-value	0.000		0.000		0.000		0.000	

	Full sample							
	Deposit using formal financial institutions						Deposit using informal mechanisms	
	Bank and/or credit union		*Bank*		*Credit union*			
	(1)	Total effect (2)	(3)	Total effect (4)	(5)	Total effect (6)	(7)	Total effect (8)
Pr(MM user)	-0.027		-0.214		0.130		0.119	
	(0.488)		(0.481)		(0.359)		(0.412)	
Irregular income	-7.181		9.064		-21.038***		-9.302*	
	(6.561)		(6.797)		(6.976)		(5.130)	
Pr(MM user) x Irregular income	-0.147	-0.174	1.365*	1.151*	-0.368	-0.238	-0.392	-0.272
	(0.644)	(0.420)	(0.769)	(0.601)	(0.536)	(0.398)	(0.591)	(0.424)
Irregular income x Controls	YES		YES		YES		YES	
Controls	YES		YES		YES		YES	
Observations	379		379		379		379	
Pseudo R2	0.253		0.389		0.121		0.272	
Wald $\chi2$ (H0: nullity of coefficients)	70.97***		110.59***		44.93***		97.78***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	154.43***		227.76***		95.32***		170.27***	
% correct prediction (y=1)	83.21%		78.06%		67.71%		68.52%	
% correct prediction (y=0)	62.16%		83.04%		67.38%		78.80%	
Endogeneity test of MM user (H0: Exogeneity)	0.018		0.596		0.105		0.232	
p-value	0.892		0.440		0.746		0.630	
Kleibergen-Paap LM test (H0: Underidentification)	244.48		244.48		244.48		244.48	
p-value	0.000		0.000		0.000		0.000	

Note: Pr (MM user) is the independent variable of interest that is the predicted value of mobile money use that we obtain from the reduced form estimation in Table 9. Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Table 14. IV Results. Choices of deposit instruments and mobile money adoption: Low vs. High access to formal finance.

	Full sample							
	Deposit using formal financial institutions						Deposit using informal mechanisms	
	Bank and/or credit union		*Bank*		*Credit union*			
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Pr(MM user)	-0.265		0.829*		-0.314		-0.295	
	(0.435)		(0.442)		(0.385)		(0.396)	
Rural	-5.976		7.210		-7.662		-9.596	
	(6.623)		(6.922)		(5.247)		(7.379)	
Pr(MM user) x Rural	0.134	-0.131	-1.036	-0.207	0.320	0.006	0.136	-0.159
	(0.614)	(0.434)	(0.653)	(0.481)	(0.528)	(0.361)	(0.624)	(0.482)
Rural x Controls	YES		YES		YES		YES	
Controls	YES		YES		YES		YES	
Observations	379		379		379		379	
Pseudo R2	0.211		0.387		0.089		0.262	
Wald $\chi2$ (H0: nullity of coefficients)	69.28***		96.23***		32.73*		90.91***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	135.19***		226.73***		78.81***		165.20***	
% correct prediction (y=1)	80.60%		81.94%		67.71%		74.69%	
% correct prediction (y=0)	60.36%		80.36%		61.50%		69.59%	
Endogeneity test of MM user (H0: Exogeneity)	0.022		2.035		0.190		0.312	
p-value	0.881		0.154		0.663		0.577	
Kleibergen-Paap LM test (H0: Underidentification)	245.33		245.33		245.33		245.33	
p-value	0.000		0.000		0.000		0.000	

	Full sample							
	Deposit using formal financial institutions						Deposit using informal mechanisms	
	Bank and/or credit union		*Bank*		*Credit union*			
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Pr(MM user)	-0.142		-0.385		-0.330		-0.768	
	(0.492)		(0.462)		(0.368)		(0.482)	
Female	4.937		15.390***		-6.682		-0.000	
	(5.010)		(5.713)		(4.752)		(5.558)	
Pr(MM user) x Female	-0.046	-0.188	1.593**	1.208**	0.403	0.073	0.668	-0.099
	(0.635)	(0.402)	(0.736)	(0.573)	(0.529)	(0.380)	(0.628)	(0.403)
Female x Controls	YES		YES		YES		YES	
Controls	YES		YES		YES		YES	
Observations	379		379		379		379	
Pseudo R2	0.210		0.386		0.087		0.282	
Wald $\chi2$ (H0: nullity of coefficients)	75.86***		102.13***		41.19**		124.46***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	134.54***		226.24***		77.44***		175.59***	
% correct prediction (y=1)	79.85%		79.35%		64.58%		83.95%	
% correct prediction (y=0)	60.36%		77.68%		62.03%		67.28%	
Endogeneity test of MM user (H0: Exogeneity)	0.075		0.320		0.843		1.526	
p-value	0.784		0.572		0.358		0.217	
Kleibergen-Paap LM test (H0: Underidentification)	234.34		234.34		234.34		234.34	
p-value	0.000		0.000		0.000		0.000	

	Full sample							
	Deposit using formal financial institutions						Deposit using informal mechanisms	
	Bank and/or credit union		*Bank*		*Credit union*			
		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Pr(MM user)	-0.700		0.374		-0.683*		-0.282	
	(0.463)		(0.387)		(0.352)		(0.397)	
Less educated	8.573		13.018*		7.278		-10.278**	
	(5.448)		(6.947)		(5.196)		(4.931)	
Pr(MM user) x Less educated	1.341**	0.641	0.871	1.245**	1.355***	0.672*	-0.090	-0.372
	(0.615)	(0.405)	(0.715)	(0.602)	(0.524)	(0.388)	(0.565)	(0.402)
Less educated x Controls	YES		YES		YES		YES	
Controls	YES		YES		YES		YES	
Observations	379		379		379		379	
Pseudo R2	0.222		0.341		0.101		0.219	
Wald $\chi2$ (H0: nullity of coefficients)	192.34***		268.91***		219.73***		263.81***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	140.22***		203.52***		85.07***		143.02***	
% correct prediction (y=1)	82.46%		74.84%		69.27%		79.63%	
% correct prediction (y=0)	60.36%		79.91%		63.10%		65.44%	
Endogeneity test of MM user (H0: Exogeneity)	0.316		1.037		0.402		0.128	
p-value	0.574		0.309		0.526		0.720	
Kleibergen-Paap LM test (H0: Underidentification)	250.08		250.08		250.08		250.08	
p-value	0.000		0.000		0.000		0.000	

Note: Pr (MM user) is the independent variable of interest that is the predicted value of mobile money use that we obtain from the reduced form estimation in Table 9. Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Table 15. Choices of saving instruments and mobile money: using Global Financial Inclusion Database.

	Full sample	
	Saved using account at formal financial institutions	Saved using informal saving club
	(1)	(2)
MM user	2.536***	-0.057
	(0.571)	(0.517)
Age	0.127**	0.129**
	(0.054)	(0.055)
Age squared	-0.001	-0.002**
	(0.001)	(0.001)
Female	-0.115	0.884***
	(0.264)	(0.199)
Education	1.461***	0.176
	(0.246)	(0.209)
Income quintile	0.009	1.324***
	(0.456)	(0.409)
Income quintile squared	0.059	-0.192***
	(0.073)	(0.064)
Constant	-8.105***	-6.406***
	(1.263)	(1.097)
Observations	999	999
Pseudo R2	0.207	0.077
Wald $\chi 2$ (H0: nullity of coefficients)	92.02***	44.97***

Note: Dependent variables: : saved using an account at a formal financial institutions and saved using informal saving club are all dummies. Saved using an account at a formal financial institution equals 1 if respondents save using an account at a formal financial institution, and 0 otherwise. Saved using informal saving club equals to 1 if respondents save using informal saving club, and 0 otherwise. The variable of interest, MM user is also a dummy that equal to 1 if respondents use mobile money, and 0 otherwise. The coefficients reported in the table are the log odds of the use of mobile money on the choices of savings instruments. To obtain the odds ratio, we simply compute the exponential of log odds. Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Table 16. Choices of saving instrument and mobile money. Individuals participating in informal savings groups.

	Individuals participating in informal savings groups	
	Saved using account at formal financial institutions	
	(1)	Total Effect (2)
MM user	1.704***	
	(0.466)	
Individuals participating in informal saving club	7.850***	
	(2.749)	
MM user x Individuals participating in informal saving club	0.186	1.890**
	(1.002)	(0.887)
Individuals participating in informal saving club x		
Age	-0.437***	
	(0.085)	
Age squared	0.005***	
	(0.001)	
Female	0.753	
	(0.607)	
Education	-1.148**	
	(0.533)	
Income quintile	0.459	
	(1.179)	
Income quintile squared	-0.024	
	(0.178)	
Controls		
Age	0.309***	
	(0.052)	
Age squared	-0.003***	
	(0.001)	
Female	-0.059	
	(0.243)	
Education	1.635***	
	(0.260)	
Income quintile	0.109	
	(0.502)	
Income quintile squared	0.046	
	(0.077)	
Constant	-11.629***	
	(1.457)	
Observations	999	
Pseudo R2	0.281	
Wald chi2	122.62***	

Note: Dependent variable: saved using an account at a formal financial institutions is a dummy variable. Saved using an account at a formal financial institution equals 1 if respondents save using an account at a formal financial institution, and 0 otherwise. The variable of interest, MM user is also a dummy that equal to 1 if respondents use mobile money, and 0 otherwise. The coefficients reported in the table are the log odds of the use of mobile money on the choices of savings instruments. To obtain the odds ratio, we simply compute the exponential of log odds. Robust standard errors are in brackets. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

Appendix

Table A.1. Correlation matrix. Full sample.

	MM user	Deposit using MM	Formal	Bank	Credit union	Informal mechanisms	Participating in informal mechanisms	Age	Age squared	Married	Rural	Male	Occupation	Irregular income	At least one person in charge	Education	Income	Income squared
MM user	1																	
Deposit using MM	0.785	1																
Formal	0.054	0.088	1															
Bank	0.137	0.140	0.546	1														
Credit union	0.005	0.052	0.661	0.023	1													
Informal mechanisms	-0.124	-0.124	-0.159	-0.155	0.111	1												
Participating in informal mechanisms	-0.134	-0.163	-0.194	-0.193	0.080	0.759	1											
Age	-0.027	-0.018	0.201	0.227	0.013	-0.238	-0.190	1										
Age squared	-0.045	-0.036	0.195	0.223	0.008	-0.232	-0.189	0.990	1									
Married	0.131	0.154	0.196	0.162	0.084	-0.155	-0.143	0.607	0.579	1								
Rural	0.146	0.127	-0.006	-0.139	0.005	-0.386	-0.246	0.251	0.245	0.226	1							
Male	0.007	0.066	0.085	0.125	-0.040	-0.264	-0.303	0.267	0.254	0.107	0.032	1						
Occupation	-0.078	-0.107	0.082	-0.014	0.070	-0.032	0.060	0.430	0.384	0.348	0.159	0.115	1					
Irregular income	0.043	0.062	-0.097	-0.294	0.145	-0.047	0.036	0.100	0.080	0.106	0.302	-0.096	0.197	1				
At least one person in charge	0.107	0.089	0.055	0.066	0.076	0.075	0.062	-0.003	-0.009	0.024	-0.030	-0.008	0.047	0.015	1			
Education	0.162	0.185	0.275	0.449	0.017	-0.065	-0.192	-0.148	-0.139	-0.169	-0.227	0.017	-0.391	-0.358	-0.013	1		
Income	0.071	0.086	0.359	0.417	0.089	-0.175	-0.234	0.441	0.426	0.358	-0.052	0.271	0.342	-0.131	0.055	0.127	1	
Income squared	0.070	0.074	0.320	0.407	0.056	-0.160	-0.229	0.427	0.417	0.349	-0.078	0.255	0.297	-0.145	0.063	0.135	0.977	1

Note: MM user stands for mobile money user; Deposit using MM for deposit using mobile money account; Formal for deposit using formal financial institutions; Bank for deposit using bank account; Credit union for deposit using credit union account; and informal mechanisms for deposit using informal mechanisms.

Table A.2. Correlation matrix (Attributes of formal deposit instruments).

	Deposit using MM	Access	Risk	Cost	Liquidity	Privacy	Age	Age squared	Married	Rural	Male	Occupation	Irregular income	At least one person in charge	Education	Income	Income squared
Deposit using MM	1																
Access	-0.305	1															
Risk	-0.014	-0.042	1														
Cost	0.320	-0.139	0.048	1													
Liquidity	-0.288	0.120	0.176	-0.217	1												
Privacy	-0.256	0.060	-0.217	-0.010	-0.058	1											
Age	-0.018	0.240	-0.199	0.034	-0.059	0.154	1										
Age squared	-0.036	0.244	-0.202	0.014	-0.054	0.150	0.990	1									
Married	0.154	0.098	-0.125	0.099	-0.104	0.094	0.607	0.579	1								
Rural	0.127	-0.186	-0.114	-0.230	-0.106	0.088	0.251	0.245	0.226	1							
Male	0.066	0.130	-0.127	0.065	0.009	-0.040	0.267	0.254	0.107	0.032	1						
Occupation	-0.107	0.098	0.094	0.119	-0.075	0.105	0.430	0.384	0.348	0.159	0.115	1					
Irregular income	0.062	-0.264	-0.063	0.030	-0.042	0.066	0.100	0.080	0.106	0.302	-0.096	0.197	1				
At least one person in charge	0.089	-0.026	-0.026	-0.002	0.118	-0.037	-0.003	-0.009	0.024	-0.030	-0.008	0.047	0.015	1			
Education	0.185	0.256	-0.115	0.089	-0.089	-0.089	-0.148	-0.139	-0.169	-0.227	0.017	-0.391	-0.358	-0.013	1		
Income	0.086	0.262	0.046	0.151	0.026	-0.021	0.441	0.426	0.358	-0.052	0.271	0.342	-0.131	0.055	0.127	1	
Income squared	0.074	0.258	0.071	0.131	0.048	-0.020	0.427	0.417	0.349	-0.078	0.255	0.297	-0.145	0.063	0.135	0.977	1

Table A.3. Correlation matrix (Attributes of informal deposit mechanisms).

	Deposit using MM	Risk	Cost	Liquidity	Privacy	Age	Age squared	Married	Rural	Male	Occupation	Irregular income	At least one person in charge	Education	Income	Income squared
Deposit using MM	1															
Risk	0.048	1														
Cost	0.059	0.224	1													
Liquidity	-0.398	-0.127	-0.180	1												
Privacy	-0.371	0.013	-0.263	0.515	1											
Age	-0.018	-0.173	0.108	-0.030	-0.009	1										
Age squared	-0.036	-0.190	0.094	-0.036	-0.003	0.990	1									
Married	0.154	-0.161	-0.012	-0.137	-0.020	0.607	0.579	1								
Rural	0.127	0.056	0.069	0.215	-0.073	0.251	0.245	0.226	1							
Male	0.066	-0.033	0.180	-0.049	-0.054	0.267	0.254	0.107	0.032	1						
Occupation	-0.107	0.150	-0.067	0.169	0.100	0.430	0.384	0.348	0.159	0.115	1					
Irregular income	0.062	-0.140	-0.041	0.139	0.054	0.100	0.080	0.106	0.302	-0.096	0.197	1				
At least one person in charge	0.089	-0.018	-0.164	0.104	0.035	-0.003	-0.009	0.024	-0.030	-0.008	0.047	0.015	1			
Education	0.185	0.014	-0.039	-0.197	-0.256	-0.148	-0.139	-0.169	-0.227	0.017	-0.391	-0.358	-0.013	1		
Income	0.086	0.006	0.001	-0.007	-0.079	0.441	0.426	0.358	-0.052	0.271	0.342	-0.131	0.055	0.127	1	
Income squared	0.074	0.023	0.017	-0.027	-0.080	0.427	0.417	0.349	-0.078	0.255	0.297	-0.145	0.063	0.135	0.977	1

Table A.4. Correlation matrix (Reduced form for predicting the use of mobile money).

	MM user	Distance	Age	Age squared	Married	Rural	Male	Occupation	Irregular income	At least one person in charge	Education	Income	Income squared
MM user	1												
Distance	-0.888	1											
Age	-0.027	0.043	1										
Age squared	-0.045	0.060	0.990	1									
Married	0.131	-0.070	0.607	0.579	1								
Rural	0.146	-0.088	0.251	0.245	0.226	1							
Male	0.007	0.009	0.267	0.254	0.107	0.032	1						
Occupation	-0.078	0.069	0.430	0.384	0.348	0.159	0.115	1					
Irregular income	0.043	-0.030	0.100	0.080	0.106	0.302	-0.096	0.197	1				
At least one person in charge	0.107	-0.097	-0.003	-0.009	0.024	-0.030	-0.008	0.047	0.015	1			
Education	0.162	-0.126	-0.148	-0.139	-0.169	-0.227	0.017	-0.391	-0.358	-0.013	1		
Income	0.071	-0.043	0.441	0.426	0.358	-0.052	0.271	0.342	-0.131	0.055	0.127	1	
Income squared	0.070	-0.047	0.427	0.417	0.349	-0.078	0.255	0.297	-0.145	0.063	0.135	0.977	1

Note: Distance is the distance to the nearest agent.

Table A.5. Deposit in mobile money account and individuals' characteristics. (IV Results are also reported).

	Full sample											
	Deposit in mobile money account											
	Participating in informal mechanisms		Low vs. High income		Irregular vs. Regular income		Rural vs. Urban		Female vs. Male		Less vs. Highly educated	
		Total effect		Total effect		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
MM user	5.445***		6.315***		20.255***		6.314***		5.748***		6.642***	
	(0.790)		(1.012)		(1.093)		(1.206)		(0.821)		(1.266)	
Individuals' characteristics	-1.642		25.976**		12.763*		-2.715		2.801		-9.375	
	(10.058)		(10.564)		(6.638)		(8.942)		(8.723)		(6.554)	
MM user x Individuals' characteristics	0.483	5.928***	-1.325	4.990***	-15.578***	4.678***	-1.264	5.051***	-0.521	5.227***	-2.231	4.411***
	(1.293)	(1.024)	(1.314)	(0.838)	(1.332)	(0.752)	(1.467)	(0.836)	(1.262)	(0.959)	(1.453)	(0.713)
Individuals' characteristics x Controls included	YES		YES		YES		YES		YES		YES	
Controls *included*	YES		YES		YES		YES		YES		YES	
Observations	376		378		378		378		378		381	
Pseudo R2	0.634		0.627		0.641		0.634		0.630		0.616	
Wald $\chi2$ (H0: nullity of coefficients)	158.92***		130.03***				106.22***		133.92***		327.80***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	355.56***		351.11***		358.46***		354.72***		352.84***		344.55***	
% correct prediction (y=1)	92.86%		90.91%		92.21%		92.21%		93.51%		94.16%	
% correct prediction (y=0)	86.94%		87.05%		86.61%		87.95%		86.61%		86.34%	
	Deposit in mobile money account											
	Participating in informal mechanisms		Low vs. High income		Irregular vs. Regular income		Rural vs. Urban		Female vs. Male		Less vs. Highly educated	
		Total effect		Total effect		Total effect		Total effect		Total effect		Total effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Pr (MM user)	4.666***		4.576***		5.359***		5.734***		4.764***		5.109***	
	(0.622)		(0.546)		(0.694)		(0.927)		(0.675)		(0.734)	
Individuals' characteristics	-0.164		20.932**		2.544		-4.599		1.749		-8.191	
	(9.502)		(9.258)		(6.523)		(8.340)		(8.049)		(6.144)	
Pr (MM user) x Individuals' characteristics	0.616	5.282***	0.371	4.947***	-0.966	4.393***	-1.307	4.426***	0.155	4.920**	-1.161	3.948***
	(1.089)	(0.894)	(1.003)	(0.842)	(1.013)	(0.739)	(1.134)	(0.655)	(1.049)	(0.803)	(0.964)	(0.625)
Individuals' characteristics x Controls included	YES		YES		YES		YES		YES		YES	
Controls *included*	YES		YES		YES		YES		YES		YES	
Observations	376		378		378		378		378		378	
Pseudo R2	0.556		0.540		0.555		0.564		0.558		0.522	
Wald $\chi2$ (H0: nullity of coefficients)	158.00***		155.68***		148.65***		144.83***		150.01***		347.67***	
Likelihood ratio test $\chi2$ (H0: nullity of coefficients)	315.96***		306.69***		314.43***		319.08***		315.89***		297.75***	
% correct prediction (y=1)	87.66%		87.01%		88.31%		88.96%		87.66%		88.31%	
% correct prediction (y=0)	86.49%		85.27%		85.71%		87.05%		86.16%		84.82%	
endogeneity test	5.383		7.757		6.995		5.917		5.880		9.064	
p-value	0.020		0.005		0.008		0.015		0.015		0.003	
Kleibergen-Paap LM test	251.09		237.24		244.48		245.33		234.34		250.08	
p-value	0.000		0.000		0.000		0.000		0.000		0.000	

Note: Dependent variable: deposit in mobile money account is a dummy that takes the value 1 if respondents make deposits using mobile money account, and 0 otherwise. Pr (MM user) is the independent variable of interest that is the predicted value of mobile money use that we obtain from the reduced form estimation in Table 9. Robust standard errors are in brackets. Controls included: age, age squared, married, rural, male, occupation, irregular incomes, at least one person in charge, education level, incomes level and incomes squared. According to each regression (from 2 to 6) we drop the concerning individual characteristic from the control variables. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

CONCLUDING CHAPTER

This research has assessed the adoption of mobile financial technology in developing countries and subsequently focuses on the impact of mobile money on individual financial behaviors. In the three chapters presented above, we start with an overview of mobile financial technology adoption across developing countries, identification of the drivers of mobile money adoption and the similarities and differences between Sub-Saharan African and other developing countries. We then analyze empirically the impact of mobile money adoption on individual saving behaviors using individual-level survey data that we collected between May and June 2014 in Burkina Faso. Finally, using our same individual-level survey data we examine empirically the comparative advantage of mobile money over traditional financial services and its impacts on the choice of deposit vehicle.

In this concluding chapter, we draw lessons from the main findings of our thesis, highlight their implications and underline directions for future research.

In this thesis, our first objective was to provide insights about the adoption of mobile financial technology across developing countries (chapter 1). We proceed by distinguishing mobile money from mobile banking to highlight which mobile financial technology dominates. Moreover, in this analysis we take into account the gap in mobile financial technology adoption that may exist among regions by setting Sub-Saharan Africa against other developing countries. To achieve our objective, we consider a sample of developing countries where both mobile money and mobile banking co-exist. Looking at regional breakdown of mobile money and mobile banking adoption, we find that mobile money remains the dominant mobile financial technology especially in Sub-Saharan Africa. We confirm empirically the specificity of Sub-Saharan Africa where mobile money is more likely to be adopted than in other developing countries using a cross-country analysis. We also identify empirically the determinants that promote mobile money adoption in developing countries and highlight similarities and disparities between Sub-Saharan African countries and other developing countries. Overall, the results indicate that Sub-Saharan Africa remains the region where mobile money meets rapid uptake with the potential to improve financial development.

The second chapter provides evidence on the impact of mobile money adoption in developing countries by assessing its impact on individual saving behavior. Our choice to focus on individual access to savings services stems from the work of Dupas and Robinson (2013b),

which shows that simply providing a safe place to keep money is sufficient to increase preventative health savings. Moreover, mobile money appears cheap, available and safe and may be prominent to solve problems coming from limited access to financial services in developing countries. As our goal is to examine the impact of mobile money as a saving device on individual saving choices, we address the following two questions. First, we investigate whether the use of mobile money increases the capacity of individuals to save, particularly for unpredictable events such as health emergencies. Second, we examine whether disadvantaged groups benefit from the use of mobile money to increase their savings. In this regard, we design and conduct a survey at individual-level in Burkina Faso. Overall, we find that the use of mobile money facilitates saving for health emergencies. We also find that disadvantaged groups (rural, female, less educated individuals and individuals with irregular income) benefit from the use of mobile money which increases their capacity to save for health emergencies. We also investigate the mechanisms underlying these results. We show that safety and the cross-border remittances within the sub-region associated with mobile money are factors that may lead mobile money users to save for health emergencies.

The last chapter extends our investigation on the impact of mobile money adoption on individual financial behaviors by assessing the complementarity and substitutability between mobile money and traditional financial deposit instruments. This work shows precisely how mobile money is integrated into individual financial portfolio that combines formal and informal deposit instruments. To do so, we exploit our same individual-level survey data to analyze the relative attributes (access, risk, cost, liquidity and privacy) that may lead individuals to prefer using mobile money to make deposits. We also check whether mobile money facilitates access to formal financial services according to the fact that in developing countries physical infrastructures of financial institutions are weak which hinders their access and usage by individuals. Interestingly, as our analysis is related to developing countries, we investigate the extent to which the adoption of mobile money may impact participants in informal mechanisms to access formal financial services. Moreover, we separate bank institutions from credit union institutions given the important widespread and specificities of the latter in developing countries in general and Burkina Faso in particular. Overall, our findings confirm that the convenience associated with mobile money makes it a preferred deposits instrument. Interestingly, we show that the use of mobile money brings individuals participating in informal financial mechanisms

toward formal financial services especially banks. Considering individuals characteristics, we find that the use of mobile money leads advantaged individuals to use a bank account, while brings disadvantaged individuals toward bank and a credit union accounts.

Overall, our research results have important implications that may help governments, policymakers, international organizations and central banks to sharpen the financial sector and improve financial inclusion in developing countries.

In developing countries, many improvements have been done in the regulation context to allow the entry of non-banking institutions in the provision of payment services in order to facilitate financial access. However, some improvements are still needed to allow non-bank institutions, especially mobile network operators, to launch their own mobile money products. In fact, in several developing countries mobile network operators need to build partnerships with banks in order to launch mobile money services. Moreover, mobile network operators remain the active actors in the supply of mobile money products through their presence across countries and scalable retail agents. Enabling them to launch mobile money products may reinforce competitiveness in the financial system and hence reduce costs and increase efficiency. This can be achieved by putting in place consistent policy and regulatory reforms that cover all mobile money services. This in turn will allow providers to foster mobile money system development and improve formal financial inclusion.

Despite the initiatives implemented to boost mobile money adoption in developing countries some disparities remain across countries. One leverage on which Government, policymakers and Central Banks may act is through the expansion of electronic money issuers and retailer agents. They may act through specific strategies to motivate mobile money providers to reach remote areas especially in rural areas to ensure broader access to basic formal financial services. For instance, microfinance institutions appear as key alternatives to banks in many developing countries to provide financial services for unbanked people. In some countries, microfinance institutions have started to participate to the supply of mobile money services. For example, a microfinance institution, Musoni, whose operations are entirely mobile-based exist in Kenya since 2009. Yoban'tel a mobile money product launched in 2010 in Senegal and that operates in partnership between a microfinance institution (Crédit mutuel du Sénégal) and a bank (Société Générale des Banque du Sénégal). Indeed, as microfinance institutions are widespread in

developing countries, one way of achieving this may be to encourage them to adopt mobile money and increase the supply and usage of mobile money services.

Policies that target and motivate disadvantaged groups to use mobile money services should also be encouraged. Promoting the creation of an informal savings groups linked to individuals' mobile money account and that allows transactions between both accounts may reduce the need of cash exchanges that is less secure and favor electronic money. The involvement of governments in the development of mobile money can also increase the confidence of the population to adopt this financial innovation. The traceability of the various operations conducted through mobile money could also be put forward for the credibility of this new system.

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