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Financial Inclusion through mobile money -

A literature review

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Brussels, August 2016



Lena Maria Hug

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Abstract

Mobile financial services among the most promising aspects of the new technology revolution in the developing world. Mobile money could have the potential to transform entire economies, by providing financial services and thereby encouraging saving and investment. Today 271 mobile money systems in 93 countries are in place with worldwide 411 million registered accounts. Mobile money providers are processing on average 33 million transactions per day.

The objective of this paper is to examine, whether mobile money can fulfill its promise and promote the financial inclusion of unbanked population in developing countries. A lack of financial services is particular present in sub-Saharan Africa, where less than one in five households has a bank account. Therefore, the focus of that work is set on the sub-Saharan African region.

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Abbreviations

ICT = Information and communications technology

LDC = Least developed countries

MFI = Micro Finance Institutions

KCY = Know your customer

1. Introduction

The technology development of mobile phones and the widespread distribution network are providing new opportunities to the African continent. Furthermore, the rapid pace of technical change in the financial sector has led to the development of new products and forms of payments. Mobile money accounts, such as M-Pesa in Kenya change the financial landscape by providing customers a simple, efficient and cost-effective method to make payments and to transfer money. Sub-Saharan Africa is globally leading in providing mobile financial services and these services target in particular the unbanked population. Still in 2012, Africa includes the top five of the most expensive remittance corridors in the world (Batista and Vicente 2012). Thus, transferring money remains extremely costly and a large part of the population remain excluded from formal financial institutions.

In this review I tackle the question whether mobile money has the potential to include people which are unbanked into the financial system. Which types of financial constraints can be alleviating through the innovative mobile financial services and what are the expected impacts on the welfare of the individuals?

An unbanked individual is defined as not having any type of formal bank account including checking and saving accounts. According to World Bank data on global financial inclusion, mobile money services are available in 85% of those countries where the number of people with a formal account at a financial institution is less than 20 percent (Demirgüç-Kunt et al., 2015).¹ Thus, part of the unbanked population may have the opportunity to use financial services for the first time in their life.

This paper begins by giving an overview and outlook of mobile phones and the mobile financial service adoption in sub-Saharan Africa between 1990 and 2025. The adoption of mobile phones and the development in the mobile financial sector in the last decades are impressive and were not expected to that extend. The technology and connectivity is transforming lives in sub-Saharan Africa.

¹ World Bank, Global Financial Inclusion Database (2015), Account at a financial institution (% age 15+) [2014]. Source : <http://databank.worldbank.org/data/reports.aspx?source=global-findex>

In chapter 3 I define financial inclusion and review briefly the economic theories of credit constraints. Furthermore, I present a conceptual discussion about saving behaviour and constraints of the poor.

Chapter 4 provides a reflection of new opportunities opened by mobile financial services. To which extend has mobile money the potential to overcome the previous mentioned credit and saving constraints? What do we know about potential micro and macro-economic impacts of mobile money? How do mobile financial services change or transform the savings pattern of the poor, and which impacts are potentially observable on welfare? The chapter aims to answer this questions.

Finally, the paper ends by concluding whether mobile money can be seen as a booster of financial inclusion of the unbanked population in sub-Saharan Africa.

2. Mobile phone and mobile financial service adoption and advantages in sub-Saharan Africa

In this section I present an overview of the adoption of mobile phones in sub-Saharan Africa (2.1), the development of mobile financial services (2.2), a definition of mobile money (2.2.1) and an overview of the services provided by mobile money (2.2.2).

2.1 The development of mobile phone coverage in Africa 1990-2025

“ONCE the toys of rich yuppies, mobile phones have evolved in a few short years to become tools of economic empowerment for the world's poorest people. These phones compensate for inadequate infrastructure [...] making markets more efficient [...]”²

Sub-Saharan Africa comprises 48 countries and a population of 830 million people. The sub-Saharan infrastructure is poorly developed and the rate of infrastructure investment is globally one of the lowest. A significant share of roads is unpaved or in bad condition, one third of the population has no access to electricity and fixed telephone lines rarely exist (Aker and Mbiti, 2010). The telephone landline penetration is close to zero. However, the region experienced in the last two decades an enormous growth in the Information Communication Technologies (ICT) sector. “ICT is an

² The Economist Newspaper limited 2016: “The power of mobile money” article from, Sep. 24th 2009, <http://www.economist.com/node/14505519>, website visited 18/07/2016.

umbrella term that includes any communication device or application, encompassing: radio, television, mobile phones, computer and network hardware and software, as well as various services and application associated with them.³

From an almost zero mobile coverage rate in the 1990s, the growth and adoption of mobile phones in the last two decades is impressive. Already in 2010 were 10 times as many mobile phones in use than existing telephone landlines (Aker and Mbiti, 2010). Today the coverage rate is around 80 percent and expected to reach 100 percent by 2021 (Ericsson mobility report sub-Saharan Africa, 2015). Furthermore, a forecast of the Ericsson mobility report sub-Saharan Africa done in 2015 indicates that in 2025 half of the sub-Saharan Africa's population will have internet access via smartphones. This predicted growing connectivity provides further possibilities for IT-businesses in finance and retail services.

In rural areas, mobile phones are representing the first modern telecommunication infrastructure (Aker and Mbiti, 2010), due to a need of large infrastructure investment, mobile telephony leapfrogged landline telephony in this areas. The sub-Saharan Africa mobile phone market structure has evolved from monopolies in the mid-1990s to largely deregulated markets within less than one decade (Aker and Mbiti, 2010).

For the period 2016 – 2018, sub-Saharan Africa's GDP growth prospects are relatively high. The annual growth is predicted at 4 - 5 percent (Demirgüç-Kunt and Klapper, World Bank Group 2012), however the ICT sector is estimated to grow faster than the regional economy. The key drivers for the predicted sustained investment in the ICT sector are a further expected increase in consumer spending for mobile phones and value added services such as mobile financial services, a large share of population that is still unconnected and a favorable regulatory environment (Ericsson mobility report sub-Saharan Africa, 2015). The competition among the various mobile operators in sub-Saharan Africa is high (Pénicaud and Katakam, 2014).

Greater competition improves quality, variety and innovation of products for customer and leads to continuous falling prices for mobile phones and mobile subscriptions and continuously service improvements (Porter, 2012).

³ Tech Target: <http://searchcio.techtarget.com/definition/ICT-information-and-communications-technology-or-technologies>, website visited 27/07/2016.

Mobile phones are connecting people, information, markets and services. For instance, patients are reminded through an SMS to take their medicine or a fish seller can check the prices through a simple call, instead of having travel cost to get the information directly on the market. The reduction of search costs and communication costs are improving the efficiency of agriculture and labour markets and increasing consumer and producer welfare (Aker and Mbiti, 2010; Porter, 2012; Jensen, 2007).

Aker and Mbiti (2010) name five potential benefits of mobile phones on economic development in Africa: 1.) Simplified access and more efficient use of information, 2.) Higher firm's productivity due to a better management of the supply chain, 3.) New job creation in mobile related services, 4.) Reducing household's exposure to risk because of an improved communication among social networks, 5.) Delivery of innovative financial, agricultural, health and education services.

In summary, the mobile phone evolved from a simple communication tool to a provider of a service delivery platform. This development has shifted the view on mobile phones from devices that can "just" reduce communication and coordination cost to devices, that have the potential to transform entire lives through innovative cost and application services (Porter, 2012).

2.2 The development of mobile financial services

The term mobile financial services refers to a range of innovative financial services that can be provided over a mobile network, including mobile money transfers, mobile banking and mobile payments (see figure 1). The concept of mobile financial services is broad and continuously growing. In recent years, additional products were added to mobile financial services, such as the provision of a M-Pesa health-micro insurance product in Kenya (Pénicaud and Katakam, 2014). The "Mobile Financial Services State of the Industry Report" of 2013, reports worldwide 84 existing mobile insurance services⁴. However, a closer consideration of mobile insurance services is outside the scope of this work.

⁴ Over three quarters (76%) of mobile insurance are life insurance and 24% are providing health insurance. State of the industry report see: http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/02/SOTIR_2013.pdf.

2.2.1 What is mobile money?

The following section describes the functionality of mobile money. I take as an example the functionality of M-Pesa in Kenya, the first provided mobile money service in sub-Saharan Africa⁵. However, the operating mode of M-Pesa is quite similar to mobile money programmes offered by other mobile operators.

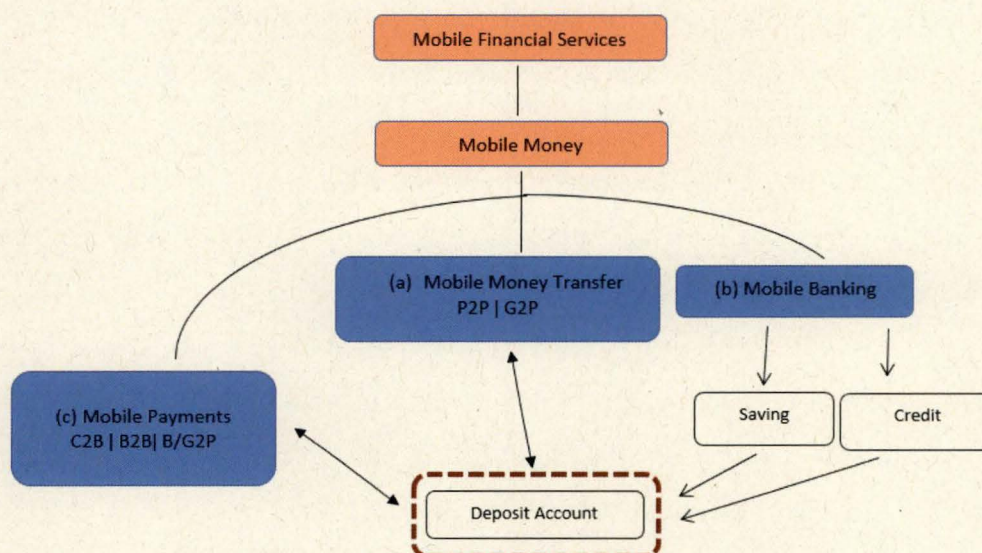


Figure 1: The functioning of Mobile Money⁶

Mobile financial services rely on mobile money. Mobile money is a form of electronic money that enables the consumer of mobile financial services to carry out financial transactions over a mobile phone. The ECB defines electronic-money “as an electronic store of monetary value on a technical device that may be widely used for making payments to entities other than the e-money issuer. The device acts as a prepaid bearer instrument which does not necessarily involve bank accounts in

⁵ M-Pesa launched in 2007 by the mobile network operator Safaricom is the most widely adopted mobile phone based financial services worldwide (Jack and Suri, 2014). Consumer subscription are increasing consistently. By 2011, 14 million accounts existed this number indicates that 70 percent of the Kenyan adults have a mobile money account⁵ (Jack and Suri, 2014). The concept of M-Pesa consists of a tight mobile money agent network. Agents are typically having business related to the mobile phone industry, but the network also include gas station, grocery stores or tailors (Jack and Suri, 2014). To use M-Pesa individuals exchange cash to electronic money at any mobile money agent across the country and transfer this money via an SMS to any other mobile phone in Kenya. Even if the owner has no M-Pesa account or uses another mobile money network. It is free of charge to deposit money, for a transfer a small fee is charged from the sender and recipient, the fee depends on the send amount. No interest is paid for a M-Pesa account.

⁶ Own drawing

transactions”⁷. Mobile money is usually denominated in the given country’s currency and held on a mobile money deposit account⁸.

It is important to distinguish between mobile money and airtime. Airtime only represents the prepaid amount held on a mobile phone for phone specific consumer services e.g. voice calls, short message services and data usage. The different channels of mobile money are illustrated in figure 1.

2.2.2 Services provided by mobile money

In this section I define the main services provided by mobile money and comment on their development.

A **mobile money transfer** is a transfer of mobile money between two persons (P2P). In specific cases, also the government can use mobile money transfers (G2P) e.g. to provide unconditional cash transfers to the poor. A mobile money cash transfer requires converting cash into mobile money (“cash-in”) through a mobile money agent. The sender, who needs to have a mobile money account, instructs the destination of the money transfer by sending an SMS. The recipient of the transfer does not necessarily need an own mobile money account⁹. He can convert the electronic money back into physical cash (“cash-out”) through a mobile money agent.

A **mobile payment** is a mobile money transfer in exchange for a good or a service. Mobile money can be sent to pay e.g. school fees, electricity or water bills or retail bills. Mobile payments also include salary payments from business or government to persons (G/B2P) or payments between two businesses (B2B).

Mobile Banking refers to more traditional banking services provided over mobile devices, such as providing a deposit account and issuing loans to mobile money customers. Typically, there are no interest earned on a deposit account.

Crucial for a functional and efficient mobile money service is the “cash-in” (saving) and “cash-out” (withdraw) infrastructure of mobile money. This infrastructure consists of a network of **mobile money cash agents**, who receive a small commission for turning cash into electronic value and vice versa. This agent network needs to be

⁷ <https://www.ecb.europa.eu/stats/money/aggregates/emon/html/index.en.html>, Copyright 2016, European Central Bank, website visited 18/07/2016.

⁸ Also called: “mobile wallet” or “m-wallet”.

⁹ Notice: Sending fees are mostly higher, if the recipient does not have a mobile money account.

widely spread to provide the possibility of including people living in rural areas to mobile financial services.

The “cash-in” and “cash-out” infrastructure becomes less relevant with a high frequency of reciprocal cash transfers and payments; thus mobile money can stay repeatedly in its electronic form.

The provision of mobile money services is growing rapidly. Figure 2 shows that between 2005 and 2015 the number of mobile money services increased from six to 271 globally. Mobile money has achieved a broad success especially in sub-Saharan Africa, where by end of 2015, 52 percent of the services worldwide were provided.

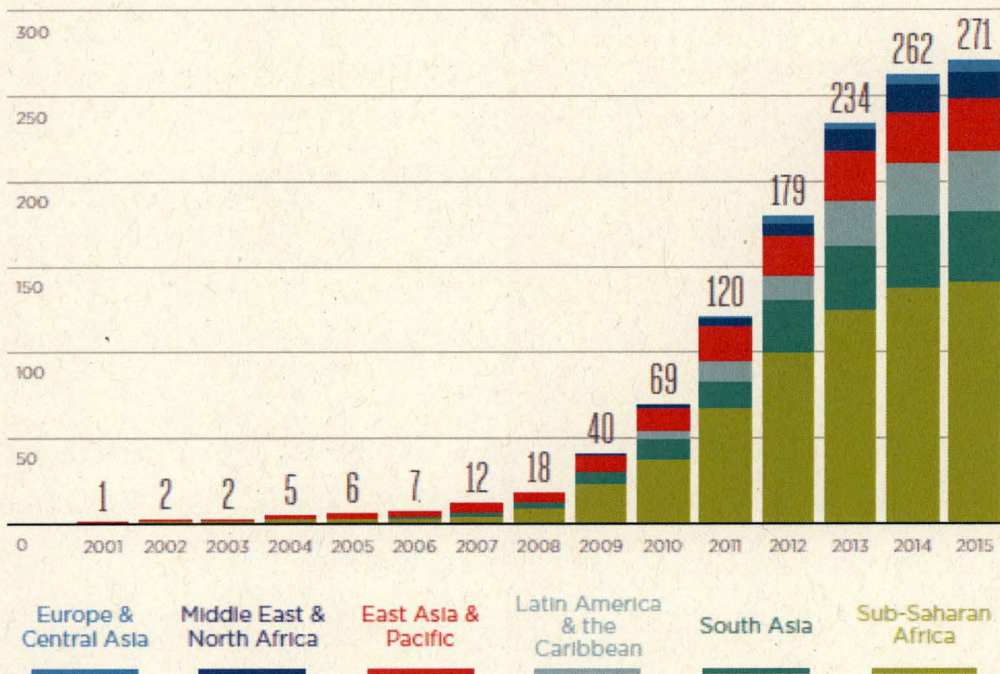


Figure 2: Number of mobile money services by region (2001-2015, year-end)¹⁰

¹⁰Figure adapted from: GSMA state of industry report 2015, page 13, see: http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2016/04/SOTIR_2015.pdf.

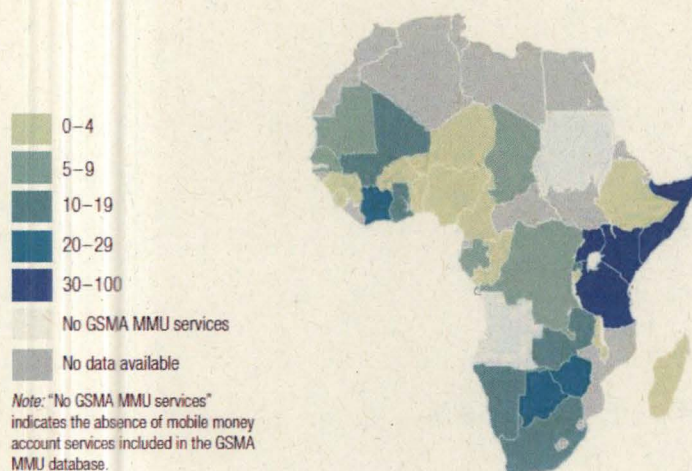


Figure 3: Mobile money account penetration in sub-Saharan Africa, adults with an account (%) in 2014¹¹

In 2012, 16 percent of sub-Saharan adults reported a usage of mobile financial services for either mobile money transfers or mobile payments in the last 12 months. In Kenya, where the major mobile money service M-Pesa was launched already in 2007, even 68 percent of adults were reporting a usage of mobile money in the past 12 months. (Demirgüç-Kunt and Klapper, World Bank Group 2012)

Figure 3 shows the mobile money account penetration for Africa in 2014. It is conspicuous that especially in Kenya and its neighbouring countries the mobile money account penetration is high.

According to World Bank data on global financial inclusion, mobile money services are available in 85 percent of countries, where the number of people with a formal account at a financial institution is less than 20 percent. In 18 sub-Saharan African countries exist more mobile money accounts than bank accounts.

Thus the novel innovation of mobile money is promising to bridge the financial access gap, allowing for socio-economic improvements especially among the financially excluded rural communities in several sub-Saharan African countries (Munyegera and Matsumoto, 2014).

The following chapter provides a definition about financial inclusion and reviews in that context credit and saving constraints of the poor.

¹¹ Source: Demirgüç-Kunt et al. (2015) Global Findex Database 2014.

3. Financial inclusion

In this section I first define financial inclusion as used by development agencies (section 3.1) and then detail the economic mechanisms that explain that poor people in particular are excluded from credit market (section 3.2) and saving market (section 3.3).

3.1 Definition and importance of financial inclusion

Financial inclusion is an important factor for reducing poverty, since it eases saving and borrowing and it helps to empower the poor to insure themselves against occurring shocks in their lives (Demirgüç-Kunt et al., 2015). Financial inclusion has many dimensions and is difficult to measure, it is thus not surprising that different definitions of the term are used in the literature. Sarma and Pais (2011) describe financial inclusion as a process that ensures the ease of access, availability and usage of the formal financial system for all members of an economy. A quite similar definition is given by the African Development Bank, which defines financial inclusion as the process of making formal financial services available, accessible and affordable to all segments of the population (Triki and Faye, African Development Bank, 2013). By using the term financial inclusion in this paper, I refer to a situation where an individual has access to the services of a formal financial institution (such as a commercial bank, MFI or insurance company).

An adequate method to measure financial inclusion has to take into account the several dimensions of the notion. The Index of Financial Inclusion (IFI) developed by Sarma (2008) has a multidimensional approach and is combining information about banking penetration, availability of banking services and usage of banking services in a single number, valued between 0 and 1. A higher value is representing a higher value of financial inclusion. The computation method of the IFI is comparable to the Human Development Index (HDI). The Global Findex database launched by the World Bank in 2011 and recalculated in 2014¹² measured financial inclusion as having an account which can be used to store money and receive payments (see figure 4: account penetration in 2014). Figure 4 shows that mobile money accounts play an important

¹² Demirgüç-Kunt et al. (2015) Global Findex Database 2014.

role in sub-Saharan Africa, a region where only 34 percent of adults have an account. Thus according to the Global Findex database the level of financial inclusion for the sub-Saharan Africa region is under the world average level of financial inclusion. The 2014 database consists of more than 100 indicators about the saving, borrowing and payment habits and the risk management behaviour of people for 143 economies.

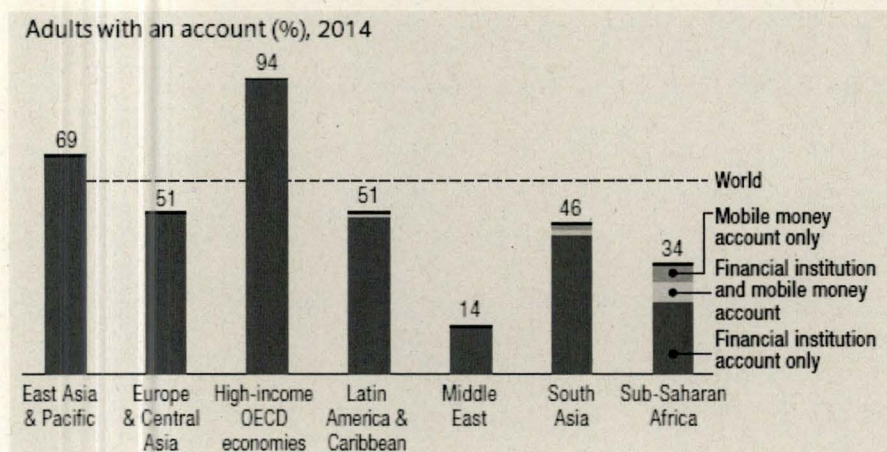


Figure 4: Account penetration in 2014¹³

The contrary of financial inclusion is financial exclusion, which can be defined according to Conroy (2005) as *“a process that prevents poor and disadvantaged social groups from gaining access to the formal financial system”*. Financial exclusion is used in that paper to refer to the involuntarily lack of access to formal financial services.

Concerning the importance of financial inclusion, it is now well admitted that exclusion from the formal institution is one of the barriers to a world without poverty. A large fraction of the population in developing countries lacks access to formal financial institutions. Lately, financial inclusion has become a policy priority (Cull et al., 2014). The access to finance is a crucial (macroeconomic) requirement for economic growth, since it leads to higher investment and income, empowers households and let them escape from poverty circles (Solo, 2008). Thorat (2008) describes that countries with a high percentage of their population excluded from formal financial services also face higher poverty ratios and higher inequality. Chakrabarty (2009) argues that financial inclusion raises the opportunities of investment and helps to develop saving and entrepreneurial capacities, which leads to higher income and in the consequence to better life's. Furthermore, persons participating in the financial system are better able

¹³ Figure adapted from Demirgüç-Kunt et al. (2015) Global Findex Database 2014, page 11.

to manage risk and have a higher ability to absorb financial shocks (Beck et al. 2015). Thus, the provision of credit is essential for the poor. Credits are needed to finance working capital and investment in fixed capital and to smooth consumption (Ghosh et al., 2000). The availability of credits has a direct influence on output, technology choices and investment (Ghosh et al., 2000).

In the next section I will focus on the importance of credit markets for the poor and on the mechanisms which are excluding people from the formal credit markets.

3.2 Credit Markets: Economic theories of credit constraint

The lack of development of financial markets for the poor carries welfare implication for this population, but is also hurting economic development of the country. Many individuals have no access to formal financial institutions (including MFI) and thus rely on self-finance or expensive alternatives, such as the informal sector. Informal credit contracts are largely inferior to formal credit contracts. Steel et al. (1997) find that the interest rates offered by moneylenders in Malawi, Tanzania, Ghana and Nigeria are at least 50 percentage points higher than formal sector interest rates. Not only that it is more expensive to borrow on informal credit markets, but informal contracts are typically only announced orally, which may raise question about negotiating possibilities of the lender. According to Ghosh et al. (2000) the informal credit market is a highly segmented market which is characterised by long term exclusive relationships, repeat lending and interlinkages to other markets (land, business, etc.). Thus, the poor can be stuck in a relationship with small negotiating power (e.g. worried about new negotiating of contract) and little competition. On the more positive side, informal credit contracts mostly only require little or no collateral and thus are providing the poor at least a possibility to borrow.

It is all the more problematic that the poor are excluded from formal financial markets, because the theory of decreasing returns suggest, that they are actually willing to pay a lot to gain access to a loan (Armendáriz de Aghion and Morduch, 2005). Both supply side and demand side constraints may explain this lack of formal credit market use of the poor. The principle of diminishing marginal returns to capital, illustrated in figure 5, is suggesting that entrepreneurs/individuals with relatively little capital should be able to gain higher returns on their investment compared to entrepreneurs/individuals with

a higher stock of capital. The principle of diminishing marginal returns is derived from the assumed concavity of production functions. Therefore, an entrepreneur should gain more output with every additional unit capital he invests. Though, those output gains are getting incrementally smaller with each additional unit of capital (see figure 5). As a result of the higher return on capital, a poor entrepreneur should be able to pay higher interest rates. Lucas (1990) finds that a borrower in India is willing to pay 58 times more for capital than a US borrower. In these condition, why are formal lenders not catching up the opportunity to enter the financial market of the poor?

Even though an investor could gain higher profits from credit issuing to poorer entrepreneurs, this group struggles to find a credit or acts hesitant by picking up funding opportunities (Armendáriz de Aghion and Morduch, 2005).

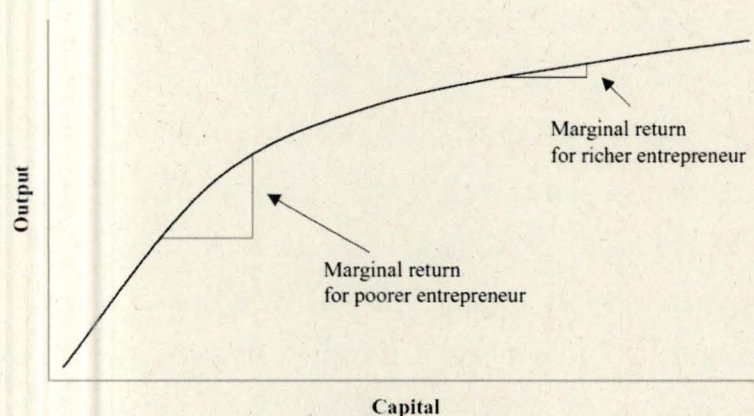


Figure 5: Marginal returns to capital¹⁴

Thus credit markets are characterised by non-price rationing, this means that there exist potential borrowers willing to pay the interest rate (price) prevailing in the formal sector but are excluded from the market. Boucher et al. (2009) named three types of non-price rationing, which can be sorted to supply or demand side constraint: *quantity rationing* (supply side constraint), *risk rationing* (demand side constraint) and *transaction cost rationing* (demand side constraint). I describe these constraints in the next two sections.

¹⁴ Figure adapted from Armendáriz de Aghion and Morduch (2005), page 5.

3.2.1 Supply side constraint

To explain supply side constraint, Stiglitz and Weiss (1981) describe in the seminal paper "Credit Rationing in Markets with Imperfect Information" the two classic asymmetric information problems: asymmetries about *type* and asymmetries about *action*.

Asymmetric information exists because borrowers have more information than lenders. Borrowers may hide the true return of their project (their type). Bad types may pretend to be good. This leads to an adverse selection problem. Furthermore, borrowers may hide the effort they invest in their project (their action). This behaviour leads to a problem of moral hazard. Both the type and action of the borrower influences the profit of the lender in presence of limited liabilities. The lender responds to the existence of low value projects and low effort possibilities by increasing the interest rate, in order to compensate for situations where borrowers do not pay. Those who are willing to pay a higher interest rate, may on average be worse risk, thus they are willing to borrow on high interest rates, because they calculate their probability to repay as low. As a consequence, by increasing the interest rate the average riskiness of the borrowers rises and possibly lowers the banks profit. Good types borrowers with a high level of effort may be discouraged by the set interest rate. The market collapses, when the interest rate is set too high, because the good types of borrowers drop out of the credit market and only the bad types remain. Profitable investments are not made. Stiglitz and Weiss (1981) show that even in equilibrium a credit market is characterised by supply side credit rationing, due to a lack of information the lender has about the borrower.

In a world of perfect information, a bank could precisely measure all actions the borrower could undertake. Since perfect information is not existing, a bank is determining the interest rate r^* at a level on which credits are still attractive to low-risk borrowers and expected return on capital is high.

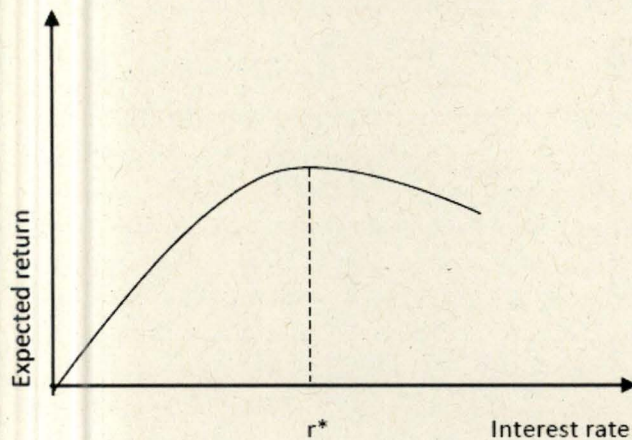


Figure 6: Equilibrium interest rate¹⁵

Figure 6 shows that expected return on capital and the interest rate are not linear increasing. The curve has a concave shape and expected returns are decreasing after r^* . The supply of loans and the demand of funds are both functions of the interest rate. At point r^* the demand of funds exceeds the supply. Even if the unsatisfied borrowers would offer to pay higher interest rates, the bank would deny a credit. Hence on point r^* supply does not equal demand, but r^* is representing the equilibrium interest rate. The bank is not offering a loan for a higher interest payment. Stiglitz and Weiss (1981) describe that situation as follows: "No competitive forces leading supply to equal demand and credit is rationed". The consequence is that poor borrowers, due to adverse selection, have no possibility to get a loan, even if they would be willing to pay a higher interest rate.

The presence of asymmetric information between lender and borrower results in problems of adverse selection and moral hazard. Moral hazard arises because financial institutions are unable to ensure that customers are making the full effort requirement for their investment projects to be successful. A common response of lender to asymmetric information is to require collateral. The provision of collateral addresses moral hazard, because it is providing an incentive to the borrower to perform in the best possible way (Hoff, Karla, & Stiglitz, Joseph E., 1990). Furthermore, it can also address adverse selection by sorting borrowers (Bester, 1987).

¹⁵ Figure adopted from Stiglitz and Weiss (1981), page 394.

The poor have less securities and often not the right type. Regularly they do not hold the land titles for their land or lack sufficient assets to put up as collateral (Ghosh et al. 2000). Due to a lack of traditional collateral a formal credit is often denied.

Issuing a loan has a fixed transaction cost for the lender, thus lenders also prefer to deal with larger borrowers than with poor small borrowers.

3.2.2 Demand side constraint

Beside the supply side endogenous quantity credit rationing mechanism, Boucher et al. (2009) stress the importance of demand side credit constraint, which can also arise due to information asymmetries. For household survey data in rural Peru, they find that only taking into account supply side constraint is significant underestimating the frequency and impacts of credit constraint. Boucher et al. (2009) name risk rationing and transaction cost rationing as demand side constraints.

A risk rationing household can be defined as a household which is holding the required asset wealth to qualify for a credit, but is voluntarily refusing from it, because of the fear of losing the collateral. Carter et al. (2007) describe risk rationing as a situation of absent insurance markets and asymmetric information, in which lenders are shifting so much contractual risk to the borrower that he voluntarily withdraws from the credit market, even if he has the wealth of the required collateral. The risk of collateral loss is unacceptably high for a risk-rationed household.

Transaction cost rationing describes a household that holds the required asset wealth, but voluntarily refuses the credit because of the unacceptable high transaction cost. Due to asymmetric information and high administrative cost, the transactions costs for a formal credit are high. The transaction cost paid by the borrower is mostly fixed, therefore the cost is proportional to the borrowed amount largely higher for borrowers, who are asking for a small loan. Thus the poor are more likely discouraged by transaction costs.

Informal lender can profit from an informational advantage (Conning, 1996; Hoff and Stiglitz, 1990), hence transaction costs are lower and application procedure easier. The effective cost of an informal loan might be lower, even if the interest rate is higher. Furthermore, a transaction cost rationed household might be discouraged by the high

transaction cost and might choose an informal loan contract, even if he could possibly get a formal loan (Guirking, 2008).

3.3 Why do the poor not save? Saving constraint: Conceptual discussion

Saving is important for an economy. At the macroeconomic level it is an indicator for future economic growth. For individuals having a saving deposit can be seen as an insurance against occurring economic shocks. Furthermore, it helps to smooth household consumption and finance productive investments in human and business capital (Karlan, 2014).

According to Demirgüç-Kant and Klapper (2012), 77 percent of adults living on less than 2 US Dollar per day, do not have a deposit account at a formal financial institution and a significant share of those having access, do not use their saving account in an efficient and effective way. This circumstance does not automatically imply that the poor in general do not have any means or capacity to save. Several household studies are indicating that even the very poor are saving.¹⁶

Therefore, the low penetration rate of formal accounts can be seen as a sign for existing constraint to saving in formal financial institutions, which might hinder the poor to save in an efficient way.

Transaction costs, lack of trust and regulatory barriers, information and knowledge gaps, social constraints and behavioural barriers are five sets of constraints named by Karlan et al. (2014), that may hinder the adoption and effective usage of savings products and services by the poor. According to Karlan, these 5 categories could be potential explanations for the existing “undersaving” of the poor. “Undersaving” is defined as a lower level of savings that an individual would experience in a state of perfect markets and fully rational decision making processes. In the following paragraph, I specify the five sets of constraints described by Karlan et al. (2014).

Transaction costs are the costs of using formal banking. Karlan et al. (2014) distinguish between pecuniary costs such as account opening fees, minimum balance requirement withdrawals fees and transportation cost; and non-pecuniary costs (non-

¹⁶ See for instance: Banerjee, Abhijit V., & Duflo, Esther 2007.

monetary costs) such as opportunity costs in terms of time and forgone salaries. Non-pecuniary costs are difficult to measure. Under the assumption of perfect markets, transaction cost should be zero. In fact, transactions costs are in relation to the saving deposit amount extremely high for the poor and thus maybe lead to “undersaving”. The faced transaction costs are relative to the deposit more expensive for the poor.

Trust can be defined as a subjective assessment of reliability of an individual on the formal financial institutions. It affects the willingness of individuals to use formal institutions. Meaning a person who is willing to save needs first trust in the institution it wants to save in. Furthermore, empirical studies show that a high level of regulation is more likely to diminish consumer trust, than enhancing it. “Know Your Customer” (KYC) rules can hinder financial inclusion in the banking sector particular for the poor. Various different official documents such as national ID card, birth certificate, salary certificate, etc. are needed to register at a formal financial institution. The poor are often not in the possession of those documents or they face difficulties to get them. Formal financial institutions are reluctant to customer they do not know. A lack of trust can be seen as an implicit cost due to moral hazard and leads from the consumer perspective to unconsummated transactions (Karlan et al., 2014).

The requirement of the mentioned identification documents, could create the impression that the formal institutions do not trust their potential customers, especially the poor are not familiar with such identification processes.

Monitoring bank account transactions and ownership can be seen as a key obstacle to entry for the poor (Karlan et al., 2014). A strong **regulatory barrier** for formal banking are the enforcement of Anti-Money-Laundering (AML) laws which aim to prevent money flows from terrorist activities. AML prudential regulation carries additional transaction cost for both side the banks and the customers. It is necessary to collect detailed personal information about the client (e.g. proof of name, residential address, date of birth, national identity number). Such information are often not available or incomplete or costly to obtain for the poor.

The “financial literacy” of the poor is low, due to an **information and knowledge gap**. The poor may not be able to read and understand the bank account contract probably, may have difficulties with simple math calculation or do not keep their saving book at

a safe place. Those information and knowledge gaps may carry saving constraints. However, empirical evidence by Fernandes et al. (2014) provides a mixed picture, whether the low level of knowledge causes undersaving. Definitely the results imply that so far tried programmatic interventions to increase financial literacy are not working cost-effectively (Fernandes et al., 2014).

Social constraint may have an influence on the formal saving performance of the poor. Family, community and saving networks are an important shock absorber for the poor. The financial support of the network is used to smooth consumption and to respond to economic shocks. Those social connections can foster risk-sharing across both an intra-household and an inter-household level. However, the networks have an informal nature and can hinder formal saving performance. Individuals can be forced to support with an existing money surplus family and friends. The consequence of social pressure is either that money is spent right away or used to support the expanded family, but not saved in a formal account. Money transfers are an important income factor in sub-Saharan Africa, especially in rural areas.

A **behavioural bias** is a decision, which is not compatible with standard expected utilities theories. According to Karlan et al. (2014), four types of behavioural biases are present in the context of saving constraint of the poor: 1.) Biases in preferences (e.g. self-control, multiple-self), 2.) Biases in expectation of prospects (e.g. over optimism), 3.) Biases in price perceptions (e.g. underestimating compound interest) or 4.) Biases in the decision making process conditional to the previous three variables, present.

As a result, deep seated saving constraints of the poor exist. Those constraints might provide an explanation for the rare number of formal saving accounts hold by the poor and in general the lack of saving opportunities of the poor. However, the provided reasons for the small participation of the poor in formal saving opportunities remains vague. A deeper research in the field is necessary and needed, especially to target specific innovations and programs to increase the formal saving ability of the poor.

4. Economics of mobile money: Conceptual discussion

In this section I discuss the consequences of gaining access to mobile money for households and the economy in general. This section is based on the following authors, who examine aspects of the economics of mobile money: Aron et al. (2015); Aron (2015); Aker et al. (2014); Cull et al. (2014); Di Castri (2013); Mas and Klein (2012); Weil et al. (2012); Jack and Suri (2011); Mbiti and Weil (2011) and Aker and Mbiti (2010). I borrow ideas from all to reflect on the credit and saving constraints mentioned in section three.

None of the mentioned authors is providing a comprehensive overview, of the channels through which mobile money might impact the economy, from both the micro- and macroeconomic perspective.

4.1 The micro view: potential economic impacts

Mobile money could affect household and business outcomes through several different channels. In what follows, I describe how mobile money can help to overcome existing financial constraints and what advantages mobile money have over the classic formal banking sector.

Transaction cost:

I discuss the transaction cost aspects of mobile money for the three main customer services: a) Mobile money transfer (person-to-person transfers); b) Mobile banking (saving and credit); c) Mobile payments (see figure 3, section 2.5.1).

Firstly, mobile payments could substantially reduce transaction cost, both in terms of cash expenditure and time. Mobile financial services are dominated by person-to-person transfers, sending cash to family members is highly important in sub-Saharan Africa. A person-to-person money transfer, for instance from a migrant family member living in a city to a family member in a rural, far distance area is simplified through the introduction of mobile money. There is no need to pay transport costs or to send money in an unsecure way through middlemen. Beside the drop of pure transportation cost, regarding savings and person-to-person transfers the advantage of mobile money is the absence of the risk of losing value through corruption or in the most extreme case the complete loss of the value through a theft. The reduced funds could have been

invested, spent or saved and the reduced time could have been spent in productive activities.

Withdrawing cash ("cash-out) or putting money in in a saving account ("cash-in") still requires a physical visit to an agent and therefore, the density of the mobile money agent network is a critical determinant of transaction cost, just as in the case of the formal banking sector. A crucial condition for a decrease of transaction costs for mobile saving is that there is no need to go to a potentially far distant bank branch each time an individual wants to put money in an account.

For mobile credit, the effect of decreased transaction cost is less relevant, since it is in most of the cases still necessary to go to a bank branch to get access to a loan. Mobile payments potentially decrease transaction costs, but this requires that the mobile money agent network is widespread. The importance of the density and proximity of the mobile money agent network on the amount of transaction costs also depends on the frequency and the reciprocal structure of the payments, this features determine whether it is frequently necessary to transform electronic money to physical money or mobile money can stay in its electronic form and is used for future transfers or payments.

As a result, a well- working mobile money infrastructure with the feature of a widespread agent network presumably has to be in place to catch up the benefits of decreased transaction costs. If this is the case transaction cost rationing (see section 3) may lead to a greater financial inclusion of the poor.

Coordination and opportunity cost:

Mobile payments can cover retail bills, rent payments, payments to suppliers by firms, payment of salaries and pensions, cash transfer from government or donors, etc. Those mobile payment opportunities are enable the poor to potentially establish a greater timing and planning of their payments and for the receiver a certainty of cash receipts. As a consequence, the development of mobile money transfer instead of cash payments may reduce coordination cost and opportunity cost (cost of delay). The combination of the reduced search, information and communication costs through a mobile phone and mobile payments may also increase the welfare of the poor.

Asymmetric Information, Transparency:

The lack of available information on a potential customer is mentioned as a failure of the formal banking sector in section 2.2.1. Asymmetric information hinder the granting of credit to poor potential customers without sufficient collateral and a documented financial history. A clear advantage of mobile financial services is, that every financial action of a mobile money customer is automatically recorded (deposit, withdrawal, transfer transaction, payment transaction). Thus, cash which was previously stored at home is moving into an electronic account and turns into recorded cash. Not only that the financial history of a mobile money costumer is automatically provided, another advantage is that the history consists of much more information than the data-back up of a classic account in the formal banking sector. In particular, it helps evaluating the accurate saving behaviour of a client, which can help to evaluate the ability to pay back a loan.

The data back-up¹⁷ is creating credit scores based on the types: Timing, frequency and size of mobile payments and transaction. This feature is especially important for the unbanked customers of mobile financial services, because the record of the individual financial history eases the granting of credits and thus can deal as an important indicator to greater financial inclusion. As a result, the financial transactions records, are not only building up a greater level of financial transparency, but also reduce asymmetric information.

Greater information can potentially decrease supply side constraints, such as quantity rationing. Thus lenders could be more informal about borrowers and need to rely less on collateral to select them. This could particular raise the access to loans for the poor and their level of financial inclusion.

Trust:

To open a mobile money account requires less information about the customer, than opening a "normal" formal bank account. To create an individual mobile money account a potential customer can register at a random mobile money agent shop. The simple and short process only requires a valid identification document. Financial regulators allow a range of identification documents to verify the customer identity such as a voter card, a driver license, a valid passport or a national ID, a local village council letter, a

¹⁷ The Data-set-up is calculated through the application of algorithms.

company or an employer issued ID or a tax certification (Di Castri, 2013). Mobile money recipients do not necessarily have to be registered (Mbiti and Weil, 2011). According to Aker and Mbiti (2010) and Jack and Suri (2011) those low and easy accessible KYC-requirements are strengthening the trust of the consumers in mobile financial services. Furthermore, the adequate functioning and operational security of mobile financial services, has achieved a grounded consumer trust level in all parts of the sub-Saharan African population. This is not a priori intuitive however, one could have expected that individuals with low literacy and little knowledge of new technology would have been very reluctant to adopt mobile money. The majority of the poor never used a non-cash payment service in their life's. Once a basic trust level in mobile financial services is achieved in a community, communal spill-over effects guided by positive experience may additionally increase the usage and adoption of mobile money. Thus, the high established trust level in mobile financial services by the sub-Saharan African population is one factor for the rapid growth of mobile money in the region.

Risk and insurance:

The poor face the risk of multiple communal shocks (flooding, droughts, etc.) and idiosyncratic shocks (theft, illness, death of family members, etc.). Few possibilities are present to formally insure against those shocks. Family and kin networks are important for the poor, since they are creating informal insurance networks by spreading risk and building up trust relationship among the members (Jack and Suri, 2011). According to Jack and Suri (2011) mobile money may improve the functioning and efficiency of the informal insurance networks. The geographic reach of networks and the actability enlarges, for instance through electronic transfers it is still possible to transfer money in remote areas, which are not reachable by public transport due to impassable roads after a natural disaster. Transfers can be better targeted, for instance through frequently, small in size remittances. Thus, negative shocks can be managed more flexible. Informal insurance network may function more effectively, which could lead to more efficient investment decisions. However, the risk-reducing benefits could be mitigated through a lower level of observability and moral hazard since no physical contacts are needed to transfer money, in the case where sender and recipient are separated by large distances (Jack and Suri, 2011).

Changing the nature of saving and family dynamics (social constraint):

Mobile money accounts offer the possibility of safe storage of cash and can thus potentially increase net household savings (Jack and Suri, 2011). Beside the safety aspects, another advantage aspect could be the privacy aspect. The discreet nature of transfers could allow personal savings to accumulate, without the direct realization of family, relatives and friends and maybe thereby reduce claims concerning current consumption needs (Aker et al., 2014). Mobile financial services may change the family bargaining power, especially of women and economically weaker family members in poor households, through the mentioned reduced observability of timing and size of mobile money transfers and accumulated savings (Aker et al., 2014 and Jack and Suri, 2011).

Greater privacy may influence both inter-household allocations (Jakiela and Ozier, 2012) and intra-household allocation (Duflo and Udry, 2004). Furthermore, if the nature of expenditure differs by gender, this could lead to welfare changes in the household. (Duflo and Udry, 2004).

The introduction of mobile phones may change the nature of social networks, improve communication and coordination opportunities and lead to more planning and efficiency. Through the adoption of mobile financial services, the size of a social network can be expanded by greater geographical reach of money transfers.

The social cohesion can be strengthened or weakened by the introduction of mobile money.

The flipside in the insurance possibilities might be raised expectation of larger and more frequent remittances which might lead recipients to put pressure on migrant family members. Jack and Suri (2011) suggest that the incentive to work or to invest in innovative projects may weaken within recipient households and thereby may create a greater dependency on money transfers. On the contrary, the migrants are less observable and accountable. Morawczynski, Olga, & Pickens, Mark. (2009) are stressing the concern, that migrated husbands could visit their families less frequently which could lead to disintegration of marriages.

Coming back to the financial constraints highlighted above (see section 3 on credit and saving constraints), more advantages and positive aspects of mobile financial services are present in respect to saving than to credit.

The high transaction costs are a substantial factor for the poor to be reluctant to formal saving accounts. The potentially extreme reduced transaction costs of mobile money, are building up new saving opportunities for the poor and unbanked population. Furthermore, mobile money has the potential to build up trust among the poor, when they once experienced the well-functioning of mobile money transfers and mobile money storage. Thus, mobile financial services can overcome important, deep-seated saving constraints.

In respect to credits the advantage of mobile financial services at present are still limited. The provided data-back up can lower asymmetric information, however the mobile money account has to be used frequently to build up a sufficient data back-up base. Through the provision of greater information about the borrower, supply side constraint such as quantity rationing can be potentially mitigated. As a consequence, a credit institute may require less collateral, which is in particular beneficial for the poor. However, to lower sufficiently supply side and demand side credit constraint also in regard to a reduction of transaction cost a broad enlargement of credit provision through mobile financial services would be advantageous. At present the provision of credits through mobile financial services is merely existing in limited, specific pilot projects.

An additional service that mobile money may indirect provide, is an improvement of informal insurance through facilitating and strengthening informal insurance networks through mobile transfers and thus potentially increasing household welfare.

4.2 The macro view: potential economic impacts

In contrast to the quite homogeneous literature on potential microeconomic impacts of mobile money, there is a lot of heterogeneity in the literature on potential macroeconomic impacts.

Impact on Money Supply

According to Klein and Mas (2012) is it important to distinguish between two different existing mobile money schemes, to discuss the impact of mobile money on the money supply: 1.) Basic mobile saving, the cash backed model and 2.) Bank-integrated mobile saving.

A mobile money scheme based on the cashed backed model, creates no new money. The cash is withdrawn from the financial system and exchanged with an adequate amount of electronic money (Klein and Mas, 2012). Mobile money schemes allow small amounts of mobile money to move rapidly. Thus, the velocity of money might change. Velocity of money describes the rate at which money is exchanged from one transaction to another and how much a unit of currency is used in a given period of time.¹⁸ The velocity of money is an important contributor to measure the rate at which money in circulation is used for purchasing goods and services and deals as a key input in the determination of an economy's inflation calculation (Mbiti and Weil, 2011). The effect of a changed velocity of money may currently be small since transaction based on mobile money are small in size, but may become significant in the near future, if the growth of mobile money continuous in the current speed (Aron, 2015). In the case of bank integrated-mobile saving, interest payment is provided for deposit on mobile money accounts. Thus, the money supply increases, which can lead to an increase of the aggregate demand.

Impacts on parallel markets:

The recorded money supply is potentially increasing through the usage of mobile money, because transactions are rechannelled and recorded. A side action may thus be a reduce in the size of parallel markets (Aron et al., 2015).

In general, the amounts involved in mobile money networks are far less than the amounts involved in the official banking system. For instance, shows data from Uganda that in 2014 mobile money accounts for only 1.4 percentage of total financial deposit and less than 10 percent of all the financial transactions in the financial system were transactions through mobile financial services.¹⁹ However, the shares may gain in the coming years.

International mobile money remittances, money supply and inflation:

At present most mobile money services, allow merely for transactions within a country. Nevertheless, foreign remittances are part of recent innovative mobile money projects,

¹⁸ Velocity of money is usually measured as a ration of Gross National Product (GNP) to countries total money supply.

¹⁹ Figures given by Mr Tumusiime-Mutebile, Governor of the Bank of Uganda, at the Digital Impact Awards Africa, Kampala, 21 August 2014; see: <http://www.bis.org/review/r141024i.pdf>.

such as the opening of three corridors from *Orange France* in October 2015. Mobile subscribers in France have since then the possibility to transfer mobile money to Orange money customers in Senegal, Mali or Cote d'Ivoire.²⁰ International remittances is the fastest growing mobile money product the volume increased by 52 percent in 2015²¹. Thus, the future size of foreign remittances through mobile money might be large.

The impact on inflation is uncertain. The remittances may reinforce immediate consumption, or may be held as savings or channelled into productive investment. Additionally, if inflows of foreign remittances further increase in the future may be offsetting effects on inflation via exchange rate appreciation observable (Aron, 2015). According to an Overseas Development Institute study, the average fee to remit money to Africa is the highest of any world region (Watkins and Quattri, 2014). The average cost for sending 200USD to a sub-Saharan country lies at 9.5 percent (Pénicaud and Katakam, 2014).

The flow of foreign remittances might increase in the coming years, due to lower transaction costs and improved simplicity of remittances through mobile financial services. This can be potentially a channel to increase the money supply and as a consequence aggregated demand.

Financial Integrity, Regulatory Responses

It is important to observe the mobile financial services sector, in regard to issues about regulation and money laundry issues. The transfers through mobile money are small in size and move rapidly. According to Klein and Mas (2012) are the high frequency and the option to disguise transactions, cause concern for the authorities dealing with money laundering and terrorist finance issues.

Those potential threats can be mitigated through a strict application of KYC-rules and thus creating an identity of a mobile money customer. Moreover, it can be useful to establish subsection transaction reporting to detect pattern of financial transfers. (Klein and Mas, 2012).

²⁰ Les Echos: <http://www.lesechos.fr/finance-marches/banque-assurances/0211002256255-transfert-dargent-orange-money-fait-ses-premiers-pas-en-france-2004178.php>, website visited 27/07/2016.

²¹ State of Industry Report Mobile Money, 2015: http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2016/04/SOTIR_2015.pdf

On the contrary, it is costly to build up a complete documentation control mechanism and the current transaction through mobile financial services are rarely exceeding amounts above a few dollars. Furthermore, may stricter KYC- rules exclude (again) large parts of the unbanked population (Di Castri, 2013).

According to Di Castri (2013) it may be preferable, if the threat of money laundering and terrorist finance can be limited through a sufficient setting of transfer limits, in terms of both maximum amount and maximum frequency within a defined time frame.

Overall, as long as mobile money transfers remain small in size no systemic risk is present.

Since potential macro impacts are less relevant, concerning the question of increased financial inclusion of the poor through mobile money; the potential aspects are not followed in detail in this work. However, macro impacts can become substantial for the poor population, when the sector will introduce stricter prudential regulation. This would automatically change the simple and easy adoption mechanism of mobile money present today.

Cull et al. (2014) point out, that policy efforts to enhance financial stability should thus not only focus on macro prudential regulation, but also recognize the positive effect of broader access to bank deposits for the poor.

5. Impacts of mobile money

In the following section I describe and review evidence studies on mobile money. The chapter aims to compare the methodologies and the results of the studies looking at the pattern of adoption (who adopts, how many people use it and for what) and at the impacts of mobile money on saving, transfers and in few cases on welfare of households.

Table 1: Typology of pattern of adoption and empirical studies on impacts of mobile money on saving, transfers and on household's welfare

Main question	Study	Country and Data	Method + identifying assumption	Potential shortcomings	Result
Who is using mobile money services?	1. Adoption pattern of mobile money <i>Weil et al (2012)</i>	Country: Kenya, Tanzania, Uganda Fin-Access data Kenya (2006, 2009) Fin-Scope data Uganda and Tanzania (2006, 2009)	Comparison of user and non-using a simple OLS framework Dependent variable: Adoption of mobile money (a) Zero/one dummy: whether an individual uses mobile money (b) Frequency of mobile money transactions per user	<u>Endogeneity and other issues:</u> Omission of control (e.g. unbanked/banked)	<ul style="list-style-type: none"> ➤ Adapters are younger, wealthier, better educated, urban resident ➤ High frequency of transfers ➤ No gender effect ➤ High adoption speed
Who is using mobile money services?	1. Adoption pattern of mobile money <i>Munyegra and Matsumoto (2014)</i>	Country: (rural) Uganda Panel of 838 households generated from the 3 rd + 4 th rounds of household and community surveys 2009&2012	Comparison of users and non-users from the same village, using Probit regression and Linear probability model with household fixed effects Dependent variable: Zero/one dummy: whether household I living in a village j in district d uses mobile money services at time period t	<u>Endogeneity and other issues:</u> Controls for hh heterogeneity, district-level time variance & phone ownership	<ul style="list-style-type: none"> ➤ No gender or age effect ➤ Distance to nearest agent is important ➤ Dummies for ownership of the phone and migrant workers are significant
Does an idiosyncratic shock increase amount of transfer or	2. Risk sharing and transaction cost <i>Jack and Suri (2014)</i>	Country: Kenya <ul style="list-style-type: none"> • Household panel survey conducted between late 2008 and early 2010, three rounds, using 	Panel differences-in-differences regressions (random intervention = idiosyncratic shock)	<u>Endogeneity and other issues:</u> Level time variance & phone ownership and interaction with	<ul style="list-style-type: none"> ➤ Mobile money significantly reduces transaction costs ➤ Individuals with access to mobile money are better able to smooth consumption than those

frequency of mobile money transactions? How does mobile money impact household welfare?		two period panel of 2,283 households. • 2010 survey submitted to 7,700 M-PESA agents.	Dependent variable: Annual per capita consumption for a household at a particular location and time.	the shock with all controls. Validity of instrument assumes random roll-out of agents	without. → Cushion against consumptions volatilities. ➤ Remittances are crucial for an improved risk spreading (greater frequency and size after negative shock)
Does mobile money have an impact on consumption and welfare of households?	3.Impact on welfare and on consumption in rural areas <i>Munyegra and Matsumoto (2014)</i>	Country: (rural) Uganda Panel of 940 households from 94 local councils (10 households randomly selected from each LC), generated from the 3 rd + 4 th rounds of household and community surveys 2009&2012	Panel differences-in-differences regressions (random intervention = introduction of mobile money services) Instrumental Variables [Instrument for mobile money adoption at the household level: with log of the distance to nearest mobile money agent] Dependent variable: Total monthly per capita consumption for a household at a particular location and time. Disaggregated monthly food and non-food social contributions expenditure.	Endogeneity and other issues: Controls for hh heterogeneity, district-level time variance & phone ownership, validity of instrument assumes random roll-out of agents. The IV result is problematic!	➤ FE regression: 9.47% increase in household per capita consumption given the adoption of mobile money services ➤ Disaggregating consumption (food, non-food and social contributions) significant coefficient for non-food (20.7%) and social contributions (47.4%). ➤ Stronger impacts of mobile money for social expenditure ➤ FE-IV: 72.7 % increase of per capita consumption (38% standard errors)
Does mobile money increases savings of households in rural areas? Does mobile money increases remittances in rural areas?	4.Mobile banking and savings <i>6.Batista and Vicente (2013)</i>	Country: Mozambique Data generated in rural areas of the Maputo district in 2012	(Simple) OLS reduced form regression in a RCT (targeted individuals in the treatment location received education and dissemination about mobile money) Dependent variables: Binary dummy variables for willingness to save and remit to	Endogeneity and other issues: First stage of selection may not be entirely random.	➤ Willingness to save and to transfer money through Mkesh increases when comparing targeted and control individuals. ➤ Distribution of Mkesh raised willingness to send money transfers regardless of transfer method. ➤ Mkesh substituted traditional methods of saving.

			migrants in Maputo and to save and remit using Mkesh (mobile money)		
<p>Increases the use of mobile financial services the prevalence of savings?</p> <p>How much savings do mobile money users accumulate?</p> <p>Who uses mobile savings?</p>	<p>4.Mobile banking and savings</p> <p><i>Demombynes and Thegeya (2012)</i></p>	<p>Country: Kenya</p> <ul style="list-style-type: none"> Survey realized by the Financial Sector Deepening Kenya, covering 6,083 individuals, during October and November 2010. Collected data included: general financial product usage, savings behaviour, mobile phone ownership and usage, M-Pesa usage Categorization: M-Pesa users, non-users 	<p>Probit and OLS</p> <p>OLS & IV-regression</p> <p>[Instrument for M-Pesa registration: The fraction of respondents in the sub-location registered with M-Pesa]</p> <p>Dependant variable: Probit: zero/one dummy weather for reported general savings and M-Kesho savings OLS: Log of average monthly savings</p>	<p><u>Endogeneity and other issues:</u> Instrument may not be completely exogenous</p>	<ul style="list-style-type: none"> ➤ M-Pesa users are 32% more likely to report savings. ➤ M-Pesa users save 12% more than un-registered.
<p>What are the impacts of unconditional cash transfers through mobile financial services for poor households?</p>	<p>5. Public Cash transfer through mobile money</p> <p><i>8.Aker et al. (2014)</i></p>	<p>Country: Niger</p>	<p>RCT</p> <p>Dependent variable: Various outcomes of interest (usage of the cash transfer, cost, food security and assets)</p>	<p><u>Endogeneity and other issues:</u> First stage of selection may not be entirely random.</p>	<ul style="list-style-type: none"> ➤ Reduced transaction costs (travel and queuing time). ➤ Increased intra-household bargaining power for women. ➤ Better nutrition for children.

Abbreviations: FE= Fixed Effect, IV = Instrumental Variable, hh = household, mm= mobile money

Empirical evidence on adoption and impacts of mobile money

The literature on the determinants of the use of mobile banking and the impacts of mobile banking on household welfare is recent and still relatively limited. Table 1 provides an overview of the available papers. Most of the studies are qualitative studies and only a few have a quantitative nature. The studies are published between 2012 and 2016 and include several different sub-Saharan countries.

Due to econometric modelling difficulties, which are mentioned further on in details, the results are often only suggestive.

Before summarizing the findings of existing studies it is important to mention that the mobile money infrastructure and the present formal institutional structures are differing substantially across the different sub-Saharan countries. Moreover, different regulations are imposed and the demand patterns are heterogeneous across countries. This circumstance has to be taken into consideration and therefore, the external validity of the provided empirical evidence is limited.

Column 4 in table 1 indicates that, the selected studies are using various methodologies. Some of them are observational studies, some explore the adoption over time using panel difference in difference regressions, other use randomised control trials (RCTs) with a treatment and a control group.

I subdivided the empirical studies into five groups: 1.) Adoption pattern of mobile money, 2.) Risk sharing and transaction costs, 3.) Impact on welfare and on consumption in rural areas, 4.) Mobile banking and saving, 5.) Public cash transfer through mobile money.

1.) Adoption pattern of mobile money

Studies aiming to measure the causal factors behind the adoption of mobile money are rare. A difficulty is that the causal influence of explanatory factors of mobile money is hard to assess (such as spill-over effects in the community). Two studies which aim to analyse the trends in the adoption of mobile money are the studies by Weil et al. (2012) and Munyegera and Matsumoto (2014).

Weil et al. (2012) use Fin- Access Data from Kenya and Fin-Scope data from Tanzania and Uganda in 2006 and 2009 to analyse the adoption pattern of mobile money.

The authors regress a zero-one dummy, whether an individual uses mobile money (sends or receives) on individual characteristics using OLS and robust standard errors.²²

They find for all three country cases significant results that the adopters of mobile money are likely to be younger, better educated and urban area residents. However, the size of the figures vary extremely across the different countries. An individual living in an urban area in Kenya uses 17.4 percent more likely mobile money and a poor Kenyan uses 11.7 percent less likely mobile money. In Tanzania, an urban person uses 1.7 percent more likely mobile money and an urban Ugandan 2.6 percent more likely. The poor do use mobile money in Tanzania 0.34 percent and in Uganda 2.2 percent less likely. The authors find no gender effect.

In a second regression, the author regress determinants of the frequency of mobile money transactions in Kenya (dependent variable: Frequency of mobile money transaction per user) and find similar result. pattern. By analysing observational statistics on the adoption of mobile money and banking services, they find an extremely fast speed of adoption of mobile money in all three countries. In Kenya, mobile money displaces the sending and receiving of money through all other means, as it is illustrated in figure 7 and figure 8. Furthermore, figure 9 shows that sending money via informal methods and the post office declined across all observed countries. The extremely high adoption and frequency figures of money transfer in Kenya²³ are leading the authors to the deduction that such an increase could also be visible in the Tanzania and Uganda in the following years, since mobile money services were introduced just shortly before 2009.

²² Independent variables are: gender, married, urbanised, level of poverty, three different age cohorts and three different education levels. The authors equate adoption of mobile money to usage of mobile money.

²³ In Kenya mobile money was introduced in 2007.

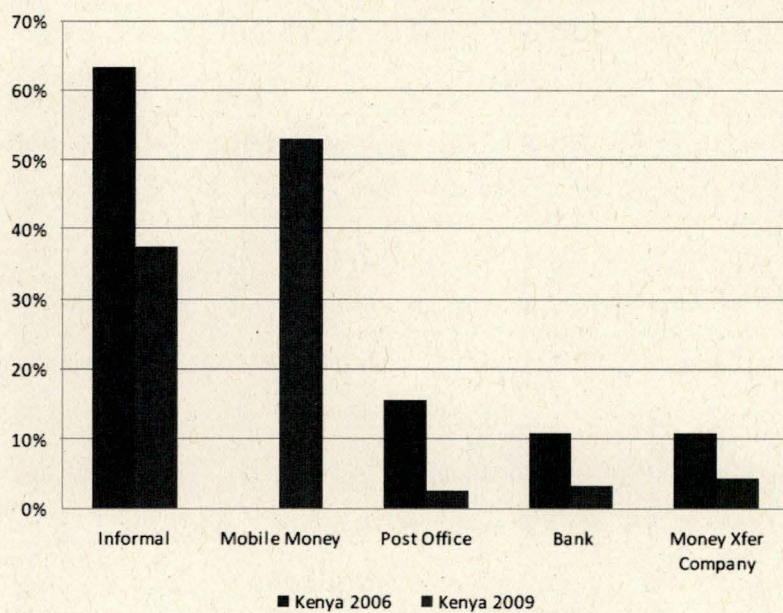


Figure 7: Money sending methods in Kenya²⁴

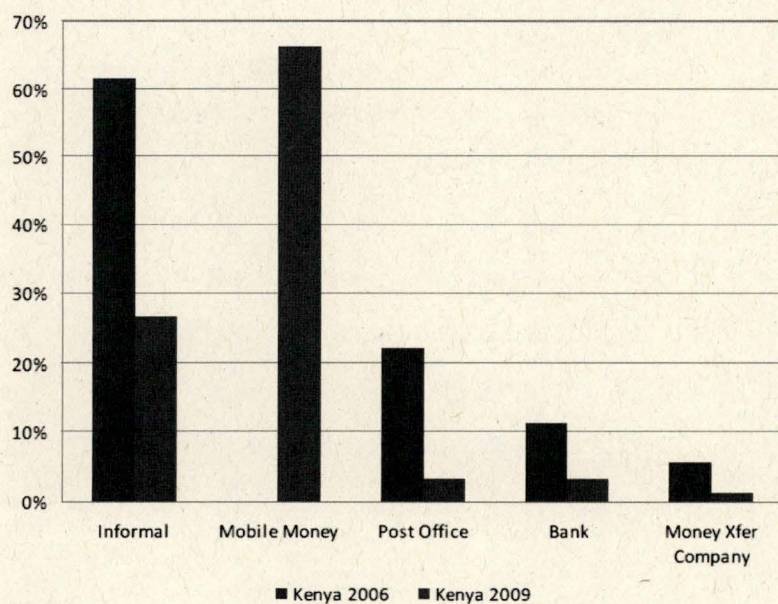


Figure 8: Money receiving methods in Kenya²⁵

²⁴ Adapted from Weil et al. (2012), page 6.

²⁵ Adapted from Weil et al. (2012), page 7.

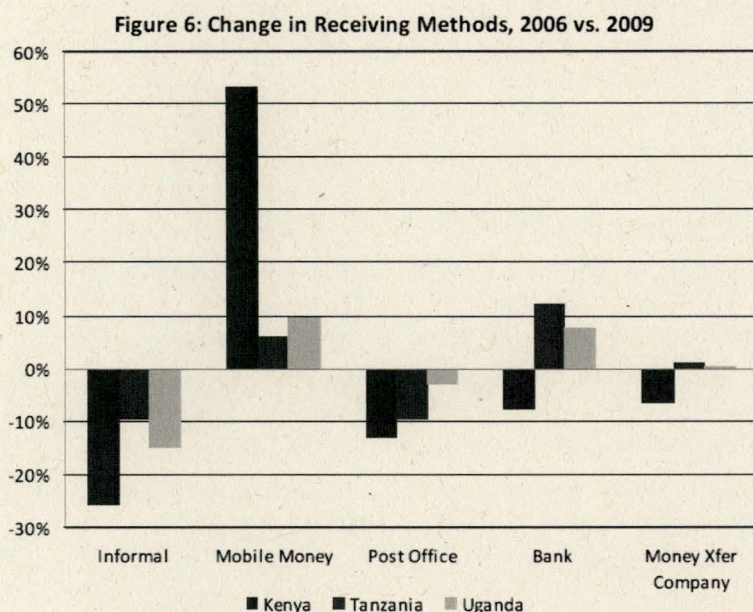


Figure 9: Changing in receiving methods, 2006 vs. 2009²⁶

However, the study provided by Weil et al. (2012) is lacking of sufficient control variable, thus the causal interpretation is difficult. To increase the validity the following control variables could be added: Distance to the nearest mobile money agent, presence of a migrant worker in the household or unobservable controls. It would be useful to add those controls to estimate better the drivers behind an adoption of mobile financial services. The study can therefore only be taken into account in a suggestive way. It is not useful to generalise the results.

The second considered study by Munyegera and Matsumoto (2014) determines the drivers of adoption of mobile money in Uganda.

Mobile money was firstly introduced in Uganda in March 2009 by the Mobile Telephone Network (MTN) and labelled as *MTN Mobile Money*. Since 2009, the number of subscribers increased continually. By end of 2012, already 9 million people were using *MTN Mobile Money*, which is a threefold increase compared to 2011. The number of mobile money transactions increased from 180 million to 242 million between 2011 and 2012 and the total exchanged value through the platform increased from \$1.5 billion to \$4.5 billion in the same period (Bank of Uganda, 2013).

²⁶ Adapted from Weil et al. (2012), page 11.

The authors use a panel of 838 households generated from the 3rd and 4th round of households and community surveys collected as part of the “Research on Poverty, Environment and Agricultural Technology” (RePEAT) project in Uganda in 2009 and 2012. In the baseline study of 2003 where in 94 LC1²⁷, 10 households randomly selected. The households are predominately rural based.

The authors use as dependent variable a zero/one dummy whether household i living in village j in district d uses mobile money services at time period t . The following formula describes the decision to adopt mobile money services which depends on observed and unobserved characteristics of the household:

$$Mmoney_{ijdt} = 1\{\beta X_{it} + n_{dt} + \varepsilon_{ijdt} > 0\} \quad (5.2)$$

Where X_{it} is a household vector, which includes household size, log of value of assets and land endowments, age, gender and education level of the household head, log of distance to the nearest mobile money agents in km, a dummy whether a household has a migrant worker and a dummy for mobile money ownership, n_{dt} captures unobservable characteristics which affect the mobile money usage.

Mobile money adoption has expanded immensely over the considered period, in 2009, less than 1 percent of the considered Ugandan households reported a usage of mobile money, the number rose to 38 percent in 2012. Between 2009 and 2012, the proportion of households with at least one mobile phone increased from 55 percent to 93 percent for adopters of mobile money and from 51 percent to 61 percent (for-non adopters).

Munyegera and Matsumoto (2014) use two approaches with similar outcomes a Probit regression and a linear probability model with household fixed effects, to roll out the effect of unobservable time-invariant household characteristics. Both dummies (mobile phone ownership and migrant worker) are significant at the 1 percent level, furthermore are the determinants for distance to the nearest mobile money agent, household head's years of schooling and the log value of total assets significant. Households which own a mobile phone are 11 percent more likely to use mobile money services. This number is not surprising since mobile money services are provided over a mobile phone. The likeliness of using mobile money services increases by 9 percentage points, if the household has a migrant worker. The probability of an adoption of mobile

²⁷ An LC1 is the second smallest unit of administration in Uganda.

money decreases by 4.4 percent per increased kilometre to the nearest mobile money agent. Wealth has a small positive impact on the adoption of mobile money (2%) as well as the education level of the household head (1 % per year of schooling).

Like Weil et al. (2012), the authors cannot find a gender effect, but they do also not find any age effect.

To sum up, Munyegera and Matsumoto (2014) find an extreme high speed of adoption for mobile money, a high importance of a close distance to the nearest mobile money agent shop and of mobile ownership and small positive impacts of higher adoption numbers of mobile money for wealthy, well educated people.

In general should be more weight set on the findings of the second adoption study; since Munyegera and Matsumoto (2014) use household fixed effects and time variant location dummies in the panel context, therefore potential bias is more likely to be smaller than for the outcomes of Weil et al. (2012).

2.) Risk sharing and transaction costs

The first thorough econometric study on risk sharing and mobile money is the study by Jack and Suri (2014). The authors discuss the impact of reduced transaction costs of private mobile money transfer on household's welfare through risk sharing. They show that the introduction of mobile money in Kenya²⁸ reduced transaction cost of money transfers and affected the risk sharing within informal family and kin networks. Households with access to mobile money are better able to smooth consumption than those without access.

A key result of the paper is that in a situation of a poorly developed financial infrastructure and large geographical separation of sender and receiver, the mobile money transfer channel substantially reduces transaction costs, in comparison to alternative means of money transfer. For example, find Jack and Suri (2014) that the average cost of sending a remittance over a distance of 200 kilometres through M-Pesa is 68 Cent, through Western Union 1.32USD, through a postal bank 2.45USD and through hand delivery 5USD.

Lower transaction costs are affecting the size, the frequency and the sender diversity of domestic remittances and hence the ability to smooth household's consumption after the occurrence of an economic shock.

²⁸ M-Pesa was introduced in Kenya in 2007.

Jack and Suri (2014) use a diff-in-diff approach, where the random intervention is a negative shock, the shock can be of any nature such as a drought or an illness. They compare changes in the response to the shock of per capita consumption across M-Pesa users and non-users of M-Pesa. The consumption data is taken from a two-round household panel survey conducted between 2008 and 2010 of 2,283 households. Furthermore, they consider a 2010 submitted survey of 7,700 M-Pesa agents. In 2010 3 out of 4 households (2008: 46%) are having at least one mobile phone and 70 percent of the households are using M-Pesa (2008: 49%). The mobile money agent network grew fourfold between the two periods. Remittances through M-Pesa increased from 933 remittances in the first round to 1615 in the second round, remittances through other means decreased contrary from 1930 in the first round to 760 in the second round.

The simple diff-in-diff regression is described in the following term:

$$c_{ijt} = \alpha_i + \gamma Shock_{ijt} + \mu User_{ijt} + \beta User_{ijt} * Shock_{ijt} + \theta X_{ijt} + n_{jt} + \pi_{rt} + \varepsilon_{ijt} \quad (5.3)$$

The dependent variable c_{ijt} is the annual per capita consumption for household i in location j in period t . The panel specification controls for households fixed effects, location by time-dummies and rural-by-time dummies. They use a dummy ($Shock_{ijt}$) for a negative shock to income in the last six months and a dummy for an m-Pesa user in the household during the survey. These dummies are also crossed to test whether M-Pesa users are better able to smooth risk occurred through negative shocks.

The validity of the diff-in-diff specifications depends upon the shock being random in reality. The authors remark that the usage of M-Pesa and its interaction with negative income shocks might be two endogenous variables (reversal causality issue). Therefore, they run in a second step an instrumental variable regression. Jack and Suri (2014) use as instruments the distance to the closest mobile money agent, the number of agents within 5km of the household and the interaction of each of them to the shock.

The findings show for the simple diff-in-diff, that the consumption of mobile money user is unaffected by a range of negative income shocks (such as illness, unemployment, fire, harvest or business failure), while the consumption of non-users drops by 7 percentage points. This effect is even stronger for the bottom three quantiles

of the income distribution. M-Pesa provides a convenient and safe method of saving, which could facilitate self-insurance, however the authors identify that the underlying mechanism of improved risk spreading are the reduction in remittance transaction costs and not due to any liquidity and/or saving effect M-Pesa may provide. The overall welfare implications of M-Pesa remain unclear.

The ability to smooth negative shocks perfectly is derived from an increase of received remittances in number (households using M-Pesa are about 13 % more likely to receive remittances) and size (average amount between 6 and 10% of annual consumption within a 6-month period). Furthermore, the diversity of transfer senders is larger for M-Pesa adopters, than for non-mobile money users. The Instrumental variable regression reinforced the concluded findings. The same effect of increased remittances in number and size and greater diversity of senders is seen by Blumenstock et al. (2016) and Batista and Vicente (2012).

Furthermore, Jack and Suri (2014) find that closer access in kilometres to M-Pesa agents improves a household's ability to smooth risk. The findings are significant for 1km, 2km and 5 km (small positive effect) distance to the nearest M-Pesa agent.

3.) *Impact on welfare and on per capita consumption in rural areas*

Munyegera and Matsumoto (2014) uses a diff-in diff approach, where the random intervention is the adoption of mobile money and analyses its effect on consumption, rather than on risk sharing after a negative income shock, as mentioned before.

$$c_{ijt} = \alpha_i + \mu Money_{ijdt} + \Psi X_{it} + n_{dt} + v_{ijdt} \quad (5.4)$$

c_{ijt} represents the monthly per capita consumption of households i in village j in district d in period t , alpha represents household fixed effects and the coefficient μ describes welfare impact of mobile money use.

The result suggests a 13.5 percent increase in household per capita consumption given the adoption of mobile money services.

By disaggregating consumption into three components: 1.) Food, 2.) Non-food and 3.) Social expenditure, a strong, significant evidence for an increase of social expenditure is measurable (47.4%). Hence the authors suggest an increased investment in informal social and insurance networks after the adoption of mobile money.

However, the mobile money adoption may be potentially endogenous given reverse causality concerns (e.g. households may adopt mobile money because they expect to receive remittances) Thus, the authors use a standard fixed effect Instrumental Variable method to control for the endogeneity concerns. They use as instrument the distance to the nearest mobile money agent. The Instrumental Variable results reveal that consumption increases by 72 percent (with 38% standard errors) after the adoption of mobile money. The f-statistic of the first stage regression shows that the instrument is valid. This result is unrealistic and highly divergent from the previous results. The question arises whether the roll out of the mobile money agents is random or maybe the spread of agents is caused due to potentially higher incomes for the agents based on population density, wealth, education or other villages and household's characteristics. The authors argue against those concerns and do not find significant correlation between the placements of mobile money agents and households or villages characteristics. However, their results are not reported in the study.

4.) Mobile banking and saving

The studies by Demombynes and Thegeya (2012) and Batista and Vicente (2012) describe mobile saving patterns.

Demombynes and Thegeya (2012) analyse the saving pattern of mobile money in Kenya. They distinguish between basic mobile saving, the standard mobile money system without the payment of interest (M-Pesa) and bank-integrated mobile saving with access to an account, that offers financial services beyond basic storage and transfer of money e.g. payment of interest, access to credit or insurances (M-Kesho²⁹). In Kenya, the factor of a mobile money agent to a bank branch is 100:1.

The key questions of the study are, whether mobile money services may increase the prevalence of saving behaviour and how much in value do mobile savers accumulate. Prior to answering those questions Demombynes and Thegeya (2012) analyse general usage and adoption pattern of mobile money services.

The authors use saving data from a survey conducted by the Financial Sector Deepening Kenya in late 2010. The survey consists of 6,038 individuals and the

²⁹ Condition of M-Kesho: No requirement of traditional Bank account, joint venture between Equity Bank and Safaricom. M-Kesho promotes to offer a broader range of banking service to the poor, through a network of mobile money agents. M-Kesho (613,000 subscribers, 6 months after launch).

subsample of M-Pesa users of 2,692 individuals (accounts for 45%). The simple comparison of reporting any savings of M-Pesa and M-Kesho users to non-users shows that 65 percent of mobile money users report having some savings, compared to 31 percent of non-users. An important observation is that specifically younger and poorer individuals that use either M-Pesa or M-Kesho are much less likely to have a formal bank account beside their mobile money account³⁰.

First Demombynes and Thegeya (2012) run a Probit regression, where the dependant variable equals 1 if the individual has savings of any kind and 0 if the individual has no savings³¹. They find that savings are significantly more likely for individuals who are male, married, based in urban areas, registered to M-Pesa and have a higher level of education, reported income and wealth. M-Pesa users are 32 percent more likely to report savings; the result is significant at a 1 percent level. Very few people used M-Kesho (0.6%), though adoption pattern are similar to those of M-Pesa users: greater saving for wealthier, married, registered to M-Kesho, more educated and male users. To address the concerns, that individuals registered for M-Pesa have in general a higher preference of saving as those not registered, the authors use IR. Instrumenting for M-Pesa usage drops the coefficient from 32 to 20 percent.

How much do mobile savers save?

The saving amounts are substantially larger for those who save with accounts other than M-Pesa. Those who save only with M-Pesa save on average 1,305 Kenyan shillings per month (equal to 13USD³²), compared to 2,282 Kenyan shillings (equal to 23USD) per month who save only with a formal bank account and 2,959 Kenyan schillings (equal to 29USD) per month for those who save with M-Pesa and a formal bank account. This result may be driven by the fact that users of a formal bank account tend to be wealthier. Among those in the poorest quantile the difference in amount saved are much less: 1,052 (equal to 10USD) for M-Pesa savers, 1,075 (equal to 10.70USD) for other accounts and 1,130 (equal to 11.20USD) for those who save with M-Pesa accounts.

To measure the possible effects of M-Pesa usage on savings behaviour the authors regress log average monthly saving amounts on various explanatory variables and a

³⁰ Only 10 percent of the poorest quantile holds a formal bank account beside the mobile money account.

³¹ The determinates of the regression are: rural, male, age, age squared, married, education, 2nd poorest quintile, middle quintile, 2nd wealthiest quintile and wealthiest quantile, log household income, registered to M-Pesa

³² At the publishing date of the paper.

dummy for M-Pesa registration using OLS. The results show that saving amounts are significantly higher for men, registered for M-Pesa, based in urban areas, with a high education level and a high income. The registration for M-Pesa increases the saving amount with a probability of 12 percent.

Batista and Vicente (2012) provide some insights about the desire to save through mobile money in rural Mozambique. Mobile money in Mozambique is still in its infancy. The authors conducted a saving game and remittance game in treatment and control locations in rural Mozambique provinces. Targeted individuals in the treatment location received financial education and information about the dissemination of mKesh³³. The authors determine the willingness to save and to transfer money to migrant family members in general and to save and transfer particularly using mKesh. The game uses real money.³⁴ They use RCT with a reduced OLS form regression. The dependant variable is binary and they compare outcomes for targeted and individuals with a treatment dummy variable and location level and individual controls³⁵ and correct standard errors by clustering at location. The study captures short term effects of the project after 3 months of the provided education and dissemination of mKesh.

The authors find as a result that the overall willingness to transfer money with mKesh dissemination significantly increased, while the overall willingness to save is not increasing significantly. The authors conclude that the dissemination of mKesh raised the willingness to transfer independently of the transfer method and that at a margin mKesh substituted “traditional” methods of saving and transferring. It would be interesting to see results of long-term effects of mobile money on savings and remittances.

5.) Public cash transfer via mobile money

A randomised evaluation of the impact of a unconditional cash transfer programme delivered through mobile money in Niger by Aker et al. (2014), shows cost savings for the household recipients due to lower transaction costs, household welfare improvements and positive-community spill over effects. The authors find after the

³³ mKesh is the name of the local mobile money product in Mozambique.

³⁴ See Batista and Vicente (2012): The participants of the saving games were given about \$1, which they could keep or save. For the remittance game they were given about \$1, which they could either keep or remit to a family member.

unconditional cash transfer through mobile money, a significant increase in the intra-household bargaining power for women and as a consequence a better nutrition level of their children. However, Aker et al. (2014) describe that transaction cost saving is linked to a well-established mobile money agent infrastructure in Niger, which is absent in most of the other West-African countries. In poor countries with a poor financial literacy level and great financial exclusion, sufficient investment in the necessary payments infrastructure is prerequisite to realize saving benefits. Thus, the generalizability of the promising results of Aker et al. (2014) may be limited, but potentially generalizable with an improvement of the mobile money agent infrastructure.

As a result, what do we learn about the development of mobile money? What are the consequences of the introduction of mobile money for the poor?

The majority of the papers are mentioning the surprisingly fast speed of adoption of mobile money in sub-Saharan Africa. Regardless of the different infrastructure and institutional settings across the different countries. Moreover, are adoption and usage patterns of mobile money in Kenya, the country with the longest mobile money history, showing the most promising result.

Mobile money is predominantly used to transfer money and can be seen as a substitute of traditional transfer methods. The probability of using mobile money increases with the presence of a migrant family member.

Evidence shows that the adoption rate of mobile money is higher for well-educated, urban, male. This raises the question whether the poor are benefitting from the mobile money development. The poor use mobile money less frequently and transfers and savings are small in size. However, in many cases the poor use for the first time a saving account with the possibility to accumulate money and to create a financial history. Mobile money transfers carry significant less transaction costs compared to other means of money transfer. Evidence shows an increased bargaining power of women, after receiving mobile money transfers and thus potentially a higher spending on nutrition.

Mobile money has a positive impact on consumption smoothing and welfare of households and is providing indirect an improvement of informal insurance through facilitating and strengthening informal insurance and risk sharing networks. The overall saving implications of mobile money remain vague.

6. Conclusion: Greater financial inclusion through mobile money?

To conclude the findings, we know that mobile money is carrying a huge potential to increase the financial inclusion of the poor. Due to specific characteristics, such as extreme high remittance charges and the skipping of infrastructure steps through the fast adoption of mobile phones, this is particular the case in sub-Saharan Africa. People who never used a bank account are now using mobile money accounts. Those accounts are creating a recorded data-back-up, which can be used to reduce information asymmetries and thus further integrate the former unbanked into the financial system through mitigating supply side credit constraint. Mobile money transfers reduce transaction costs and seem to improve households' ability to manage shocks by sharing risks. However, we need to be careful about true impact of mobile money on saving and welfare. In regard to mobile payments Jack and Suri (2014) promise over the long run, on the condition that mobile payments are mature and facilitate more frequent, the impact on the level of consumption, as well as its variance, could be significant.

However, the further development of mobile money and the process of increased financial inclusion of the poor is influenced by affordable technological innovation for the population in sub-Saharan Africa, such as the provision of cheap smartphones and capable applications (Aron, 2015).

We also can notice limitations and boundaries of mobile money. A tight mobile money agent network is a crucial condition to build up a mobile money infrastructure, which fits the needs of the unbanked and poor, especially in rural areas is the proximity to an agent important. It is not foreseen whether such an infrastructure can be provided in sparsely populated, large size sub-Saharan African countries. Another limitation is a potential change in regulation requirements regarding mobile financial services. Strict regulation can diminish the ongoing growth process of the sector and potential exclude (again) parts of the poor, unbanked population. Furthermore, is it important to add through sustained investment additional value in the sector of mobile financial services, such as the provision of (micro-)credits.

Robust evidence studies are needed, which are disentangling channel and product of mobile money and provide a deeper insight into how mobile payments and mobile money impacts the saving pattern and life of the poor. Such robust long term impact studies will take time, due to the relative newness of mobile money. Furthermore, it would be useful for forthcoming studies to use data from the provided data-back-up through mobile money activities, either than use household questionnaire.

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