Working Paper # 2015/19

INNOVATION FOR FINANCIAL ACCESS AND ITS IMPACT IN FINANCIAL INTERMEDIATION AND POVERTY REDUCTION

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UAM-Accenture Working Papers
ISSN: 2172-8143

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Abstract

Mobile phones are used as financial inclusion tools in developing countries, especially Sub-Saharan Africa. Mobile phone is one of the most important innovations in recent years, its impact in the economy and society is growing, especially with the introduction of smartphones. Most authors point out that, from the financial point of view, it is contributing to an increase of the number of people moving from informal economy to formal economy. There are other positive effects like poverty reduction. Existing studies focus only on certain communities or mobile money deployments, most of them with a qualitative approach. An

other quantitative studies focus on the impact of financial intermediation and its role in poverty reduction but without studying the role of financial access. This study aims to provide a cross-country quantitative approach of the effects of financial access provided by mobile money deployments in the financial intermediation and poverty reduction.

Introduction

In recent years we have observed the rise of a new tool, mobile money, that allows financial inclusion at an unknown speed. The use of mobile phones has allowed to deliver financial services to a population without access to bank branches. This is often referred as mobile money, mobile payments or mobile banking. However, using different terms for the same type of tool often leads to confusion.

Shaik (2015) has reviewed the most common terms that are used to define banking management using a mobile device: "Researchers use various terms to refer to mobile banking, including m-banking (Liu, 2009), branchless banking (Ivatury, 2008), m-payments, m-transfers, m-finance (Donner, 2008), or pocket banking (Amin, 2006)." Mobile money is the term used organizations like GSMA and the European Central Bank (ECB, 2007) considers them a type of electronic money if provided by non-banks. The term used in this study is mobile money as it includes banks and non-banks.

The term mobile (m) seems to be consistent on most definitions. Mobile is classified as a contactless payment (remote or proximity) made through a mobile phone as payment mean. For near communications, the payment is arranged through Near Field Communication (NFC), Bluetooth, infrared for data transmission, this is the technology behind most mobile wallets and used for smartphones with internet connection. For far communications uses Internet or GSM (European Payments Council, 2014). GSM is the technology used for the deployments reviewed in this study, using SMS text messages to accomplish the transaction.

The SIM card acts as the identifier, as a solution for the lack of a national ID for most population which made it easy to enter the market for telecommunication companies. However, Anti Money Laundering (AML) legislations and keeping the minimum level of Know your Customer (KYC) is still a key issue, as an example regulator in India has created a system for an eKYC to support those services (Rao, 2013). KYC is required in order to avoid money laundering issues: the same customer can have several small value deposits in different anonymous accounts and avoid tax payment as all of them count as anonymous.

There is a list of different financial services that can be provided from a mobile phone, smartphone or not, that goes from bill payment or peer to peer payments and remittances to other services like PIN change or locate ATMs. Not all applications are provided by all providers. And, even more important, not all providers provide m-banking services. M-PESA, for example, means mobile money in Swahili and it is provided by Safari.com and not by a bank. According to Shaik and Karjaluoto (2015), the literature usually calls m-payments when the service is provided by a non-bank and m-banking when it is provided by a bank. The term m-payment can cause misunderstood as it seems only transactional (pay), while other services can be provided, like savings (M-PESA), loans (M-Kesho, Safari.com together with Equity Bank) or the whole financial status of the person, like Personal Finance Management applications. However, we must point out that a non-bank can provide limited banking services, usually confined to transactional issues and, for other services (usually formal credit related) a banking license is usually required. This study would not review the access to credit tools, as it is a different financial channel.

The mobile deployments reviewed in this study are services used for financial inclusion that allow payments and savings on developing countries and that are based on mobile phones not connected to the internet, also called SMS banking. From the technical point of view is a GSM system where the SIM card is very important, as it provides the unique identification and allows to carry out the transactions (Shaik and Karjaluoto, 2015). Mobile has allowed

the creation of cheaper services to deliver financial services (Aker, 2010; Mmolainyane 2015; Kendall, 2014; AFI Global, 2012; Khavul, 2012).

The most known case is M-PESA in Kenya, a mobile money service deployed by Safari.com, Vodafone's subsidiary, although it was not the first deployment of this kind. M-PESA's case is the most documented and most studies are based on it. Before the irruption of this service, only high income rural citizens had access to regulated financial services in Kenya. The rest of the population, especially in rural regions, used what is called informal economy, exchanging money by hand, using ROSCAs or sending it through post offices (Demirgüç-Kunt, 2012). Although this system was not new-to-the-world, it was new-in-this-context , and has been the most successful deployment of this kind ever and was rapidly exported to similar countries achieving different results. mobile money deployments, because of its easy access for the whole population and cheap costs are considered to increase financial inclusion in developing countries and, thus, to alleviate poverty.

M-PESA allowed to make payments cheaper and safer than the existing informal financial services already operating in Kenya. Therefore, it is likely to impact the whole financial system by improving the quality of financial intermediators. This service also allows micro-payments, financial services provided by banks did not serve this before. The pilot of M-PESA was an International Money Transfer between Safaricom and Western Union in 2008, providing a low-value remittance service from the UK. (Rutten, 2012) This service evolved in a national basis to an initial service that offered to its customers four types of payment services transfers of money, pay bills, airtime, save money. Afterwards, it expanded its service to loan and bank account opening (like M-Kesho) in partnership with banks and a whole entrepreneurial ecosystem has been created surrounding it. Mobile money fills the gap caused by the lack of a bank branch networks as users only need to access a mobile to

transact and a Safaricom agent to cash it. The deficiencies are those of the areas without mobile coverage, as 3G or internet access is not needed.

Financial services are not the only service based on mobile. Due to its easy access, most users are finding innovative business solutions based on its technology. In Ghana farmers in Tamale can know the price of their products in Accra market in advance avoiding the cost of the travel or in Malawi people infected with AIDS or HIV get text messages to remind them to take their medicines (Aker, 2010). Mobile opens up a wide range of opportunities (Kamga, 2006).

Mobile money has democratized the access to financial services: cheaper, fast, accessible and is pointed out as an important tool for financial inclusion and, thus, poverty reduction. There are several case studies, based on local information, have proved the impact of mobile money on poverty reduction. Fro the intermediation point of view, several qualitative studies point out the importance of a better financial intermediation in poverty reduction. In this study we will review if mobile money is contributing to poverty reduction by improving the quality of financial intermediation from cross country perspective.

Financial inclusion and poverty reduction

Financial inclusion is considered to be one of the sources of poverty reduction, included in the Millenium goals: Eradicate extreme poverty and hunger. This issue is not just related to charity: market opportunities among the poorest are underestimated and should be explored by multinational companies, as there is an evidence that multinationals that provide services to the bottom-of-the-pyramid are successfully doing business in developing countries (Prahalad and Hammonds, 2002).

The challenge of most African economies is how to move funds from informal to formal economy. Mobile money institutions are a formal channel of storing funds. There are doubts

whether its use is inclusive with the poor or not but there is a consensus that it is increasing the use of formal economy which also impacts in the lowest income.

There are diverse opinions of what does financial inclusion mean. Leading financial organizations, such as the Global Partnership for Financial Inclusion and Alliance for Financial Inclusion, have pushed the belief that financial inclusion is achieved and defined differently in each distinctive circumstance (Deb, 2012). The Maya Declaration (AFI Global, 2014) also deepens in understanding the differences amongst circumstances and points out that financial inclusion must cover three issues: access, usage and quality. This declaration provides the basis for the expansion of financial inclusion and establishes a measurable set of commitments while keeping the local influence of solutions. The same measure is not necessarily useful for all regions and solutions differ between countries. Technology from the Developed World might require an infrastructure and labour skills not present in developing countries. And, even amongst developing countries differences arise that might require different adaptations: different political stability, infrastructures... (Khavul, 2012; Weil, 2006). As an example, the first approach of M-PESA was offering a microloan service. After observing customer behaviour and the use of airtime to exchange money, the approach was changed into a remittances service (Rutten, 2012). This service is a successful example of user led innovation where the product was designed according to customer needs (Von Hippel, 2005). It was rapidly adopted amongst the population, developing a local business ecosystem that increased its stickiness (Teece, 2007). However, the target is the same in all cases, achieving financial inclusion, by giving an easier access to financial services, to boost overall growth and reduce poverty. According to Pickens (2014) financial inclusion was usually related to brick and mortar banks. However a new term arises, branchless banking, that refers to banking in digital economy. Financial services are

not confined to a brick and mortar institution, can be provided just by digital means. This opens the door for financial services innovations like mobile money.

There is another controversy about the term financial inclusion and how it does affect to the poor. Poverty reduction is considered one of the main factors behind the development of a country (Essegbey, 2011) On of the main ideas behind is the reduction of inequalities within the society. The poor in developing countries find expensive and difficult to save, few banks are interest in their savings and in providing services for them. As a result those people cannot accumulate money to invest. (Khavul, 2012). However, it is estimated that the majority of people who have no access to financial services will have access to electronic payment instruments. (Pickens, 2014). There is a discussion towards the issue whether mobile money have led or not to financial inclusion. In the M-PESA case, where the number of users expanded quickly, allowing an unpreceded number of people to access financial services. Most authors review the reasons why people are not using financial services: there is still people who have not got a governmental ID and not access to banking services (BIS, 2014), not being able to understand financial services (Lusardi and Mitchell, 2013 mentioned by BBVA Research, 2014), not trusting financial entities or religious issues (Beck, 2013). However, we will not take into account personal reasons behind this access in this study.

The regulator also has an important role in the expansion of those services. Clear legal mandate to regulate/oversee mobile financial services but not being an stopper for this type of service (better but not more regulation) (Digital Financial Services survey, 2014). In most countries storing funds and the merchant cash function has been a banks' task. M-PESA's is provided by a telecommunications company and there are other examples in Sub-Saharan Africa like mobile money deployments provided by Orange or Airtel. In the example of M-PESA, the Central Bank of Kenya established that M-PESA must keep the same amount of

money that is been transacted at a deposit stored at commercial banks (Klein, 2011; Rutten, 2012). For further services, M-PESA partnered with different banks creating, for example; M-Shwari with CBA, which opens a bank account and gives access to small amount loans. (Safaricom, 2014). Mobile banking services are provided by Banks and financial institutions like Hello in Bangladesh or by Telecommunication companies M-PESA in Kenya or Tanzania (GSMA, 2014).

The evidence is mostly based on the m-Pesa case and shows an impressive growth of users can be seen as a successful financial inclusion, as it has also reached unbanked rural population (Suri, 2011; Rutten, 2012). However, there are authors that find out that, although there has been an impressive growth in the acceptance of this service, this does not necessarily mean a benefit for the poor and there has, also, been an increase of the number of bank branches at the time (Manji, 2010; Johnson, 2013). According to Manji (2010) the biggest number of users of M-PESA are those that were potential bank customers. We can point out that, not debating about this finding, by some reason those customers were not using bank financial services. From our point of view this ensures that there has been an expansion of the financial inclusion in that society as unbanked customers are entering formal channels no matter the reasons behind this.

One of the characteristics of mobile payment is its reduced transaction costs and its capacity to allow low value transactions makes it suitable for the poor. But it does not exclude other customer segments. Johnson (2013) points out that M-PESA is more a complementary service to financial services than a substitutive. Rutten (2012) carried out a survey were rural Masai pastoralist and higher income customers from urban areas were both happy with the service and found it was a valuable service. However, the use of mobile phone for financial users is not as common in all Sub-Saharan countries, Essegbey (2011) noted that only 13% of MSE in Ghana were aware this type of service. However the literature agrees

that there have been an improvement in the access of financial services in this region and that there is an exceptional expansion of this service amongst the population.

The importance of financial intermediation and the expansion of mobile money

The main feature of mobile money deployments is that allows to make payments and small savings. For this study, payments include all transactional money movements like remittances or bill payment. But. also, those payments need stored fund to authorise the payment, providing a solution for customer's savings.

Payments are considered within the financial industry as an entry door for other financial services and rely on the network effect, the more users in one end (payer) the more users need on the other end (payee) (BIS, 2012). Once users start using one payment mean, it is logical to think that this will increase loyalty and customer retention, customers will continue using that financial service provider for other services instead of swapping providers for different services. Behind this idea is also the need of interoperability, especially in mobile money operators, pointed out by African central banks (IFC, 2015). Interoperability means that the payment mean is accepted everywhere instead of using different financial providers for different services. Payments is a difficult issue to study (Beck, 2007b). Very often we can see how the success of M-PESA is measured by the amount of money is moving, overcounting the same money by its different movements (one dollar can be transacted ten time and this does not mean ten dollars). However, payments need a money deposit to back the payment, those deposits are within the boundaries of the formal economy. The money of those deposits is used to provide loans, literature often points out that the way to measure financial intermediation efficiency is the ability to provide credit to individuals. Therefore, the efficiency of the financial system is seen as the

ability to provide private credit from Banks (Andrianivo, 2010; Beck, 2007a; Levine, 2000; Ahlin, 2010; Imai 2012).

The relation of mobile money with banking can be tracked by several ways. The mobile money provider can be a bank, can use a pool account in a commercial bank (M-PESA) or can allow users to expand their services with further financial services like a bank account (M-PESA as a direct entry door for further financial services). Also, we must point out that this service allows microsavings which leads to investment (Khavul, 2012). Also, World Bank includes in their estimations any financial entity that keeps money deposits.

Modern economic growth is not possible without a well-functioning monetary and financial system (Suri, 2012). UNCTAD (2006) points out the growth requires capital accumulation, structural change and technological progress. Financial systems may affect long-run growth, financial markets enable small savers to pool funds, that these markets allocate investment to the highest return use, and that financial intermediaries partially overcome problems of adverse selection in credit markets (King, 1993). According to Mmolainyane (2015) financial innovations demonstrate financial market management strategies that provide resilen innovative products that are tailor made to the local market and more open than government policies by encouraging private sector participation. The financial sector has experienced a major growth in the last decades in Sub-Saharan Africa (Andrianivo, 2010; Oyelaran-Oyeyinka, 2014). This is can be due to the increase of capital accumulation in Africa in recent years. Investments from countries like China or India have increased (Oyelaran-Oyeyinka, 2014). However, as an example, Chinese firms tend to invest in extractive industries but import Chinese labour. Can this help the overall economy? Sub-Saharan countries have an strong dependance on the export of minerals but Asian economies are more dependant on manufacturing. Oyelaran-Oyeyinka points out that in the last four decades mineral dependence has been more damaging than beneficial to

development. Value added activities related to those investments and exports benefit external economies. However, there is growing concern that the benefits of those investments and exports have not been inclusive and equitably shared (Anyanwu, 2013). From this point of view, the increase of the accumulation of capital must be explained together with other variables that can be more inclusive and help more to reduce poverty.

Financial intermediation and poverty reduction

Mmolainyane (2015), has seen a link between financial access and economic growth in Botswana: financial development and access foster overall growth. Innovations, like mobile money are one of the key boosters of this. However, Johnson (2013) mentions that by the time M-PESA was introduced in Kenya, the number of bank branches also increased. In fact, the number of bank branches has been growing in Sub Saharan Africa in recent years.

Financial inclusion can be seen as a tool that promotes growth and stability while reducing poverty (Soederberg, 2013). Modern economic growth is not possible without a well-functioning monetary and financial system (Suri, 2012). Financial inclusion is now recognized as an important part of the mainstream thinking on economic development based on country leadership (Maya Declaration, 2012). And financial inclusion is considered a key issue for alleviating poverty.

The effects in poverty reduction and growth from the offer side are obvious, telecommunications companies have increased the number of services, demanding more employees, and the creation of an agent based system has open the opportunity for several entrepreneurs to start their own business. Agents work on a commission based on the fees made per transactions (Klein, 2011). However, the situation of those agents is not as idyllic as expected but it is becoming steady. In the case of Kenya, after an initial boom of M-PESA retailers, the service became crowded specially in Nairobi. From the negative point of

view, 11% of agents report not to be profitable in 2014, in 2013 17% reported this situation. From the positive point of view, agents are more optimistic and will continue to operate, 80% in 2014 against 58% in 2013) and, also, most are diversifying their sources of income, 64% in 2015, instead of closing down. In rural areas this service is not as expanded and retailers there show to be more profitable (only 22% of retailers are rural in a country where the majority of the population is rural).

From the offer side we can conclude that mobile money has positive growth effects (Mehrotra, 2015). Also, there has arise an ecosystem of companies surrounding M-PESA like asset management services linked to the pay bill function (Zimele) or pension products funded through mobile money (Ju Kali Association) (Kendall, 2011). Also the Massai pastoralist are using this service, as it provides a solution where bank branches do not arrive, to transfer money when they are away from home (Rutten, 2012).

We can conclude that the quality of financial intermediators is seen as one of the sources of growth because of their role of redistributing their available funds within the economy (Beck, 2000; Levine, 2000; Berger, 1997; Schumpeter, 1947; Honohan, 2004). This redistribution role also affects the overall level of poverty within countries although is difficult to trace what society segments is affecting. Several case studies studies point out the effect on certain communities but it is difficult to extended those results to the whole country (Kendall, 2011; Rutten, 2012).

However, it is not the only factor behind growth and poverty reduction, although it is considered to be one of the sources. Other factors like regulatory issues, governance, law respect, zero corruption, competition or external commerce relations (Mmolainyane, 2015; Oyelaran-Oyeyinka 2014). The main external sources of revenue for the countries come from foreign direct investment and commerce. It is often mentioned that rising commodity prices and foreign capital inflows contribute to growth and, thus, reduction of poverty

(Beck, 2000). However, this might not be the case of Sub-Sahara African countries, as explained before.

However, in Sub-Saharan countries there is another source to consider, international remittances. Remittances received from relatives and friends have a positive impact on household income. Such remittances contribute to income directly, but they also help to reduce risk and liquidity constraints, thus promoting agricultural commercialization (Kikulke, 2014). Remittances refer to the money and goods that are transmitted to households by migrant workers working outside of their origin communities (Adams, 2013). Households receiving either internal or international remittances spend more at the margin on three important investment goods: education, housing, and health as compared to what they would have spent without the receipt of remittances (Adams, 2013). International remittances are considered more a game changer than national remittances. However, according to a CGAP study (2013), the use of international remittances through mobile money was still low in 2013, with few exceptions like GCASH. There is a problem for handling international transfers of money, the payment must enter two different legs of payment systems which causes problems like different legislations (AML and KYC), time delays and increases costs. (BCE, 2014). This is one of the reasons behind the use of remittances services like Moneygram or Western Union, where only one provider is involved and low KYC identification is usually required. Those services did not require a bank account and very often the money was cashed and entered informal economy, which is likely to affect negatively to capital accumulation. New deployments, like Bitpesa powered by Bitcoin technology and mobile money are seen as promising. However, the ability to exchange money on a cross-border basis is a challenge even for developed countries, where rules like SEPA are setting the basis for an interoperable system amongst European countries to correct this issue (SEPA, 2014).

Other non economical factors for reducing poverty are human capital (Hughes, 2007; Wedgwood, 2007) and controlling inflation as it can reduce disposable real income (Anywaru, 2013; Easterly, 2001; Wodon, 2010). Also, the influence of the Government is another important factor behind this growth, good-quality institutions are expected to foster financial development (Mankiw, 2005; Anywaru, 2013).

Research question: Does a better access to financial services provided by mobile money contribute to poverty reduction in Sub-saharan Africa?

Literature review points out that that mobile money contributes to poverty alleviation in Sub-Saharan Africa, as is the region where this type of service has expanded the most. Qualitative studies review how users are creating new services based on those deployments, contributing to the expansion of an entrepreneurship ecosystem. Studies also note how the lowest income is finding here a solution to handle money reducing the risk of carrying cash or using informal channels. Some authors follow a case study method. Adams (2014) reviews the case of Ghana or Aker (2010) shares different case studies of the use of mobile phone for innovative business solutions. Most literature focus on M-PESA's in Kenya deployment like Rutten (2012), Manji (2010), Johnson (2012), Jack (2011), Kikulwe (2014). Some authors have carried out local surveys, like Essebey (2011). Both methods are difficult to extrapolate to other regions or communities to provide a cross-country review.

Qualitative studies have proved the link between financial intermediation and poverty reduction. Beck (2007a) proves that financial development aids poverty reduction using a panel data study, finding correlations. He also took into account traditional poverty reduction indicators, like education to minimize the effect of other factors and studied the impact of private credit in poverty reduction. The conclusion was that "greater financial

development induces the incomes of the poor to grow faster than average per capita GDP growth,which lowers income inequality" (46, Beck, 2007a). Honohan (2003) proves that financial depth is negatively associated with headcount poverty using cross-country regressions. Kikulwe (2014) has proved through panel survey data and regression models that mobile phones have a positive impact on household income but focuses on Kenya. There is also literature focusing in African growth but not relating it to poverty reduction, like Anywaru (2014) who used a panel data set to establish correlation between growth in Africa and other variables, but does not establish links with poverty or financial access or Andrianivo (2010) also proves the growth of the financial sector in Africa. Levine (2000) provide a quantitative framework of the relation amongst growth and financial development. Other qualitative and quantitative studies focus on poverty reduction but not relating them relating it to the financial access like Wedgwood (2007).

Financial access studies focus on the need of indicators (Beck, 2007b and Demirgüç-Kunt, 2012). Findex survey, carried out by IMF has provided useful insights to cover this gap and are used in this study.

However, there is a literature gap of studies that provide an empirical quantitative evidence that there is a relation between a better access to financial tools, boosted by mobile money and poverty reduction, in a cross-country basis. Some researchers point out that there has been an expansion in the number of bank branches at the time, which also improves this access to formal economy.

Therefore, this study aims to cover that research gap proving a quantitative cross-country evidence that there has been a poverty alleviation related to the access of mobile money.

Methodology

This study will provide a quantitative approach by analyzing poverty indicators with the quality of financial intermediation within the countries based on Beck study (2007a). Also, will introduce the formal financial access indicators and measure its impact to determine which one influences the most. As we have seen before, access is one of the main characteristics mobile money has increased, we will study if this affirmation is true.

The sample used for this study are the 40 countries of the Sub Saharan Africa region classified as Low income and lower middle income by World Bank: Benin, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Republic of Congo, Cote d'Ivoire, Eritrea, Ethiopia, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, South Sudan, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe. And the range of years is from 1990 up to 2014.

Years of study will be from 1990s to 2013 (last year of mobile money data available). According to literature, a wide gap of years is needed to establish a coherent relation. Mobile money data starts in 2007 (with the introduction of M-PESA in Kenya, although there were previous deployments but did not reach population as much).

Indicators will be divided amongst those that will show the reduction of poverty within the economy and its relation with the financial intermediation performance (measured with the loans given by the financial sector) (Beck; 2007a).

A panel data model and pooled effects model will be created finding out correlations between the growth or reduction of poverty indicators and loans given by financial

organizations, taking into account other variables to avoid endogeneity. Panel data allows to combine a time dimension with the other phenomena that we will analyse.

Access to indicators will be limited as those countries do not provide full sets of years available, the model should take into account this issue. We must also point out that it is easier to find input indicators than output indicators to study any given innovation (Sánchez, 1995). This study is an attempt to correct this deficit through existing indicators and establishing relations amongst them. It is based in studies by Beck (2007a, 2007b) and Anywaru (2013), however, as not all indicators where available, this study has changed some of them to similar ones with free access from renowned organizations or is not using data where not enough information is provided to establish a relation. There are also some indicators that will not be used, as are not related to payments or are substituted with other indicators and new indicators reflecting previous literature review and adapted to study impact of the access to a payments service.

To answer if a better access to financial services contributes to poverty alleviation first we must answer a previous question, if that financial access has contributed to the quality of the financial intermediation. In this case, we will analyse if the creation of a new finance tool mobile money, improving financial access if affecting the overall quality of the financial intermediators. According to literature, one of the main contributions of mobile money is give access to formal financial services, reducing the use of informal economy. To identify this relationship we will use a panel data set to find correlations amongst financial intermediation, financial access and other sources of improvement of this financial intermediation.

Private credit provided banks to GPD is the indicator used to measure the quality of financial intermediaries and its capacity to allocate resources. This indicator is extensively used in literature to prove the efficiency of the financial sector (Andrianivo, 2010; Beck,

2000; Beck, 2007a; Levine, 2000; Ahlin, 2010; Imai, 2012). Is it understood as the capacity of the financial institutions to redistribute financial resources within a country.

Those data will be crossed with that data that refers to financial access to find correlations.

- Number of registered mobile money accounts per 1,000 adults (FAS IMF survey)

  Although there was an active mobile money deployment, some countries do not have the information until years afterwards. Years of data non available will be estimated using the information provided by the mobile money tracker of GSMA. This database provides informations of the launching date of mobile money deployments at a World level. Crossing the information available of access at IMF with the information provided by GSMA allows to correct data and indicate that there were 0 mobile money registered users when there was no deployment available in the country. However, there is still data missing when there was a mobile deployment available but no survey data.

  This is a new indicator that we will include in this study. The indicator used is registered users because agents providing the service can lead to confusion. A mobile service agent, as an example M-PESA retailers, also provide several non financial services. This means that access to those agents is difficult to relate to financial access. However, as the mobile effectively acts as a bank branch and customers can have access to the service but still not use it this is equiparable to the use of a bank branch. Customers can have a bank branch in their neighbourhood but still not use it.

- Number of branches per 100,000 adults (FAS IMF survey) This indicator proves the ability to access a bank branch, however it cannot prove whether the use of the branch (Beck, 2007b).

It is also extensively used in the literature GPD per capita (Ahlin, 2010; Beck, 2007) In this case we use the World Bank indicator GDP per capita at current prices 2007 to diminish the effects of inflation. GDP is used to determine if the growth of financial intermediation caused by a growth of the general income of the country or by other reasons.

Trade and Foreign Direct Investment are used as indicators of external income entering the economy and related to the growth of the financial intermediation as can provide further liquidity.

The quality of the legal system is measured with the Rule of Law indicator. The quality of the institutions can be key to fostering a better financial system. We will include this indicator following the works of Anywaru (2013) or Honohan (2004) who found out the importance of the legal infrastructure and its impact in the financial development. The logic behind is that people is more likely to invest in business if there is a legal system that will preserve their rigahts and property.

On a second level, we will study the relationship amongst financial intermediation, measured with Private Credit and poverty reduction: mean income, poverty gap and and headcount income median as the % of household living under poverty lines. These indicators are commonly used in literature related to poverty (Beck, 2007a; Ahlin, 2010; Imai, 2012). Unfortunately, due to the lack of data to provide a valid sample, GINI index would not be used in this study.

The positive impact of mobile money will be implicit in the private credit indicator and, if there is a real impact in poverty by this tool, there must be an increased importance of private credit after the irruption of that tool.

Further indicators will be reviewed, to review the effect of other causes in poverty reduction and establish if there is a positive link with financial intermediation and poverty reduction.

GDP per capita is an standard indicator used to avoid the effects of overall income in the population caused by in increase of GDP of the country.

Education is known to be one of the key factors to escape from poverty as it improves the quality of the human capital (Hughes, 2007). Wedgwood (2007) found that primary education achievements did not lead to conclusive results, but secondary education does impact more in growth and poverty reduction. Therefore, the indicator used in this study will be the accomplishment of secondary school instead of an economical measure like expenditure which does not prove the success of the educational system.

As mentioned before, remittances are key to reduce poverty (Kikulwe, 2014; Adams, 2013). Ahlin (2011) lines remittances with self sufficiency. A research carried out at Ghana found that there was a positive correlation if remittances came from abroad, but not that difference when it comes from within the country (Adams, 2013). Remittances are not necessarily within the boundaries of the formal economy. Most money transfer operators cash the money to the payee instead of storing it into a bank account. However, remittances are provided by banks, mobile money services and money transfer operators which makes difficult to track down their impact in formal economy.

Finally, inflation is another indicator widely used in literature (Beck, 2007a, Anywaru, 2013; Easterly, 2001; Wodon, 2010). The reason behind is that the increase of inflation leads to a reduction of the purchasing power of the individuals within one nation as their wages cannot keep the pace with it.

Results

First, we have traced the relationship amongst financial intermediation, representing the formal economy, and access to mobile money deployments.

The results establish a positive relation amongst financial access, provided by the access to bank branches and the access to mobile money. The results in figure 1 prove that there is a positive link amongst both channels of access and the quality of the financial intermediation. Consistent to research, (Oyelaran, 2014; Mmolainyane, 2015) Trade and Foreign Direct investment positive effects are not as clear in this region as in other regions (Beck, 2000). However, we will not enter into this discussion.

	Pooled effects		Panel data			
			Fixed		Random	
Private credit by banks	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Ln GDP per capita	0,780	0,310	22,361	0,003	4,668	0,003
Bank branches	1,700	0,000	1,258	0,000	1,500	0,000
M-money	0,015	0,000	0,002	0,323	0,006	0,006
Trade	-0,017	0,195	-0,012	0,919	-0,031	0,052
FDI	-0,078	0,148	0,029	0,382	0,065	0,054
Rule of law	2,410	0,005	-0,749	-0,460	1,790	0,172
Number of observations			218		218	
R squared	0,577		0,580		0,508	
Hausman test (probability)					0,000	

Fig.1 Financial intermediation and financial access
Panel data set own creation, from 1990 to 2014
Source of data World Bank and IMF

Mobile access is not as important as bank branches, we must take into account that funds transacted and stored are mostly micropayments which causes a small impact in the financial system. This means that the access to this tools cannot affect the financial system as much as other sources of income. However, as mentioned before, the costs of this tool are low, especially if we compare to the creation of bank branches, which makes this results attractive and positive for the financial system.

	Pooled effects		Panel data			
			Fixed		Random	
Private credit by banks	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Ln GDP per capita	1,119	0,277	21,066	0,006	2,987	0,097
Bank branches	1,464	0,000	1,478	0,011	1,435	0,000
M-money	0,016	0,000	0,003	0,232	0,007	0,005
Trade	-0,006	0,771	-0,012	0,623	-0,035	0,081
FDI	-0,062	0,328	0,023	0,529	0,050	0,151
Rule of law	2,692	0,038	0,344	0,901	2,546	0,144
Number of observations			124		124	
R squared	0,546		0,550		0,509	
Hausman test (probability)					0,137	

Fig.2 Financial intermediation and financial access
Panel data set own creation, from 2007 to 2014
Source of data World Bank and IMF

After the introduction of M-Pesa in Kenya, figure 2, bank branches has lowered their influence in the financial intermediation. This is confirmed in figure 3. However, the number of observations in figure 3 do not provide a definitive answer. Also, we cannot confirm if the irruption of mobile money has lowered the importance of bank branches or if it is caused by the increase in the number of bank branches. The number of bank branches has increased according to IMF's Financial Access Survey data and it might be reducing the positive effects per branch as it is a lowering the concentration of customers and funds. In any case, the positive influence of mobile money in the financial intermediation is proved in figure 1 and 2.

	Pooled effects		Panel data			
			Fixed		Random	
Private credit by banks	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Ln GDP per capita	-0,216	0,841	19,162	0,000	2,267	0,196
Bank branches	2,296	0,000	0,087	0,879	1,647	0,000
Trade	-0,023	0,179	-0,017	0,482	-0,026	0,180
FDI	-0,466	0,003	0,013	0,838	-0,012	0,870
Rule of law	1,969	0,084	-3,487	0,035	-0,280	0,839
Number of observations			94		94	
R squared	0,661		0,660		0,576	
Hausman test (probability)					0,000	

Fig.3 Financial intermediation and financial access
Panel data set own creation, from 1990 to 2006
Source of data World Bank and IMF

Those results are confirmed if we take into account the years after the introduction of M-Pesa. Before M-Pesa, only a few deployments of this kind were in the market. Right now there are over 260 operative deployments, mostly in Sub-Saharan Africa (GSMA MMU tracker, 2015). The debate whether mobile money is providing services to potential bank branches users, which can be understood as a negative impact to the financial intermediation system, or if this brings new customers improving the whole financial system (Manji, 2012; Johnson, 2013; Suri, 2011; Rutten, 2012) proves that both systems coexist and bring a positive influence to the financial system. However, the importance of other factors like GDP per capita or Rule of Law is still very relevant as noted in figure 1 and 3 but is not as clear as the influence of bank branches and mobile money, according to the results of t probability.

	Pooled effects		Panel data			
			Fixed		Random	
Private credit by banks	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Ln GDP per capita	0,040	0,558	22,836	0,000	4,529	0,003
Bank branches	1,648	0,000	1,285	0,000	1,580	0,000
M-money	0,017	0,000	0,002	0,342	0,006	0,008
Rule of law	2,684	0,002	-0,839	0,595	1,868	0,147
Number of observations			225		225	
R squared	0,565		0,570		0,490	
Hausman test (probability)					0,000	

Fig.4 Financial intermediation and financial access excluding trade and FDI
Panel data set own creation, from 1990 to 2014
Source of data World Bank and IMF

Finally, in figure 4 we review the effects on this calculation of Trade and Foreign Direct Investment as previous results proved that there was a collinearity with other indicators. Once more, we can confirm the positive effect of providing access to the financial system through mobile money and that this influence is clearer than the results thrown by the other indicators, rule of law and GDP per capita.

We can conclude that there is a positive relation between mobile money and financial intermediation and that it coexists with the positive effects of the increasing number of bank branches.

The results of the link between poverty and financial intermediation are not as clear with data gathered.

Crossing data of poverty gap with other poverty related indicators does not provide a definite conclusion. According to studies, financial intermediation contributes to the reduction of poverty (Beck, 2007a; Honohan, 2003; Andrianivo, 2010). However, the increase of the formal economy and credit does not necessarily mean that it is better distributed and the effects, although positive, are not as strong as other indicators. The results in this study are not conclusive and, unfortunately, testing data after 2007 does not provide conclusive information as there are not enough observations (below 60) and further research in future years must be necessary.

	Pooled effects		Panel data			
			Fixed		Random	
Poverty GAP	**Coefficient**	**T probability**	**Coefficient**	**T probability**	**Coefficient**	**T probability**
Private credit by banks	-0,264	0,022	0,230	0,112	0,230	0,112
Inflation	0,312	0,011	0,014	0,882	0,014	0,882
Personal remittances	0,086	0,475	-0,278	0,159	-0,278	0,159
Ln GDP per capita	-3,170	0,106	-35,131	0,000	-35,131	0,000
Lower secondary education	-0,148	0,047	0,204	0,025	0,204	0,025
Number of observations			119		119	
R squared	0,297		0,300		0,125	
Hausman test (probability)					0,000	

Fig.5 Financial intermediation and poverty. Poverty GAP.
Panel data set own creation, from 1990 to 2014
Source of data World Bank and IMF

Figure 5 proves that the relationship between financial intermediation and the reduction of the poverty gap is not clear. The results of the pooled effects model and the panel data information seem contradictory and not reliable.

	Pooled effects		Panel data			
			Fixed		Random	
Poverty Mean	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Private credit by banks	0,049	0,004	-0,365	0,077	-0,020	0,897
Inflation	-0,365	0,041	-0,062	0,647	-0,123	0,367
Personal remittances	0,120	0,494	0,225	0,422	0,177	0,402
Ln GDP per capita	11,539	0,000	37,931	0,000	20,536	0,000
Lower secondary education	0,363	0,001	-0,163	0,204	0,035	0,747
Number of observations			119		119	
R squared	0,534		0,530		0,422	
Hausman test (probability)					0,000	

Fig.6 Financial intermediation and poverty mean per month
Panel data set own creation, from 1990 to 2014
Source of data World Bank and IMF

	Pooled effects		Panel data			
			Fixed		Random	
Poverty headcount	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Private credit by banks	-0,404	0,013	0,287	0,126	-0,081	0,580
Inflation	0,392	0,024	-0,042	0,734	0,035	0,774
Personal remittances	-0,002	0,989	-0,392	0,126	-0,120	0,554
Ln GDP per capita	-8,483	0,003	-47,261	0,000	-20,811	0,000
Lower secondary education	-0,269	0,011	0,203	0,083	0,013	0,902
Number of observations			119		119	
R-squared	0,422		0,422		0,320	
Hausman test (probability)					0,000	

Fig.7 Financial intermediation and poverty headcount
Panel data set own creation, from 1990 to 2014
Source of data World Bank and IMF

Figure 6 and figure 7 also throw the same contradiction between the results of both models. According to the pooled effects model, the improvement of financial intermediation has a negative impact with the increase of poverty headcount, the amount of households living below poverty level, and the poverty mean indicator, the average monthly expenditure per household. This result verify the positive impact of a better financial intermediation against poverty. Other factors like education provide a good impact against poverty. However,

remittance also show non conclusive results. However, those results fail the test with the pooled data model, showing different results that cannot verify those conclusions.

Remittances prove their low but positive effects in poverty reduction which is consistent with previous literature (Kikulwe, 2014; Adams, 2013). However, results are not very strong.

Due to the low level of data available, we will show only a comparison on the most influential indicator, GDP per capita and private credit to understand the evolution of its influence after the introduction of M-Pesa. However, results are biased as there is not a long run records since 2007 and indicators do not prove a solid relation.

	Pooled effects		Panel data			
			Fixed		Random	
Poverty headcount	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Private credit by banks	-0,563	0,000	0,161	0,197	0,004	0,976
Ln GDP per capita	-16,010	0,000	-34,099	0,000	-24,579	0,000
Number of observations			182		182	
R squared	0,411		0,411		0,361	
Hausman test (probability)					0,000	

Before 2007

	Pooled effects		Panel data			
			Fixed		Random	
Poverty headcount	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Private credit by banks	-0,083	0,578	0,131	0,304	-0,043	0,714
Ln GDP per capita	-16,903	0,000	-51,477	0,000	-23,976	0,000
Number of observations			98		98	
R squared	0,376		0,380		0,375	
Hausman test (probability)					0,001	

After 2007

Fig.8 Financial intermediation and poverty headcount, GDP and private credit comparison
Panel data set own creation, from 1990 to 2014
Source of data World Bank and IMF

	Pooled effects		Panel data			
			Fixed		Random	
Poverty mean	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Private credit by banks	0,875	0,000	-0,177	0,191	-0,421	0,747
Ln GDP per capita	16,996	0,000	29,286	0,000	24,608	0,000
Number of observations			182		182	
R squared	0,407		0,410		0,320	
Hausman test (probability)					0,000	

Before 2007

	Pooled effects		Panel data			
			Fixed		Random	
Poverty mean	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Private credit by banks	0,312	0,072	-0,277	0,065	0,005	0,970
Ln GDP per capita	18,867	0,000	66,067	0,000	28,893	0,000
Number of observations			98		98	
R squared	0,406		0,410		0,386	
Hausman test (probability)					0,000	

After 2007

Fig.9 Financial intermediation and poverty mean per month, GDP and private credit comparison
Panel data set own creation, from 1990 to 2014
Source of data World Bank and IMF

	Pooled effects		Panel data			
			Fixed		Random	
Poverty GAP	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Private credit by banks	-0,330	0,003	0,169	0,112	0,020	0,838
Ln GDP per capita	-9,599	0,000	-26,531	0,000	-16,211	0,000
Number of observations			182		182	
R squared	0,298		0,300		0,260	
Hausman test (probability)					0,000	

Before 2007

	Pooled effects		Panel data			
			Fixed		Random	
Poverty GAP	Coefficient	T probability	Coefficient	T probability	Coefficient	T probability
Private credit by banks	-0,057	0,551	0,097	0,270	-0,028	0,730
Ln GDP per capita	-8,390	0,000	-32,535	0,000	-13,350	0,000
Number of observations			98		98	
R squared	0,270		0,270		0,269	
Hausman test (probability)					0,001	

After 2007

Fig.10 Financial intermediation and poverty headcount, GDP and private credit comparison
Panel data set own creation, from 1990 to 2014
Source of data World Bank and IMF

Results in figure 8, 9 and 10 confirm the same influence of private credit against poverty indicators according to the pooled effects mode but fails the test with the panel data model. Also, the results are not solid as there is a big margin of error as noted by the r-squared results.

Conclusions

Data provided in this study cannot lead to conclusive results of the links of a better access to financial services and poverty reduction. This study proves that there is a relationship amongst the quality of financial intermediation and a better financial access. A better financial access provided by bank branches is still the most important contact point with formal financial services. However, mobile money also provides as a positive influence although its impact is reduced due to the lower amounts of transactions. This study has proved the existence of that link and its positive impact in the financial system.

From a case study point of view it is proved the effects of poverty reduction provided by these new tool. However from a cross-country quantitative perspective there is still a lack of data that leads to incomplete data and not consistent conclusions. Although the different data models point out the relationship amongst poverty reduction and increase of mean income with the expansion of financial intermediation, the results are not conclusive. This is especially true at finding out the relationship after 2007.

Possible policy recommendations

Although the results are not conclusive in the case of poverty reduction, this study provides an empirical evidence that opening the doors for financial innovations has positive effects for the whole financial system. Financial regulators tend to be cautious about financial innovations due to the potential risks behind like money laundering or fraud. However, the

benefits obtained can overcome the negative impact of those potential risks and benefit the whole population.

Limitations of this study

There is a lack of indicators in Sub Saharan Africa which is reflected in the results obtained. Financial access indicators are relatively new and, together with the problems of obtaining statistics in most African countries, provides non conclusive results as there are not enough observations to determine a rule.

In future years further data could verify the results obtained. However, technical change in this type of innovation is fast and most Sub Saharan African countries are currently developing broadband connections which can change the type of technology used for this service. Both factors would open up the path to future innovations in this field.

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Annex 1

Indicators used in this study. Definitions and source.

Bank private credit to GDP (%): The financial resources provided to the private sector by domestic money banks as a share of GDP. Domestic money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits. Source: World Bank Global Financial Development, International Financial Statistics (IFS), International Monetary Fund (IMF)

Mean: The "Mean$" is $ the average monthly per capita income/consumption expenditure from survey in 2005 PPP. Source: World Bank IBRO - IDA

Poverty Gap: mean distance below the poverty line as a proportion of the poverty line. Source: World Bank IBRO - IDA

Headcount: % of population living in households with consumption or income per person below the poverty line. World Bank IBRO - IDA

Foreign direct investment, net inflows (% of GDP): Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP.

Source: The World Bank, World Development Indicators, International Monetary Fund, International Financial Statistics and Balance of Payments databases, World Bank, International Debt Statistics, and World Bank and OECD GDP estimates.

GDP per capita, PPP (constant 2011 international $). GDP per capita based on purchasing power parity (PPP). PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2011 international dollars. Source: The World Bank, World Development Indicators.

Lower secondary completion rate, total (% of relevant age group): Lower secondary education completion rate is measured as the gross intake ratio to the last grade of lower secondary education (general and pre-vocational). It is calculated as the number

of new entrants in the last grade of lower secondary education, regardless of age, divided by the population at the entrance age for the last grade of lower secondary education.

Source: The World Bank, World Development Indicators. United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics.

Number of registered mobile money accounts per 1,000 adults: Number of accounts with resident mobile money service providers (MMSPs) that are primarily accessed by mobile phones and are useable or have been used for mobile money transactions. Calculated as: (number of registered mobile money accounts)*1,000/adult population in the reporting country. Source: IMF, Financial Access Survey.

Number of branches per 100,000 adults: Calculated as follows: (number of institutions + number of branches)*100,000/adult population in the reporting country --- calculated separately for commercial banks, credit unions and financial cooperatives, and all MFIs. Source: IMF, Financial Access Survey.

Personal remittances, received (current US$): Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from nonresident households. Personal transfers thus include all current transfers between resident and nonresident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by nonresident entities. Data are the sum of two items defined in the sixth edition of the IMF's Balance of Payments Manual: personal transfers and compensation of employees. Data are in current U.S. dollars. Source: The World Bank, World Development Indicators.

Rule of Law: captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Estimate

gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5. Source: The World Bank, Worldwide Governance Indicators.

Trade (% of GDP): Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. Source: The World Bank, World Development Indicators, World Bank national accounts data, and OECD National Accounts data files.