



LUND UNIVERSITY  
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# Mobile Money Adoption in East Africa

A cross-country study of best- and least-performing countries

by

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*Abstract:* Mobile money is a digital financial innovation enabling electronic payments and transfers through mobile phones. It has proven to be a convenient, safe and cheap way for money exchange in developing countries where access to traditional banking services is limited. This thesis aims to explore why Small and Medium Enterprises in Zambia do not adopt mobile money in an otherwise well-developed region of mobile money diffusion. A two-folded approach combining an econometric analysis of cross-country firm level determinants of mobile money adoption and a qualitative assessment of the mobile money market in Zambia investigates the underlying causes of non-adoption in Zambia compared to other countries in East Africa. Earlier research indicates that supplier linkages through trade credit provide demand for mobile money adoption. The results of this thesis support this claim. The thesis also shows that mobile money adoption requires continuous quality-updates of the services offered and extensive marketing towards the target groups. To improve diffusion, mobile money providers can partner with suppliers to generate a trickle-down effect along the business value chains.

*Key words:* Mobile Money, Small and Medium Enterprises, East Africa, Zambia, Adoption and Diffusion

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## List of Abbreviations

AFI	Alliance for Financial Inclusion
Airtime credit	Pre-paid cell phone credit that can be used for communication through voice (calls) or text (SMS).
ATMs	Automatic Teller Machines
B2B	Business to business transactions; refers to bill payments and employee salaries
C2B	Customer-to-Business transactions; refers to face to face transactions and bill payments
B2P	Business to customer transactions; refers to salaries, but now also B2B transactions
Cash-in	Convert cash into mobile money currency
Cash-out	Issue cash on demand in exchange for e-float currency
CICO	Cash-In-Cash-Out; refers to the services of the agent outlets
e-float	When accepting deposits of cash from customers, an m-money provider issues a commodity known as “e- oat,”
FSPs	Financial Service Providers
FST	Financial Deepening Trust
GSMA	Groupe Speciale Mobile Association
G2P	Government to Person transactions; refers to social service transfers and salaries of public employees
MFI	Microfinance Institutions
MMT	Mobile money transfer
MNOs	Mobile Network Operators
MSMEs	Micro- Small- and Medium Enterprises
M-money	Mobile money
P2P	Person to person transactions; refers to the ability of users to send money to each other.
PEOU	Perceived Ease of Use; refers to whether a technology can be used effortlessly
PU	Perceived Usefulness; refers to whether a technology increases everyday performance
SIM	Subscriber identity module; refers to the smart card used in mobile phones.
SMEs	Small and Medium Enterprises
SMS	Short message service; enable users to send text messages from mobile phones
TRA	Theory of rational action
TPA	Theory of planned behaviour
TAM	Technology Acceptance Model

# 1 Introduction

## 1.1 Background of the Study

Small and medium enterprises (SMEs) are crucial for economic growth and development. In developing countries, they represent more than 90 percent of firms outside the agricultural sector and are the main source of income and employment (OECD, 2004). Moreover, they are the key linkage between the formal and informal sector and an important part of business supply chains (Atterton et al., 2016). However, these firms are often credit constrained with limited access to finance from traditional banking sources. Data from the World Bank Enterprise Surveys (various years) suggests that access to finance is one of the main obstacles for doing business. Several studies indicate that SMEs face greater obstacles than larger firms, and lack of access to finance disproportionately affects the growth of SMEs compared to larger ones (Calice et al., 2012; Schiffer and Weder 2001; Beck et al., 2005; 2006; 2012). Furthermore, SMEs in sub-Saharan Africa are experiencing a “financing gap” relative to other developing countries (Calice et al., 2012; World Bank). The international development community has therefore listed financial inclusion<sup>1</sup> and access to finance for SMEs as an important policy priority (Calice et al., 2012; World Bank).

Mobile money is a digital financial innovation that enables transfers and payments of money through a mobile phone by simple messaging service (SMS) (Jack and Suri, 2014). More than one billion people in low and middle income countries have access to a mobile phone. The expanding infrastructure of mobile money payment systems can therefore potentially transform the way SMEs conduct business (GSMA, 2015; 2016). Early evidence indicates that mobile phone adoption by firms increases profits by increased communication with suppliers and time saved in financial transactions (Samuel et al., 2005). Additionally, mobile money is associated with reduced transaction costs, lower risk, greater liquidity and less dependency on banks (Bångens and Söderberg, 2011). This can in turn lead to economic growth through increased savings and investments, by making savings formal, increased capital, and enhanced financial resiliency during shocks (GSMA, 2016)<sup>2</sup>.

GSMA estimates show that more than 117 million mobile money accounts were active as of December 2016. Most of these are in Sub-Saharan Africa where the East African market is the primary driver of mobile applications (Caulderwood, 2015). However, there are large differences within the region. Estimates indicate that as much as 63 percent of the population in Kenya has access to a mobile money account, while the corresponding estimate for Zambia is only 14 percent. Kenya is the most active mobile money market in the world, and has therefore been heavily scrutinized in empirical work. No one has so far asked why Zambia is not catching up to its neighbouring countries, despite being one of the first countries to introduce mobile money to its markets. This provides the motivation for the following research.

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<sup>1</sup> Financial inclusion refers to the delivery of affordable and available financial services for all segments of society. Financial inclusion focus on the poor and rural individuals, and small and medium size enterprises as these segments are the ones that are excluded from financial services (World Bank).

<sup>2</sup> See Demombynes and Thegeya (2012), Frederick (2014), Islam et al. (2016), and Jack and Suri (2014), among others.

## 1.2 Research Question

There is a growing consensus among scholars about the benefits and welfare implications of mobile money for both households and firms in developing countries. So why are some countries not successful in adopting mobile money? We know that mobile phone penetration has reached close to saturation levels in the region, including Zambia. New advancements in technology has further led to an increased uptake in smartphones. However, an observation made by Mosheni-Cheraghlou (2013) point out that there is an asymmetry between mobile phone penetration and mobile money accounts. He argues that the commonly perceived determinants for successful roll-out of mobile money, infrastructure and regulation, are not as critical as previously assumed. Rather, cross-country differences in cultural beliefs about cash, security and trust are more important. The overall research question will address the following problem: Why do some countries, such as Zambia, lag behind in adapting to mobile money?

If we can assume mobile money is beneficial and useful it would be important to understand what may stand in the way of its adoption. For example, Beck et al. (2015) have found that mobile money increased the production in the SME sector in Kenya due to reduced risk of theft and increased access to trade credit. Nampeweo et al. (2016) show that mobile money in Uganda is associated with increased growth of long-time credit in the private sector. SMEs that use mobile money indicate that they accept the payment method because customers or suppliers requested so, and appear to promote adoption along the supply chain (Higgins et al., 2012; Mas and Ng'weno, 2012; Beck et al., 2015). Therefore, the paper will try to explore whether strong supplier linkages can promote mobile money adoption among firms also in Zambia by addressing the following hypotheses:

- Hypothesis 1: Firms with a trade credit relationship with suppliers are more likely to
- a: use mobile money for any financial transaction;
  - b: use mobile money to pay suppliers; and
  - c: have a larger share of supplies payed with mobile money.
- Hypothesis 2: Small firms are more likely to adopt mobile money than medium and large firms.
- Hypothesis 3: Older firms are more likely to adopt mobile money than younger firms.

The thesis will conduct two types of analyses. First, a quantitative cross-country comparison tries to explore what types of firms, why, why not, and how the linkages with suppliers affect adoption of mobile money by firms. The World Bank Enterprise Surveys (WBES) gathers representative private sector firm-level data comparable across countries<sup>3</sup>. The 2013 series also include specific questions about the use of mobile money for four East African countries<sup>4</sup>: Kenya, Tanzania, Uganda and Zambia. This generates a unique opportunity to do a comparable cross-country analysis of mobile money adoption for private sector SMEs in this region using the Probit and Tobit models. A comparison between these countries can provide interesting insights as they are neighbouring countries, all with growing and emerging markets. In recent years, they have all implemented several financial reforms aimed at improving financial inclusion and integrating their financial systems (Calice et al., 2012). They are relatively similar in terms of income levels, have their roots in British colonial rule, and host a diversity of

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<sup>3</sup> Non-agricultural, non-mining private (formal) sector.

<sup>4</sup> The definition of East Africa varies by geography and geopolitics (Calice et al., 2012). This paper adopts the classification by the United Nations, which includes 19 countries in the definition of East Africa (<http://millenniumindicators.un.org>).

religions, languages and ethnicities. However, there are also crucial contextual distinctions that might explain cross-country differences of adoption rates among firms that this paper will try to dig deeper into.

Due to low up-take of mobile money in Zambia, there is also limited variation in the data. The common procedure in the literature is to omit Zambia from the sample and consequently the analysis itself. Lack of data is an inherent problem in developing countries. Since the focus here is prediction and not causation, it allows us to raise interesting questions about non-adoption in Zambia. The second part of the analysis will therefore be a quantitative assessment of the mobile money market in Zambia. There is a limited understanding of the demand side assessments of mobile money, and even less so for the SME sector. A two-folded approach makes it possible to analyse firm level determinants and incentives of mobile money adoption across countries, and the non-adoption in Zambia by distinguishing between best- and least performing counties in the region.

### 1.3 Aim and Scope

Mobile money can be understood from four different perspectives: access, adoption, usage, and impact (Nielsen, 2013). Access depends on both the physical and the technical access. The physical access refers to mobile network operators’ (MNOs) ability to leverage a widespread distribution of agent networks, while technical access refers to access through the mobile interface (GSMA, 2016). These factors are assumed to be prerequisites for diffusion of mobile money. However, actual uptake and usage of a financial service or product depends on the individual or the firm themselves and the quality of the service provided. Adoption relates to questions of who adopts mobile money and why they do so. The choice of adoption will depend on the latent demand for mobile money and the current outside options. Usage depends on the quality of the services and refers to how customers effortlessly can apply the services, or what are the obstacles for not doing so. It is about creating usage patterns that builds the whole ecosystem. For firms, there are certain drawbacks that makes mobile money less desirable such as a cap on the amount of transaction possible. Diffusion of mobile money will crucially depend on all these factors. The impact refers to the welfare effects and implications of mobile money at the various levels. Figure 1.1 illustrates these analytical steps.

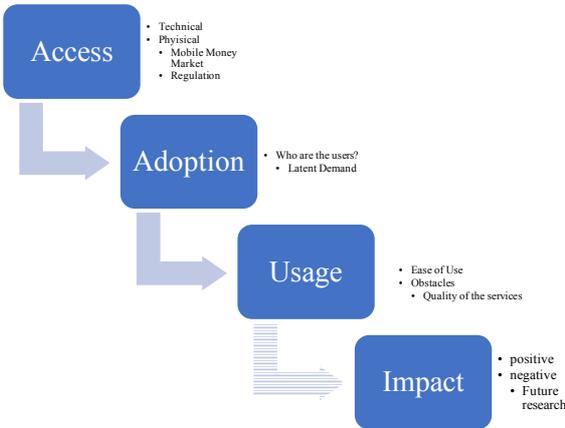


Figure 1.1 Analytical Framework of Mobile Money Diffusion.

Source: Modified version of Nielsen (2013).

The aim of this paper is to explore the potential factors that may influence firms' adoption and usage decisions of mobile money. That is, explore what types of firms adopt mobile money, why do they do so, and why not by assessing a range of firm level characteristics and factors that will incentivize adoption in Kenya, Tanzania, Uganda and Zambia. This thesis relates to three strands in the literature. First, a growing literature analyses the patterns of mobile money adoption and usage among firms in developing countries. Second, the paper relates to the literature on the role of trade credit in developing countries value chain linkages in promoting mobile money. Third, it contributes to the literature assessing the crucial determinants of mobile money diffusion across countries. Early research by Mas and Morawczynski (2009) focus on what makes M-PESA in Kenya successful dividing the analysis in supply and demand factors of adoption. Here, the aim is to understand why firms in Zambia are not following the footprints of its neighbouring countries by looking at supply and demand constraints present in the Zambian mobile money market compared to Kenya.

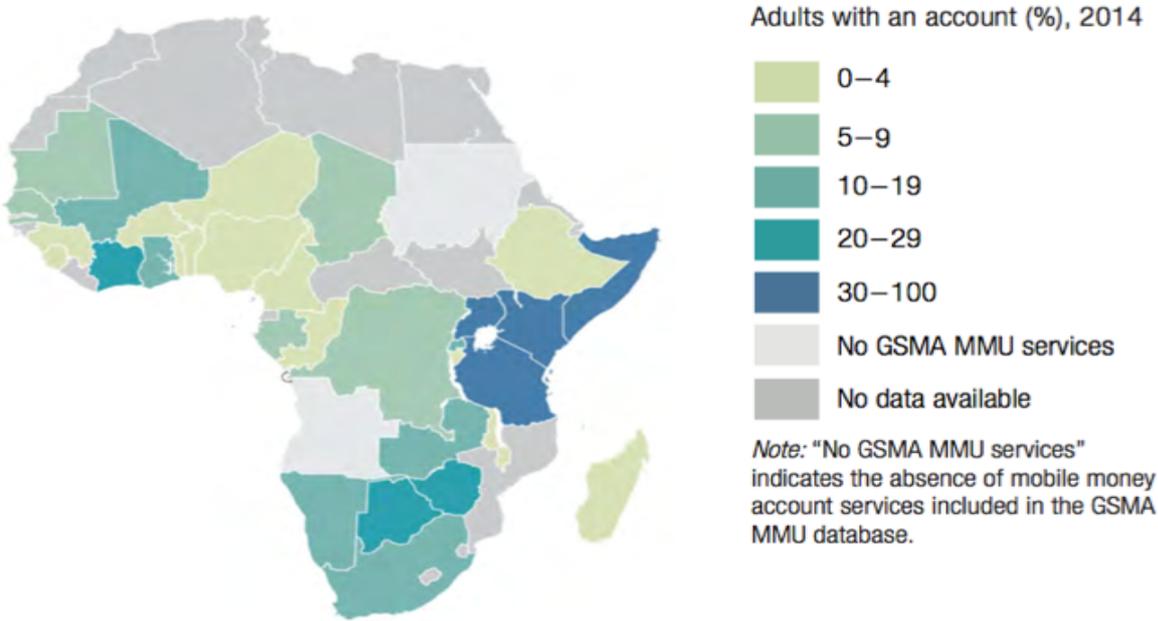
#### 1.4 Outline of the Thesis

The thesis is structured as follows. Section 2 defines the context of mobile money in East Africa by giving a descriptive overview of how mobile money has evolved in the region, and the necessary infrastructure behind its diffusion. Infrastructure and regulation are prerequisites for diffusion, while the actual decision to adopt mobile money depends in the individuals and firms themselves. Section 3 contains the theoretical framework in which the "technology acceptance model" will be introduced together with previous research on mobile money adoption. Section 4 describes the data and defines the main variables that will be applied in the quantitative analysis whereas section 5 describes the method and empirical models. Section 6 presents the results and will discuss the results of both the quantitative and qualitative analysis in light of earlier research. The last section concludes by summarizing the main results and proposes some practical implications and implications for future research.

## 2 Background and Context

### 2.1 Global Mobile Phone Penetration and Mobile Money Deployments

An estimated two billion people remains unbanked. According to the Global Financial Inclusion database (Demirgüç-Kunt, 2015), 23 percent of adults living below \$2/day have access to a bank account. In Sub-Saharan Africa, only 14 percent have access. Traditional bank infrastructure is too expensive to reach the poor and rural. They are therefore more likely to find alternative credit uses in the informal market (Asongu, 2015). One billion of these underserved people have access to a mobile phone, which is the basic platform in which mobile money accounts are accessible (Hughes and Lonie, 2007). Worldwide, there are 4.30 billion mobile phone users, representing 58.7 percent of the world population (GSMA, 2016). Sub-Saharan Africa is the fastest growing market for mobile phones (International Telecommunication Union, 2009). Furthermore, there must be a sufficient distribution of agent networks for Cash-In-Cash-Out (CICO) services, as well as a mobile money account connected to the mobile phone (SIM card). Mobile Network Operators (MNOs) have proven to be more efficient than banks to develop and manage low-cost distribution networks of CICO agents in underserved areas (Catri, 2013). GMSA (2016) estimates that there are 287 mobile money deployments around the world with 556 million registered accounts<sup>5</sup>. The most active mobile money markets are found in Sub-Saharan Africa, especially the East African region, illustrated by Map 2.1. We can see that Kenya, Tanzania, Uganda and Somalia have the largest share of mobile money accounts.



Map 2.1 Mobile Money Penetration in Sub-Saharan Africa.

Source: GMSA (2015)

Most of the global mobile phone market growth is due to the increased demand for smartphones, which potentially can change the nature of mobile money in the coming years.

<sup>5</sup> Of these, 174 million are active accounts. Active accounts are usually defined as those that are used at least once a month (GSMA, 2016).

eMarketer (2016a) has estimated that almost half of mobile phone users worldwide use a smartphone at least once a month. Numbers of smartphone users reached 1.86 billion in 2015, expected to reach 2.9 billion in 2020. The digital divide between advanced and developing economies is closing, but in terms of smartphone ownership were at 31 percentage points in 2015. North America and Western Europe are the leading regions in both mobile phone use and smartphone penetration. The Middle East and Africa have the lowest smartphone penetration rate. However, the growth in smartphone use will be much stronger in emerging regions as the uptake starts from a lower user base (eMarketer, 2016b).

## 2.2 The Infrastructure in East Africa

Kenya, Tanzania, Uganda and Zambia are four countries located in East Africa. Kenya and Tanzania border to the Indian Ocean, while Uganda (to the west) and Zambia (to the south) are landlocked. All countries gained independence from Britain in the early 1960s<sup>6</sup>. Together the region has more than 150 million inhabitants, with up to 80 percent of the population living in rural areas. Uganda is the country with the largest population density and rural population, while Zambia the opposite. Poverty levels are high, especially in rural areas leading to high urban migration (annual rate of urbanization is around 5 percent) (CIA World Factbook, 2016).

The region is characterized by strong growth, ranging from an annual average growth rate of 4.9 percent in Uganda, to 7.3 percent in Zambia over the last decade. The agricultural sector remains the largest sector of the economy. While Kenya's Rift Valley contains the continent's most successful agricultural region, Uganda, Tanzania and Zambia are all relatively rich in natural resources. Zambia has especially been dependent on its production of copper as its sole major export and is continuously making efforts to diversify its economy. The SME sector is the main source of income and employment for the population outside the agricultural sector. For example, in Kenya, SMEs contribute 40 percent of GDP, 50 percent of new employment and 80 percent of the formal workforce (Mwarari & Ngugi, 2013). Similarly, SMEs in Zambia account for 97 percent of businesses in the country, however, contributions to GDP is at 8 percent and 30 percent of formal employment (Mbuta, 2007). Unemployment is very high, although reliable numbers are difficult to find. Estimates range from up to 40 percent in Kenya, to 15 percent in Zambia. This is coherent with the large informal sector, which is estimated to account for 36 percent in Kenya and 60.2 percent in Tanzania of the official GDP (Schneider, 2004).

The strong growth performance is generally not inclusive. Productivity is hampered by underinvestment and poor infrastructure (Aker and Mbiti, 2010; Jack and Suri, 2011; Hellström, 2010). The road network is generally not paved, and transport systems underdeveloped making the rural areas are seasonally isolated. An estimated 14 percent of roads in Tanzania, Kenya and Zambia are paved (World Bank, 2017; BOZ, 2015). Less than 30 percent of total population has access to electricity. In rural areas, electricity is close to non-existent. The fixed telephone line covers less than 1 per 100 people.

The financial systems are considered deficient compared to other developing economies, despite many new improvements in the past decades (Demirgüç-Kunt and Klapper, 2012). Foreign-owned banks account for almost 50 percent of the banking industry' total assets. Competition among foreign commercial banks has expanded the sector and improved

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<sup>6</sup> Tanganyika (1961) and Zanzibar (1936) merged into Tanzania in 1964, Uganda (1962), Zambia (1964), and Kenya (1963).

efficiency, but the interest rates remain high due to the risk of fraud and lack of collateral. Kenya is the country with the highest levels of financial inclusion, in which 27 percent of the population has access to a bank account. Informal services are available, such as savings groups and member-based organizations, which are especially present in Zambia (FST-Z, 2015).

Mobile phone penetration has leaped all other infrastructural development in the region. Privatization of the monopoly-based government run telecommunications sector in the 1990s reduced prices, making mobile phones accessible for both individual users and firms (Gebreab, 2002). Tele-density coverage range from 75 percent in Tanzania to 100 percent in Uganda. Figure 2.1 summarizes mobile phone related statistics for the four countries. The combination of these factors, lack of access to financial alternatives, increased penetration of mobile phones, and a strong telecommunication market, have been crucial for the successful of mobile money diffusion in the region.

*Table 2.1 Snapshot of the Region*

<b>Category</b>	<b>Kenya</b>	<b>Tanzania</b>	<b>Uganda</b>	<b>Zambia</b>
Population (million)	46	52.4	38.3	15.5
Urban population (percentage of total population)	25.6	31.6	16.1	40.1
Mobile network operators	4	7	6	3
Access to mobile phones (%)	93	93	82	73
Tele-density coverage (per 100 people)	80	75	100	77
Registered mobile money accounts	31 642 400	53 843 917	21 102 851	4 917 204
Mobile money accounts (%)	67	61	35	14
Mobile money outlets (per 100,000 people)	538,0	924,7	540,2	219,5
Bank accounts (% age 15+)	27	NA	11	13
Commercial banks (per 100,000 people)	5,8	2,4	2,9	4,6

*Source: UNCTAD (2012), Demirgüç-Kunt et al. (2015), IMF (2015), CIA World Factbook, (2016), FII (2017).*

## 2.3 Mobile Money

Mobile money is defined as an electronic wallet, which is a transactional account linked to a mobile phone number (connected to a SIM card), instead of an account number in conventional banking (Jack and Suri, 2011). Electronic value (e-float) is issued by a telecommunication's provider stored in the account on the SIM that can be used for transfers or payments, with corresponding value is safely held in a bank (UNCTAD, 2012). Sometimes the account may be offered by a third-party provider that is neither a telecommunication provider nor a bank (Frederick 2014). With mobile money, people can transfer and receive money across large distances, store money safely, and access financial services such as saving, credit, insurance, pay utility bills and receive salaries in a time-consuming manner.

### 2.3.1 Mobile Money Ecosystem

The mobile money ecosystem consists of several actors that are important for a well-functioning mobile money market (UNCTAD, 2012). A mobile network operator (MNO) is the main delivery channel of mobile money services. Other financial institutions, such as MFIs, third-party providers and banks are either smaller providers or specializing in one type of product, partnering with the larger MNOs to offer interoperability. The largest and most successful providers are usually MNOs as they can leverage their mobile network infrastructure of airtime reseller outlets and customer base using its already well-known communication services. Their main responsibility is to ensure compliance with the telecommunication regulation. MNOs are backed by banks holding the funds and enabling exchange of money. Banks are responsible for compliance with national financial regulations, and are now also offering connections between mobile money and bank accounts. In cooperation with MNOs, banks can relatively inexpensively leverage mobile money platforms to reach potential customers in previously underserved areas. The key regulatory institutions are the Central Banks for the financial sector, and telecommunication regulations for the communications sectors. Recognizing the value of mobile money, they provide an enabling environment for MNOs, banks and new market entrants (ibid).

Due to high liquidity, agents are typically general shop owners, retailers, distributors, airtime or money exchange outlets (Frederick, 2014). They are bridging cash-in and cash-out services in exchange for e-float currency, and play an important part in attracting, registering and teaching new customers. Most of the larger MNOs in East Africa have developed a widespread agent network, while banks are usually limited to urban areas. Agents earn commission from the transactions carried out by customers, and collect these from the MNOs through head agents. The ecosystem crucially depends on its users to create demand and acceptability. Firms such as retailers and vendors help increase demand for mobile money by accepting mobile money payments for their products and services. Other businesses such as suppliers, insurance providers, MFIs, distributors and bill issuers can use mobile money to collect money for the delivery of their services. Customers subscribe to the different MNOs and benefit from cheaper and more convenient ways of money transfer and payment methods. Registration requires an official identification, but no other type of standard banking documentation. Users can deposit and withdraw money from the account, conduct money transfers (P2P), purchase airtime and

pay for products and services, check the balance directly from their cell phone, and store the money for saving or self-transportation<sup>7</sup>.

There are three types of services for defined for corporate use: Pay Bill, Pay Goods, and Bulk Payments. Pay Bill is a customer-to-business (C2B) payment where the parties do not need to meet face-to-face, while Pay Goods are face-to-face merchant payments at retail outlets. These are payments initiated by the customers but made accessible by the businesses. Bulk Payments are business-to-consumer payments (B2P). This was initially used for paying salaries, but can now be applied for any outgoing payment such as paying suppliers. These payments are initiated by the businesses. Customers enter an account number as a reference, and the receiver can check the payment status by accessing a web tool (Mas and Ng'weno 2012). For companies to register for Bulk Payments, they need a mobile money account and present copies of the company certificate and the manager's identity documentation, in addition to a compliance certification (MNT Zambia).

The charges of the services vary according to type of transactions and generally increases with the amount<sup>8</sup>. Withdrawal of cash and P2P transfers within the same operator are generally the cheapest type of transactions. The fees are fixed, and does not change often. They are usually displayed at the retail shops. Fees are charged from the user's account, deduced from the e-float that is being transacted. Copies of each transaction are given to the store's head agent, to the network operator in addition to the customer and the agent themselves<sup>9</sup>. However, copies are not stored electronically imposing a challenge for taxing and auditing services. Furthermore, there is a cap on the transactional amount possible at \$500 (Gosavi, 2015; Mas and Ng'weno, 2012).

### 2.3.2 Mobile Money Platforms in East Africa

The most successful and widespread example of a mobile money platform is Kenya's M-PESA<sup>10</sup>. M-PESA was first launched by Safaricom in March 2007, which is the largest MNO in Kenya (Jack and Suri 2014)<sup>11</sup>. Before the innovation of mobile money, customers could buy airtime credit and transfer this credit to other users. It was therefore possible to expand this function to include selling air-time credit to local agents for cash. In effect, this was a purchasing power transfer from the initial sender to the receiver. Safaricom exploited this opportunity to formalize this procedure with the launch of M-PESA in 2007 (Jack and Suri 2011).

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<sup>7</sup> The accounts are generally not interest bearing. However, M-PESA has recently started a savings service together with Equity Bank, called M-KESHO which is connected to a bank account and bears interests.

<sup>8</sup>As of 2015, the costs for basic services are US 40 cents for person-to-person transfers, US 33 cents for withdrawal up to US\$33 which is capped at US\$500, US 1.3 cents for balance inquiries (see Vodafone for more fees). More information on specific and updated charges and fees can be found on the respective telecommunications' websites. Sending or receiving money from MNO will increase the fee substantially (three times the standard fee) (Gosavi, 2015).

<sup>9</sup> The cost of mobile money services is generally cheaper than the alternatives: cash is the cheapest alternative but inhibits risks of theft; bank accounts are often unavailable because of high interest rates; checks are time consuming taking up to five days to be processes. All services carry high alternative costs in terms of travel time and/or waiting time, generally due to lack of accessibility and geographic reach. Table of the cost of the alternative services can be found in Comminos et al. (2009), Jack and Suri (2011), and Gosavi (2015), among others.

<sup>10</sup> The first one, however, was Send Money, established in 2001 in the Philippines (Heyer and Mas 2011)

<sup>11</sup> More about the M-PESA can be found in Morawczynski and Pickens (2009), Mas and Morawczynski (2009) and Hughes and Loine (2007), among others.

The reasons why M-PESA has been such a success in Kenya and subsequently Tanzania and other countries are due to Safaricom’s dominant market position, aggressive marketing and campaign for expansion in the early stage, in addition to the need and demand for payment services between urban and rural areas (Eijkmann et al. 2010, Beck et al., 2015). The figure below is a modified version taken from Gosavi (2015), describing the operating system of M-PESA in Kenya as a comparable benchmark case of platforms in the region. Vodafone is the parent company of M-PESA. Its main responsibility is to maintain the security of the customers’ accounts. Safaricom is the main company behind M-PESA and is responsible for paying commissions to its agents and deposit money. The top image is a third-party agency, appointed by Safaricom to train, supervise and evaluate agents. Usually it visits the agents once a month to assess their liquidity (Gosavi 2015 p. 433). Safaricom keeps the collected cash in bank accounts which are treated as any other current account, with no restrictions on either Safaricom nor the banks. Safaricom can thus access the funds when necessary and the banks do not have any special reserve requirements on the M-PESA deposits.

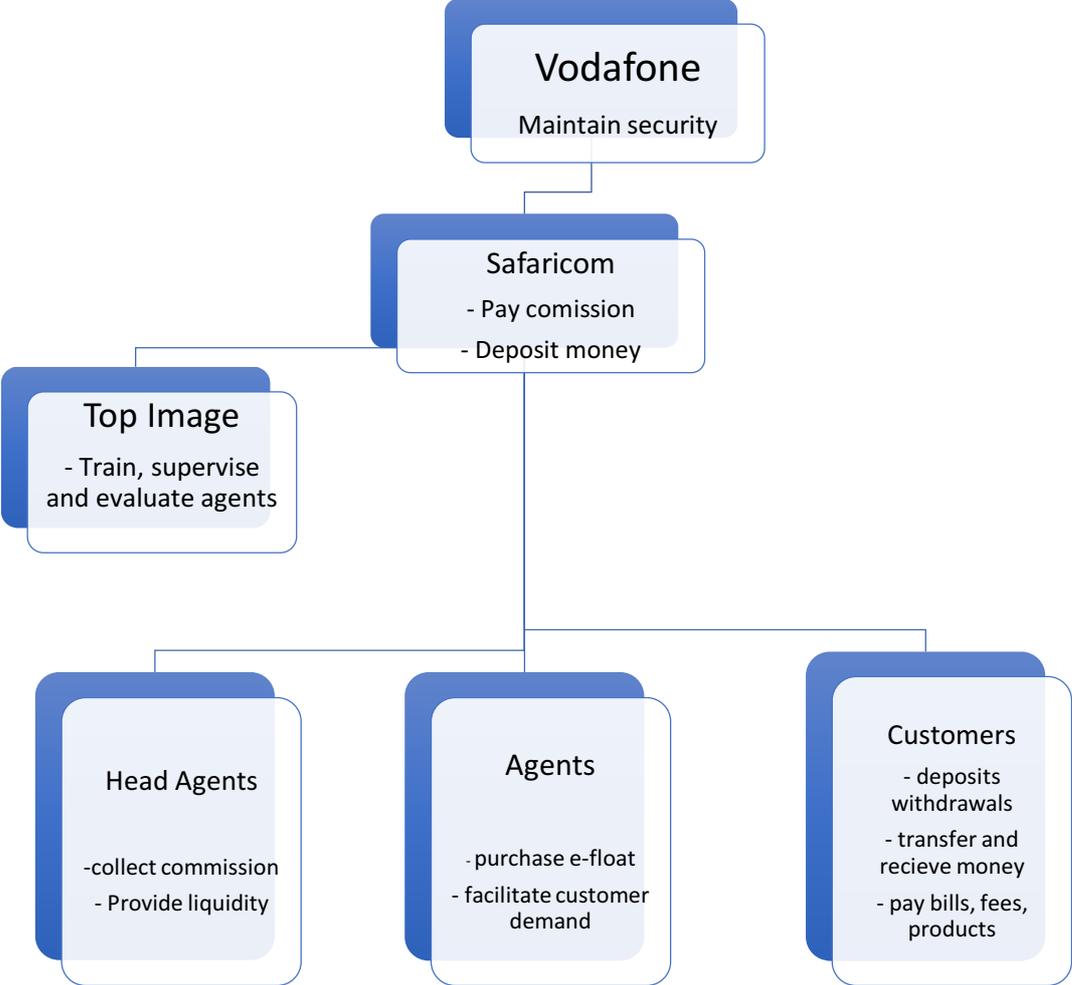


Figure 2.1 The M-PESA Operating System

Source: Own illustration, modified version from Gosavi (2015)

The customers can set up an account at an agent that is linked to their SIM cards, and it is free to set up and “test”. The agents hold e-float on their own cell phone, purchased from Safaricom or other customers. They facilitate functions such as opening accounts, depositing and

withdrawing money, and maintain records of the deposits and withdrawals of funds. The Agent Head offices (head agents or master agents) deals directly with Safaricom and have the responsibility to provide liquidity to the local agents. They do this by buying and selling M-PESA balances from Safaricom. They are also the collectors of commissions for all agents (normally a 30/70 distribution)<sup>12</sup>.

M-PESA has been dominant in terms of both customer subscribers, but also through its influence on the regulatory landscape and the formation of the subsequent platforms in the region. Other MNOs in the region have followed M-PESA's footprint in its structuring of agent commissions, transaction fees, thresholds and limits, and Central Bank regulation. Figure 2.2 summarizes the mobile money platforms offered by the different MNOs and their respective bank partnerships in the four countries. M-PESA is still the largest provider in Kenya, but are competing with Airtel Money and Orange Money. The market in Kenya is rather mature, in which all providers now offer bank partnership in addition to more specialized services offering credit, insurance, solutions for health care management and solar energy payments, among others. M-PESA is also the largest provider in Tanzania (42 percent of the market share). The initial market penetration was somewhat slower than in Kenya (di Castri & Gidivani, 2014). The market is considered competitive with three other relatively large MNOs providing mobile money. In Uganda, MNT Money has the largest agent network, with 65 percent followed by Airtel Money (FINclusion, 2015). Zambia has a competitive market with many new providers and different business models. There are three MNOs offering mobile money, MNT, Airtel and Zamtel. However, commercial banks and third party providers are increasingly entering the market. Zambia is different to the other countries in that the largest distributor is an independent third party provider, Zoono, launched in April 2009. Furthermore, the mobile money providers in Zambia started out with a focus on the corporate segment and not remittances as in the other countries.

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<sup>12</sup> In practice, agent operations are organized into three groups: the head-office model, the aggregator model, and the super-agent model (linking M-PESA services into the banking system) (Jack and Suri 2011).

Table 2.2 Mobile Network Operators, their Mobile Money Platforms and Bank Partners

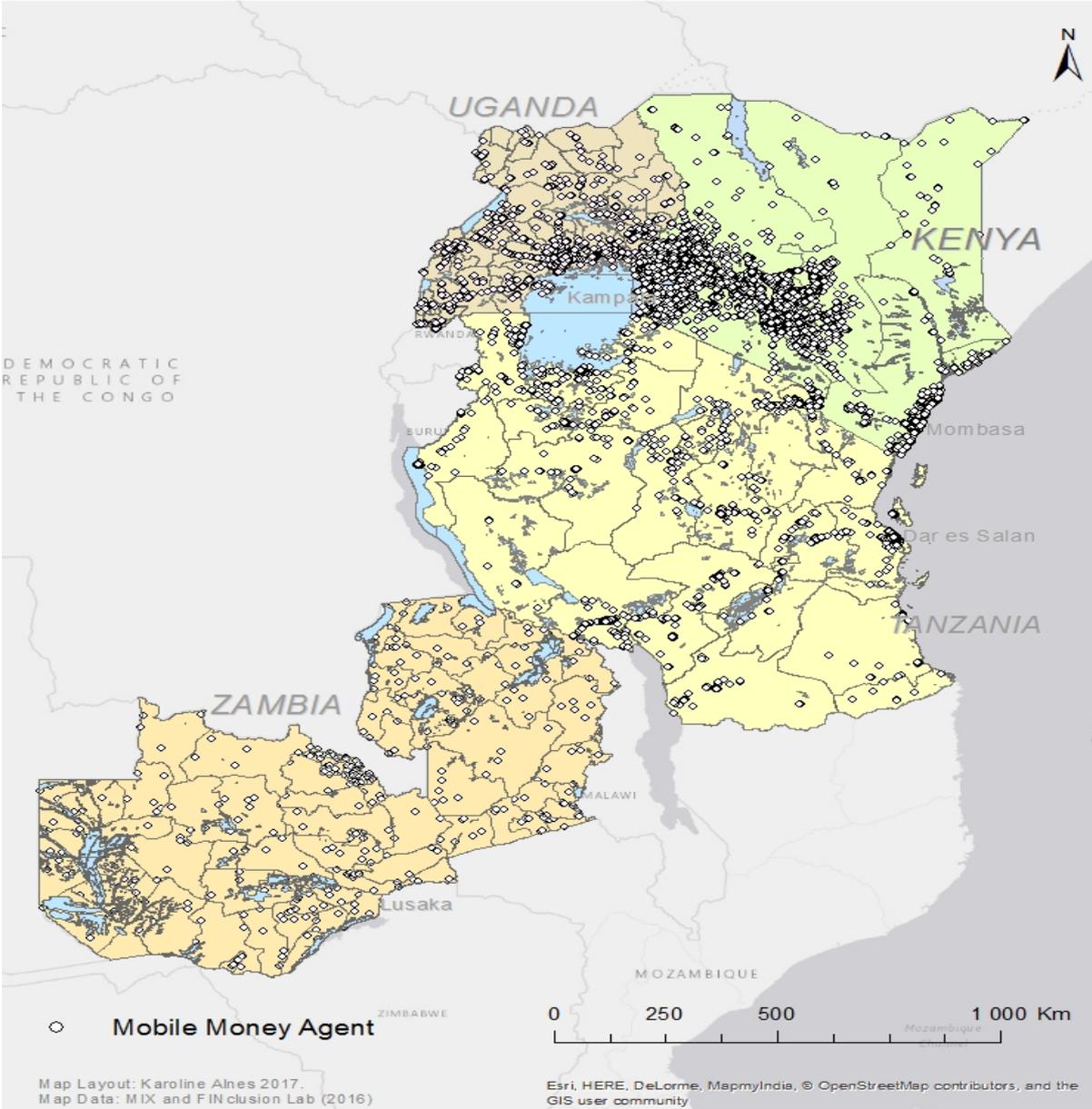
<b>Country</b>	<b>Operator</b>	<b>Mobile Money Platform</b>	<b>Bank Partners</b>
<b>Kenya</b>	Safaricom	M-PESA (March 2007)	Commercial Bank of Africa Standard Chartered Kenya CFC Stanbic Equity Bank Kenya
	Aritel Kenya	Aritel Money (February 2009)	Citigroup
	Econet Wireless	Yu Cash (December 2009)	
	Orange Kenya	Orange Money (November 2010)	Equity Bank Kenya
<b>Tanzania</b>	Vodacom	M-PESA (April 2008)	National Bank of Commerce CRDB National Microfinance Bank
	Aritel The United Republic of Tanzania	Aritel Money (February 2009)	CitiBank The United Republic of Tanzania Postal Bank CRDB
	Tigo The United Republic of Tanzania	Tigo Pesa (September 2010)	National Bank of Commerce National Microfinance Bank
	Zantel	Z Pesa (2012)	FBME Bank
	Smart Mobile	None	
	SasaTel	None	
	TTCL	None	
	<b>Uganda</b>	MNT Uganda	MNT MobileMoney (March 2009)
Aritel Uganda		Aritel Money (June 2009)	CitiBank Uganda Standard Chartered
Uganda Telecom		M-Sente (March 2010)	DFCU Bank
Orange Uganda		None	
Warid Telecom		WaridPesa (December 2011)	
<b>Zambia</b>	Aritel Zambia	Aritel Money	Standard Chartered Bank Zambia
	MNT Zambia	MNT Money	ABC Bank Zambia Standard Chartered Bank Zambia
	Zamtel	Zamtel Money	Barclays Bank National Bank

Source: GSMA deployment tracker and UNCTAD (2012)

Kenya has the largest agent network with 65,569 mobile money agents distributed across the country, (followed Tanzania with 56,017 and 41,794 in Uganda), while in Zambia there are only 4,319, representing 45 percent of the access points in the country (FINclusion Lab, 2015). Map 2.2 shows the distribution of mobile money agents in the region.<sup>13</sup> In Kenya, 73 percent of the population live within a three-kilometer radius of a mobile money agent. The corresponding estimates are 52 percent in Uganda, in which 46 percent in rural areas live in close proximity to an agent, while in Tanzania only 33 percent of the total population is in close

<sup>13</sup> For Uganda and Kenya, each dot on the map represents a mobile money agent. Due to lack of exact point data availability in Tanzania and Zambia, each dot represents 12 access points. Since it is the geographical reach that matters, this is not an important issue here

proximity<sup>14</sup>. Uganda has a large coverage of mobile money agents due to high population density. However, the large share of rural population makes it difficult for people to access the agents. Despite the significantly lower level of mobile money agents in Zambia compared to the other countries, we can see that the geographic reach is rather impressive. All districts have at least one mobile money agent. Moreover, the country is much smaller with a lower population density and a larger share of urban population. However, slow growth of agents continues to be a problem for expanding the geographic reach of the network system. We can see that mobile money agents are concentrated around the larger cities of Kampala, Nairobi, Mombasa, Dar es Salam, and Lusaka. Together with mobile phone connectivity, the potentials for adoption and diffusion of mobile money is therefore made possible by the already established infrastructure in the region.



Map 2.2 Distribution of Mobile Money Agents in East Africa.

<sup>14</sup> Estimates for Zambia are not yet available.

## 3 Theoretical Framework

### 3.1 Theories of Technology Adoption

As outlined above, access is a prerequisite of mobile money adoption, but the actual take-up depends on individual decisions and the quality of the service provided (Nielsen, 2013; FST-Z, 2015). Adoption is a voluntary choice that will materialize only when it offers benefits to the alternative ways of payments already in place, together with a clear understanding of the associated risk establishing a trust in the new system (Mas & Rotman, 2008; Dzokoto et al., 2016). Intuitively, the utility of changing “status quo” must outweigh the costs, where “status quo” refers to usage cash and checks.

The cost-benefit assessment can be explained by how attitudes towards mobile money are shaped. The attitudes are influenced by a range of factors, including personal and physiological traits as knowledge, trust, need and personal control; social aspects such as familiarity, norms and pressure; customer’s behavioral beliefs about the technology, such as perceived usefulness and the perceived ease of use; and aspects of the technology itself, including the level of divisibility, presence of attractive benefits, transaction time, leverage potential, record keeping, accessibility, simplicity and cost, in addition system developer’s and managers’ attempt to shape customers beliefs about the technology through extensive marketing and training; and the availability of other more appealing payment methods and its associated costs (Douthwaite, 1999; Schuh and Stavins 2010; Tobin and Kuwornu, 2011, Asungu, 2015; Dzokoto et al., 2016).

Yousafzai et al. (2010) summarize these aspects in three theories. These are 1) the theory of reasoned action (TRA); 2) the theory of planned behaviour (TPB); and 3) the technology acceptance model (TAM)<sup>15</sup>. The TRA assumes that customers are rational and are thus able to reflect upon all possible outcomes of their actions before adapting to a given stance. This theory provides a straightforward way to model individual’s potential attitudes, but imposes strong assumptions on their ability “to make decisive attitudes”. The TPB identifies the shortcomings of the TRA and takes into account that some people may have limited control over a given situation. In this model, there are three factors that can affect behavior and intentions of human action: i) normative influences, such as beliefs about other people’s expectations, ii) attitudinal influences, such as the behavioural beliefs of the results of a given attitude, and iii) a perceived behavioural control on the opportunities, resources and obstacles towards performing an attitude. The normative beliefs lead to a conforming behaviour towards subjective norms or pressures, behavioural beliefs can affect attitude by either resulting in unfavourable or favourable attitudes towards the underlying behaviour, and control beliefs can produce a perceived sense of behavioural control. The third model, the TAM, further extends the TRA by including that people’s adoption of a new technology is explained by the “behavioural intention to accept and use” the given technology. The behavioral intention could be thought of as a binary variable distinguished between users and non-users and is defined by the perceived ease of use (PEU) and the perceived usefulness (PU) of the technology. According to Davis (1989), perceived usefulness is “the degree to which a person believes that using a particular system would enhance his or her performance” while perceived ease of use refers to “the degree to which a person believes that using a particular system would be free of effort” (p. 320). These

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<sup>15</sup> TRA was developed by Fishbein and Ajzen (1975), Ajzen and Fishbein (1980), and Bagozzi (1982). TPB was developed by Ajzen (1991) as an extension to TRA. TAM was first pioneered by Davis (1989) and further developed by Venkatesh and Davis (2000), and Yousafzai et al. (2007ab) (Asongu, 2015).

notions are based on people’s subjective perception. However, perceived or not, ease of use will ultimately depend on the quality of the service and the reach of the ecosystem. The usefulness of the given technology will depend on the latent demand for mobile money based on current alternatives to the technology (Heyer and Mas, 2011).

Figure 2.2 illustrates an extended version of the TAM model’s conceptual framework (Lesa et al., 2016). Perceived costs and risks of the technology will affect the behavioural intention to use. Crucially, social norms and expected pressures from society will shape the attitudes both directly and indirectly through the expected benefits and quality of the service (Lesa et al., 2016). This thesis will focus on the “social norm” aspect of the TAM model, in which the relationships with suppliers and customers will be determining incentive for mobile money adoption among SMEs.

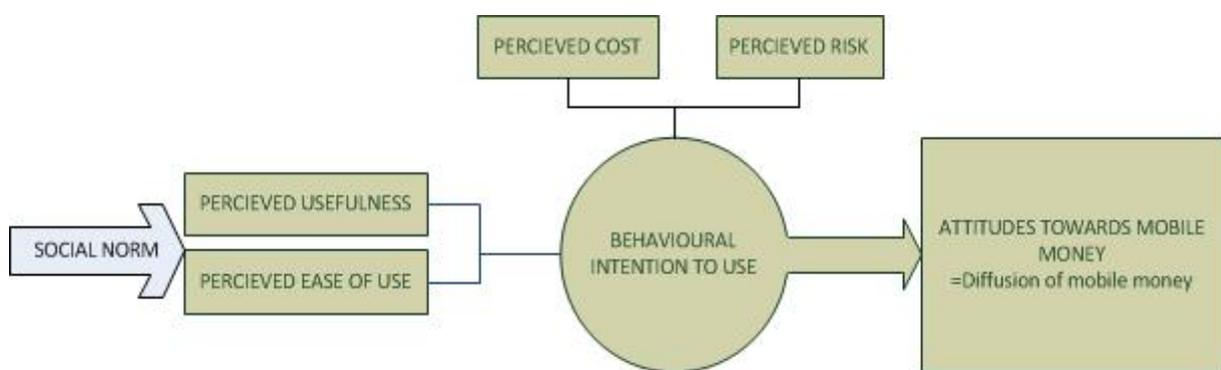


Figure 3.1 The Technology Acceptance Model.

Source: Own illustration, modified version of Lesa et al. (2016).

The aggregated diffusion process can be explained as following a normal standard distribution. The left-end tail of the distribution represents the innovators (2.5 percent) and early adopters (13.5 percent), with the early and late majority in the middle (each 34 percent), whereas the laggards (16 percent) are located at the right-end tail (Rogers, 1995; Moore 1991; Frederick, 2014; Dzokoto et al., 2016). Within this framework, increased access to mobile phones and mobile money agents leads to increased adoption rates of mobile money (Dzokoto et al., 2016).

### 3.2 Previous Research

This paper complements the literature that attempts to understand what types of firms adopt mobile money, why they do so, and why not. Gosavi (2015) investigates the characteristics of firms in East Africa and the use of mobile money. He finds that smaller and older firms, and firms with a bank account are more likely to use mobile money than larger and younger firms. He argues that older firms have longer business relationships with their suppliers and customers, while larger firms face constraints in the functioning of the service’s ease of use and usefulness. Similarly, Mas and Ng’weno (2012) find that large firms in the formal sector in Kenya are less likely to use mobile money compared to small and informal firms. They argue that there are several barriers affecting larger firms’ decision to adopt mobile money. First, there are no system for keeping records of transactions, receipts or transaction confirmation, posing problems for the accounting system. Firms fear fraud and theft as the system does not have any mechanism to handle misidentified transactions. Second, at the time of this study, transfers of funds from a mobile money account to a firm’s account could take up to four days,

while checks would take only two days. Another common barrier is that the agents do not have the liquidity or e-float necessary for larger transactional amounts (Bångens and Södergren, 2011). Additionally, there is a cap at around 500\$ for each transaction (Gosavi, 2015), making the mobile money option less attractive for larger firms.

The thesis also relates previous research on trade credit in development and specifically how linkages can promote mobile money adoption along the value chain. Trade credit is usually offered by larger suppliers to smaller firms along the value chain, and has the potential to relax finance constraints by releasing resources (Jack et al., forthcoming; Ngoasong, 2016). Earlier studies suggest that trade credit is associated with increased capital utilization (Fisman, 2001) and growth performance (Fisman and Love, 2003) of firms in countries with less developed financial markets. According to Beck et al. (2015), “suppliers have an advantage over other lenders in financing credit-constrained firms, which makes trade credit prevalent in financially less developed countries where the majority has limited access if any access to credit. Unlike credit from formal institutions, trade credit does not rely on formal collateral but on trust and reputation” (p. 7). Using data for businesses in Kenya, they find that trade credit from suppliers increases the likelihood of using mobile money. They develop a dynamic general equilibrium model in which risk of theft and limited access to trade credit creates a demand for using mobile money to pay suppliers. This in turn, facilitates credit relationship between SMEs and suppliers. According to Jack et al. (forthcoming), can mobile money facilitate trade credit by reducing the transaction costs of the often small and frequent transfers of trade credit, and by providing a convenient platform for distribution and management of credit in environments where risk of default and fraud is high and contract enforcement low.

This is consistent with research documenting effects of social norm and network on adoption. A report by GSMA (2011) find that of micro and small firms in Tanzania adopted mobile money if other firms in the same area used it. The use was mostly initiated by sellers, centred on small, standardized goods with frequent exchanges. Higgins et al. (2012) study mobile money usage among SMEs from urban and semi-urban areas in Kenya. Customers initiated the service 48 percent of the time, while 38.6 percent was required suppliers. Both types of requests were a deciding factor for adoption. Importantly, they argue that mobile money usage by SMEs could “promote viral adoption along the supply chain” (p. 72), but that receiving payments is based on trust, and those businesses who used mobile money did not actively promote mobile money as a payment method. Lesa et al. (2016) find that social norm is the most determining factor regarding behavioural intention to use mobile-payment systems. They argue that this is consistent with previous research by Phonthanukitithaworn et al. (2014), indicating that people’s willingness to use mobile money increases with the encouragement of friends and family, partners, and colleges. Applying the TAM in a sample of urban poor in Pakistan, Kazi and Mannan (2013) find that social influence significantly affects adoption of mobile banking, in addition to perceived risk and ease-of-use.

Lastly, the thesis relates to the literature trying to understand cross-country variation in mobile money adoption. The perception of security and trust, and cultural beliefs about cash differ across countries (Mosheni-Cheraghlou, 2013), even within the same region (Asongu, 2015). Gu et al. (2009) find that cross-country variation in mobile banking varies by speed of uptake, ease of use, frequency of usage, types of services adopted and household type. Self-efficiency is the most determining factor of the expected ease-of-use, while trust can potentially increase the behavioural intention use. In Malaysia, Daud et al. (2011) report that user’s attitudes towards mobile banking is determined by the degree of awareness of the technology, in addition to perceived credibility and usefulness of the platform. Ngavi et al. (2016) find that countries

that rank above the median in the ease of doing business index has a more enabling environment for mobile money success<sup>16</sup>. At the same time, mobile money located in lower-income countries and with high population densities have the greatest success, implying that the need and demand for simple financial services is important. Successful roll-out of mobile money platforms for providers depends on network externalities, economies of scale and two-sided markets. To be successful, the mobile money platform must reach a critical mass of both clients and agents, which is even more important without requirements of interoperability and non-excludability of agents (Mas and Rotman, 2008; Mas and Radcliffe, 2011). For example, Dzokoto et al. (2016) finds that both preference for and awareness of mobile money is high in Zambia and Ghana, but that the scope of use is still limited because of lack of acceptance by businesses.

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<sup>16</sup> A high ranking implies that the regulatory environment is more conducive to the start-ups and operations of local firms.

## 4 Data

### 4.1 Source Material

The data is gathered from the World Bank's Enterprise Surveys 2013<sup>17</sup>. In this round, the surveys included questions about mobile money usage in the four East African countries. The surveys are representative of the non-agricultural private sector consisting of a random sample of more than 3000 firms<sup>18</sup> in the manufacturing, retail and service sectors. The surveys use the same random stratified sampling methodology and a common questionnaire in all countries<sup>19</sup>. Stratification is applied at the firm-size, sector of activity, and region within the county. Weak eligibility weights are used to ensure that the sample is representative and unbiased<sup>20</sup>.

Following Gosavi (2015) and Islam (2016), Table 4.1 illustrates the main reasons why firms choose to and, choose not to, use mobile money by country. The top panel of Table 4.1 illustrates the main reasons mobile money adopters chose to use mobile money. The most cited reason to adopt mobile money is to reduce costs and time spent in financial transactions, demonstrating the importance of convenience. Panel B illustrates the main reasons for not adopting mobile money. The most cited reason is lack of request by the firms' suppliers, signifying the importance of suppliers' influence on SMEs in the value chain. In Kenya, however, the most important reason is related to the firms' larger payments. This is of special importance for larger firms since there is a cap of \$500 of each transaction.

*Table 4.1 Reasons For and Against Using Mobile Money from Adopters and Non-Adopters*

	Kenya	Tanzania	Uganda	Zambia
<b>Panel A. Main reason for using mobile money (% of mobile money adopters)</b>				
Reduce costs of financial transactions	9.21	26.84	26.35	37.50
Reduce the time spent in financial transactions	42.37	54.31	38.62	41.67
Reduce the risks in financial transactions	13.42	3.51	8.98	8.33
Satisfy suppliers' request	7.37	2.24	9.58	4.17
Satisfy costumers' request	25.26	11.50	14.07	8.33
Align with competitors' use	2.37	1.60	2.40	0.00
<b>Panel B. Main reason for not using mobile money (% of non-mobile money adopters)</b>				
Don't know enough about mobile money	2.09	3.45	1.65	13.99
Fees are too high	2.79	7.33	4.95	2.39
This firm's payment too large	47.39	30.60	28.57	11.60
Not easy to use	3.83	5.17	7.69	4.95
Customers don't use mobile money	5.57	16.81	17.58	6.66
Suppliers don't use mobile money	38.33	36.64	39.56	60.41

*Source: World Bank Enterprise Surveys (2013)*

<sup>17</sup> Collected for the financial year of 2012 between 2012-2013

<sup>18</sup> The sample contains 781 firms in Kenya, 813 in Tanzania, 762 in Uganda, and 720 in Zambia.

<sup>19</sup> The methodology is explained in the Sampling Manual (World Bank Enterprise Surveys), and is obtained by separating the population elements into non-overlapping groups, called strata. Then the sample is selected at random in each stratum.

<sup>20</sup> The stratification process can affect the standard errors which will render the mean estimates biased. Applying weights takes into account the survey design in order to obtain unbiased estimates. The stata-command *pweight* is a probabilistic weight that makes the sample representative for the whole population based on the groups of firm size, region and sector, and corrects for sampling bias, non-interview and non-response in the questionnaires. For more information, see the implementation note at [www.enterprisesurveys.com](http://www.enterprisesurveys.com)

## 4.2 The Main Variables

The main dependent variable for mobile money adoption is a binary variable that takes the value “1” if a firm has used mobile money for any financial transaction and “0” otherwise. The survey also asks the managers or owners whether the firm uses mobile money for different types of transactions. The most common types of transactions are to pay employees, to pay suppliers, to receive payment from customers, and to pay utility bills. The mean values and standard deviations for each variable is illustrated in Table 4.3. We can see that 34.7 percent of the firms in the sample has used mobile money for financial transactions, ranging from 49.2 percent in Kenya to only 3.5 percent in Zambia. The most common type of transaction is to receive payments for customers and pay suppliers. These aspects are important for the linkages between firms. For example, if some firms are already using mobile money, others will follow suit. Specifically, if customers demand or suppliers require firms to use mobile money, more firms will start using it. Furthermore, the survey also asks the firms to indicate the share of annual costs of raw materials and inventory payed with mobile money. This can provide interesting results as firms use mobile money more intensively than individuals. The last row indicates that firms pay on average 20.8 percent of its supplies with mobile money.

*Table 4.2 Descriptive statistics of Mobile Money Adoption and Usage by Country*

<b>Type of transaction</b>	<b>Kenya</b>	<b>Tanzania</b>	<b>Uganda</b>	<b>Zambia</b>	<b>Total</b>
Mobile Money for Financial Transactions	0.492 (0.500)	0.392 (0.489)	0.442 (0.497)	0.0350 (0.184)	<b>0.347</b> <b>(0.476)</b>
MM to pay employees	0.173 (0.379)	0.125 (0.331)	0.206 (0.405)	0.200 (0.408)	<b>0.169</b> <b>(0.375)</b>
MM to pay suppliers	0.395 (0.490)	0.390 (0.488)	0.489 (0.501)	0.440 (0.507)	<b>0.424</b> <b>(0.494)</b>
MM to pay utility bills	0.309 (0.463)	0.508 (0.501)	0.320 (0.467)	0.360 (0.490)	<b>0.373</b> <b>(0.484)</b>
MM to receive payment	0.733 (0.443)	0.530 (0.500)	0.665 (0.473)	0.400 (0.500)	<b>0.643</b> <b>(0.479)</b>
% of supplies payed with MM	17.50 (18.27)	22.91 (20.37)	40.36 (31.69)	19.91 (20.09)	<b>20.76</b> <b>(20.41)</b>

*Source: World Bank Enterprise Surveys (2013). Mean and standard errors in parentheses*

Although many firms have access to a bank account, very few have access to credit lines or finance from banks. 86 percent of the firms in the sample have access to a bank account, but only 23.3 percent have access to credit lines. Trade credit offers an alternative type of finance that that can relax firms’ short-term constraints. The main explanatory variable is a binary variable indicating whether a firm has purchased capital on credit or advances from suppliers and tries to capture the incentives for mobile money adoption through business linkages. Furthermore, the firms were asked to indicate the percentage of annual working capital purchased on credit or advances from suppliers. This variable can be used to capture the intensity in supplier finance.

The firms are asked to answer to what degree lack of financial access is an obstacle for doing business on a scale from 1 to 4 (“1” indicating no obstacle and “4” major obstacle). This makes

it possible to distinguish between firms that are constrained by access to finance. The rest of the independent variables consist of firm-level characteristics used extensively in the literature<sup>21</sup>. This includes a range of dummy variables to control for sectoral fixed effects the type of industry a firm belongs to (divided in manufacturing, retail and services<sup>22</sup>). Others include firm size (small firms are those firms up to 19 workers, medium firms between 20 and 99 workers, and large firms more than 100 workers), age of the firm (young firms are firms up to five years, middle aged firms are between six and nine years, and old-aged firms are between 10 to 99 years), export activity, and bank activity. Additionally, country fixed effects are included to account for time invariant variables in the countries. The full list of variables can be found in table A.1 in the appendix, together with the summary statistics in table A.2.

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<sup>21</sup> For example, Rajan and Zingales (1998); Beck et al. (2012); Asiedu et al. (2013); Gosavi (2015), Isam et al. (2016), among others.

<sup>22</sup> The sector is identified by the Standard Industrial Classification (SIC) code for the main product of the firm.

## 5 Methods

The three different dependent variables for mobile money usage allows us to study several empirical specifications. The baseline specification applies a Probit model in which the limited dependent variable indicates whether a firm uses mobile money for any financial transaction. Furthermore, a Tobit model will be applied for dependent variables that ranges between zero and 100. The following section will illustrate the different empirical specifications and describe the methods applied together with their limitations. The descriptions of the methods are based on Woolridge (2009), and Angrist and Pischke (2009).

### 5.1 The Approach: Limited Dependent Variable Models

The dependent variables are examples of limited dependent variables (LDV). A LDV is a variable that is restricted in the range of values possible. Specifically, a binary variable takes only the values zero and one, while the share of payments is another example in which the values range between zero and 100 (Woolridge 2009, ch. 17). The linear probability model (LPM) can be applied when dealing with limited dependent variables. However, the model has certain drawbacks: the fitted probabilities can be less than zero or greater than one, and the partial effect of any given explanatory variable is constant. Non-linearity is therefore typically introduced to deal with the shortcomings using more sophisticated binary response models. Such models analyse the response probability of:

*Equation 1*

$$P(y = 1 | x) = P(1 | x_1, x_2, \dots, x_k),$$

where  $x$  is the full set of explanatory variables. Hence, we can estimate the following relationship:

*Equation 2*

$$P(y = 1 | x) = G(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k) = G(\beta_0 + \mathbf{x}\boldsymbol{\beta}),$$

where  $G$  is a nonlinear function taking values strictly between zero and one for all real numbers  $z$ , ensuring that the estimated response probabilities are strictly between zero and one (Woolridge, 2009).

#### 5.1.1 The Probit Model

In the Probit model<sup>23</sup>,  $G$  is the standard normal cumulative distribution function (cdf), expressed as an integral of:

*Equation 3*

$$G(z) = \Phi(z) = \int_{-\infty}^z \phi(v)dv,$$

---

<sup>23</sup> Similar models are available, in which the simplest alternative is the Logit model, applying a logistic distribution. Due to the normality assumption of  $e$  in the Probit model, this model is also the most popular application in econometrics (Woolridge, 2009).

where  $\phi(v)$  is the standard normal density (Woolridge,2009).

The Probit model can be derived from an underlying latent variable model that satisfies the classical linear model assumptions<sup>24</sup> of the following form:

Equation 4

$$y^* = \beta_0 + \mathbf{x}\boldsymbol{\beta} + e, y = 1[y^* > 0]$$

where the second term is called the indicator function, defining a binary outcome. This implies that  $y^*$  is equal to one if  $y^* > 0$  and zero otherwise.  $e$  is assumed to be independent of  $x$  and has a standard normal distribution.

Specifically, the following equation will be estimated using Probit when the dependent variable is a dummy variable indicating whether a firm has used mobile money for any financial transaction, or when paying suppliers:

Equation 5

$$Prob(dMobile\ Money_{ij}) = \beta_0 + \beta_1 dSup_{ij} + \boldsymbol{\beta}\mathbf{X}_{ij} + \varepsilon_{ij}$$

where the dependent variable is a binary response probability for firm  $i$  and country  $j$  adopting mobile money, and  $dSup$  indicates whether a firm has trade credit with its suppliers<sup>25</sup>. The vector  $\mathbf{X}$  contains an array of control variables. Country dummies are included to control for fixed effects<sup>26</sup>.

The effects of the explanatory variables on the response variable are not linear. The marginal effect of a variable depends on the starting value of the variable. Furthermore, the same marginal effect will depend on the values of all other variables in the model specification. The common practice is to evaluate the marginal effect at the means of the covariates<sup>27</sup>.

### 5.1.2 The Tobit Model

The share of payments used with mobile money is truncated between zero and 100. The Tobit model is an appropriate model when the dependent variables takes on nonnegative outcomes that pull up at zero but also take a range of positive values. To estimate the Tobit model, we let  $y$  be a continuous variable ranging over strictly positive values but takes the value zero with positive probability. Again, a linear model could be a good approximation, but would obtain negative fitted values leading to negative predictions. The latent variable model of the Tobit model is defined as:

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<sup>24</sup> The classical linear model assumptions are normal, homoscedastic distribution with a linear conditional mean (Woolridge, 2009).

<sup>25</sup> Alternatively, *Supplierfinance* is the share of investments financed by suppliers or credits received from suppliers.

<sup>26</sup> All estimations are conducted with the full sample, by each country, and by dropping Zambia from the sample, respectively, to see what are the main determinants driving adoption in each country. Alternatively, the model will include interaction terms between the country dummies and firm-level characteristic to look for country-specific effects and variations between countries.

<sup>27</sup> The marginal effects are calculated from the predictions of the model at fixed values of some covariates and averaging over the remaining covariates (see Stata help sheet for more information).

Equation 6

$$y^* = \beta_0 + \mathbf{x}\boldsymbol{\beta} + u, u|x \sim \text{Normal}(0, \sigma^2)$$

Equation 7

$$y = \max(0, y^*)$$

where we again assume that  $y^*$  satisfies the classical linear model assumptions. This equation indicates that  $y$  equals  $y^*$  when  $y^* \geq 0$  and  $y=0$  when  $y^* < 0$ .  $y^*$  is normally distributed such that  $y$  is continuous over strictly positive values<sup>28</sup>. Specifically, the following underlying function will be applied when the dependent variable is the share of mobile money payments to suppliers:

Equation 8

$$\% \text{Mobile Money}_{ij} = \beta_0 + \beta_1 dSup_{ij} + \boldsymbol{\beta} \mathbf{X}_{ij} + \varepsilon_{ij}$$

where again  $dSup$  is the main explanatory variable and  $\mathbf{X}$  is a vector of firm-level characteristics.

When  $y$  follows a Tobit model, the expected outcome of  $y$  given any explanatory variable,  $E(y|x)$ , is a nonlinear function of  $\mathbf{x}$  and  $\boldsymbol{\beta}$ , which makes it difficult to obtain partial effects. As a result, the coefficients produced by these models cannot be interpreted as marginal effects of the explanatory variables on the observed dependent variables. Instead, they are the marginal effect of the underlying observed variables.

### 5.1.3 Limitations of the Empirical Strategy

The cost of applying nonlinear models is the difficulty of interpreting the coefficients. However, using marginal effects, it is possible to get the partial effect of a given variable evaluated at the mean or any other interesting values. Therefore, the nonlinear models are not well suited for estimating causal effects of a single parameter. To do so, linear models are the best option. Since the purpose here is prediction, the standard normal distribution of probabilities is the most appropriate choice (Angrist and Pischke, 2009 p. 105-107). Therefore, one should be aware that the results presented in the following section represents an association between covariates of the likelihood of using mobile money and do not necessarily imply causal inferences.

Since there are only 3.6 percent of the firms in the sample of Zambia that use mobile money there might not be enough variation in the data to infer statistical relationships. The common procedure in the literature is to omit Zambia from the sample. This highlights the continuous problem with data availability and validity when studying developing countries in general, and Sub-Saharan African countries in particular. Therefore, all estimations will be conducted with both the full sample, and by omitting Zambia to control for the lack of variation.

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<sup>28</sup> For further derivations of the Tobit function, see Wooldridge 2009, chapter 17.

## 6 Empirical Analysis

Using formal regression analysis, the following section will explore what kind of firms are more likely to adopt mobile money and their incentives to do so. Specifically, it will look at the relationship between mobile money adoption and SMEs' relationship to suppliers providing trade credit, evaluating the following hypotheses:

Hypothesis 1: Firms with a trade credit relationship with suppliers are more likely to

- a: use mobile money for any financial transaction;
- b: use mobile money to pay suppliers; and
- c: have a larger share of supplies payed with mobile money.

Hypothesis 2: Small firms are more likely to adopt mobile money than larger ones.

Hypothesis 3: Older firms are more likely to adopt mobile money than younger ones.

The second part discusses the relevance and validity of the results in light of previous research. Part three will make a qualitative assessment of mobile money in Zambia. Importantly, cross-country differences can provide an understanding of why SMEs in Zambia differ in mobile money adoption rates and how MNOs and policymakers can improve the diffusion in least-performing countries with lessons from best-performing countries.

### 6.1 Results

Table 6.1 shows the estimated relationships between mobile money adoption and usage on a range of different firm level characteristics. Columns 1-3 show the response outcome of firms using mobile money for (1) any financial transaction, (2) when paying suppliers, and (3) the share of supplies payed with mobile money, respectively. The two first columns apply the Probit model whereas the third is estimated with the Tobit model. The estimates displayed are the marginal effects evaluated at mean values.

Column one is the baseline specification. First, there is a positive association between trade credit and adoption of mobile money. *Ceteris paribus*, the estimations indicate that firms purchasing supplies with trade credit are 6.4 percentage points more likely to use mobile money for any financial transaction. Second, firms in Kenya are more likely to adopt mobile money while firms in Zambia are less likely to so. This is logical since there are more firms in Kenya adopting mobile money than in Zambia. Experiencing access to finance as an obstacle for doing business increases the likelihood of adopting mobile money by 2.6 percentage points. Lastly, large and medium sized firms, and manufacturing firms are less likely to use mobile money, while firms with access to a bank account are more likely to do so. The coefficients are statistically significant at the one-percent level.

Column two applies the same specification for firm's mobile payment linkage with suppliers. Firms with a trade are 12.9 percentage points more likely to adopt mobile money when paying suppliers, than firms without such a relationship. Firms in both Kenya, Uganda and Zambia are more likely to use mobile money for this purpose, but this is only statistically significant for Uganda. Lack of financial access has a larger probability impact on mobile money adoption when paying suppliers, which may imply that firms view suppliers as a valuable option to gain

such access. Larger and younger firms are significantly less likely to adopt mobile money for supply payments, while access to a bank account is no longer a significant determinant.

*Table 6.1 Probit and Tobit Regression Results: Determinants of Mobile Money Adoption*

VARIABLES	(1) dMM (Y:1, N:0)	(2) dMM supplier (Y:1, N:0)	(3) MM supplier (%)
dSup	0.0640** (0.0262)	0.129*** (0.0493)	18.29*** (4.938)
kenya	0.0974*** (0.0271)	0.0438 (0.0459)	8.697** (3.753)
uganda	0.0242 (0.0252)	0.104** (0.0430)	2.598 (3.612)
zambia	-0.405*** (0.0147)	0.0509 (0.106)	-42.87*** (5.826)
finance constraint	0.0264*** (0.00734)	0.0408*** (0.0131)	5.060*** (1.093)
manufacturing	-0.0504** (0.0213)	-0.0114 (0.0373)	-4.070 (3.112)
retail	-0.0196 (0.0259)	-0.0119 (0.0451)	1.442 (3.765)
medium	-0.0748*** (0.0198)	-0.0572 (0.0362)	-8.469*** (3.089)
large	-0.122*** (0.0238)	-0.108** (0.0495)	-14.71*** (4.412)
middle	-0.0134 (0.0234)	0.0191 (0.0414)	0.279 (3.364)
young	-0.0353 (0.0239)	-0.0977** (0.0425)	-9.100** (3.841)
dBank	0.0766*** (0.0241)	0.0773 (0.0478)	8.967** (4.219)
Observations	2,965	1,043	2,978

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Source: World Bank Enterprise Surveys (2013)*

Column 3 shows the regression results for the Tobit model using share of supplies paid with mobile money as the dependent variable. For a firm that has a trade credit relationship, the share of supplies paid with mobile money is 9.2 percent higher than for a firm without such a relationship, holding all other variables constant. This relationship is statistically significant at the 1% level. Thus, firms with supplier credit have a higher predicted share of payments to suppliers via mobile money than firms without. Firms in Kenya is associated with a larger share of supply payments via mobile money while firms in Zambia less. Again, medium and large sized firms and younger firms are associated with a smaller share of supplies paid through mobile money, while constrained access to finance and having a bank account are associated with larger shares of supply payments with mobile money.

Table 6.2 divides the sample by countries to compare cross-country differences of the supplier relationship and firm's probability to adopt mobile money. We can see that there are relatively

large differences is firm-level characteristics across countries<sup>29</sup>. Importantly, the effect of trade credit on mobile money adoption seem to be relevant only for firms in Uganda and Zambia, and not in Kenya and Tanzania.

*Table 6.2 Probit Regression Results by Country*

VARIABLES	Kenya	Tanzania	Uganda	Zambia
Mobile Money (Y:1, N:0)				
dSup	0.0588 (0.0376)	-0.0752 (0.0521)	0.158*** (0.0434)	0.0899*** (0.0335)
Finance constraint	-0.00607 (0.0148)	0.0923*** (0.0162)	0.00477 (0.0157)	-0.00326 (0.00437)
manufacturing	-0.138*** (0.0448)	-0.0711 (0.0445)	0.0169 (0.0453)	-0.00552 (0.0130)
retail	-0.0642 (0.0537)	-0.0365 (0.0569)	0.0140 (0.0542)	-0.0125 (0.0128)
medium	-0.00757 (0.0448)	-0.0885** (0.0421)	-0.107** (0.0418)	-0.0209* (0.0107)
large	-0.0589 (0.0473)	-0.248*** (0.0532)	-0.208*** (0.0613)	-0.0126 (0.0144)
middle	0.0628 (0.0524)	-0.0829* (0.0447)	-0.0288 (0.0508)	0.00162 (0.0149)
young	0.0259 (0.0552)	-0.0674 (0.0516)	-0.0829* (0.0457)	0.0184 (0.0203)
dBank	0.00869 (0.0727)	0.142*** (0.0426)	0.0703 (0.0584)	0.0254*** (0.00940)
Observations	767	767	733	698

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Source: World Bank Enterprises (2013)*

### 6.1.1 Robustness checks

These results are robust to gradually adding more control variables such as urban location, female management and export activity<sup>30</sup>. The robustness analysis is reported in Table A.3-5 in

<sup>29</sup> Splitting the sample reduces the sample size for each estimation significantly. However, sensitivity tests and robustness analysis shows that these results are stable across a range of different specifications.

<sup>30</sup> Whether the firm's establishment is in the main business city is associated with adoption of mobile money for all specifications. Export activity is negatively associated with mobile money, while female management is positive, but neither are statistically significant. The results are robust to other controls such as manager experience, productivity, access to credit lines, investment (positive and significant), foreign ownership (negative and significant), etc. For example, managers with more experience may be more willing to take the risk to adopt mobile money or be more familiar with technological innovations, foreign ownership may imply that access to finance is not that much a constraint, decreasing the necessity of mobile money. However, adding these controls make older firms and bank accounts statistically insignificant, implying there might be other factors such as productivity, experience and foreign ownership accounting for these effects. Applying formal bank finance instead

the Appendix. Furthermore, firms were asked to indicate the share of working capital financed by supplier credit. This variable was applied instead of the binary variable to investigate the intensity of the trade credit relationship on mobile money adoption. Lastly, cross-country differences were explored using interaction terms, providing similar results. The robustness results are found in tables A.5-6 in the Appendix. Overall, the estimates on purchasing supplies on credit are highly stable across several specifications.

## 6.2 Discussion

The previous section showed that there are some statistically significant and robust associations between firm level characteristics and mobile money adoption and usage. The results in this section point to three main implications:

1. Trade credit relationships with suppliers provide positive incentives on the probability of mobile money adoption and usage.
2. Smaller and older firms are more likely to adopt mobile money.
3. Trade credit relationship seems to be of primary importance in only Uganda and Zambia.

Drawing from technology adoption theory, the rest of this section offers some explanations of these results. As we already know, the results also show that firms in Zambia are significantly less likely to adopt mobile money than the other countries. The following part will discuss the potential explanations and implications of why this is the case by conducting an in-depth qualitative assessment of the mobile money market in Zambia drawing on desk research of earlier studies.

### 6.2.1 Firm-Level Determinants of Mobile Money Adoption

First, having linkages with suppliers through trade credit seem to provide a strong incentive on firms' probability to adopt and use mobile money. However, it is important to note that the results obtained here does not necessarily infer a causal mechanism due to the limitations of non-linear models. The results may indicate that trade credit with suppliers increases adoption of mobile money, although it may as well suggest that mobile money usage eases access to trade credit by providing a convenient payment method. It may also imply that mobile money and trade credit are equally facilitating and reinforcing each other. All suggestions provide interesting questions and implications, as these mechanisms rely on mutual trust, reputation and loyalty between SMEs and suppliers.

For example, Jack et al. (forthcoming) argue that mobile money facilitates access to trade credit. Provision of trade credit is limited by "high transaction costs, up-stream liquidity constraints and concerns over repayment". The amounts of credits are often small and frequent such that contract enforcement is difficult. They argue that mobile money provides an accountable and transparent payment system that increases supplier's incentives to provide trade credit. Beck et al. (2015) find a positive relationship between the use of M-PESA in Kenya as payment for suppliers and the use of trade credit by SMEs. To assess the causality, they calibrate a theoretical model and argue that limited access to credit coupled with the risk of theft carrying cash generates a demand to use mobile money when paying suppliers. They argue that this in

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of trade credit is also associated with a positive probability of using mobile money, but at a much lower degree. All robustness specifications are also estimated for each country separately.

turn increases the value of the credit relationship. The same mechanisms can be argued to be working here. Within the TAM framework, supplier linkages can be a type of social norm and pressure that increases the incentives for mobile money adoption. These results are also in line with earlier empirical research suggesting that firms adopt mobile money when customers and/or suppliers require so (Higgins et al., 2012). Islam et al. (2016) find that higher intensity of mobile money use for supply purchases is related with a high likelihood of investment. They argue that this provides support of the importance of the supply chain in influencing adoption of mobile money (IFC, 2014).

Second, the results suggest that small firms are more likely to adopt and use mobile money. Smaller firms are disproportionately more credit constrained and may have higher demand for and willingness to adopt mobile money. Conversely, a plausible explanation for large and medium sized firms not adopting mobile money is the functional characteristics of the services. This include the cap on the money transacted, agents lacking liquidity necessary for the larger transactional amounts, and no possibility for electronic records (Mas and Ng'weno, 2012; Bångens and Södergren, 2011; Gosavi, 2015). These attributes reduce the larger firms' perception of the usefulness of mobile money, rendering the outside option, checks and bank accounts, more attractive. Smaller firms do not always have these options. Lastly, older firms are associated with a larger probability to adopt mobile money. According to Gosavi (2015), older firms have a longer relationship with its suppliers, which seems to be a plausible explanation within this framework.

## 6.2.2 Cross-Country Differences in Mobile Money Adoption

By further exploring cross-country differences, the results indicate that the association between trade credit and mobile money adoption is entirely driven by the positive and significant effects of this relationship in Zambia and Uganda. However, this contrasts with the results put forward by Beck et al. (2015), who found that trade credit relationships are important determinants for the use of M-PESA when paying suppliers in Kenya. This thesis offers three possible explanations. First, it may simply be due to the lack of variation in the Zambian sample. This does not explain the significant and robust association of trade credit and mobile money adoption in Uganda. A possible line of reasoning could be that the relatively small share (in Zambia in particular) of SMEs using mobile money may be more competitive and profitable than others. As the robustness analysis indicate, controlling for attributes such productivity and manger experience does not change the results. Moreover, the data applied here does not differentiate between different MNOs, while Beck et al. (2015) focus on M-PESA users only.

Second, it may be that, at the time of data collection, Uganda and Zambia had less mature mobile money markets and more credit constrained firms than Kenya and Tanzania. Suppliers are often larger companies. As discussed earlier, these are the ones that are generally less likely adopt mobile money due to the constraints on the services provided. For example, there is a transactional cap when using mobile money. Only 11.6% of the firms in Zambia indicated that firm's payments were too large, compared to 47.4% in Kenya, 31% in Tanzania and 28% in Uganda. Furthermore, the main reason for not adopting mobile money in these two countries was lack of requests from suppliers. Therefore, the main explanation of this result offered here is that supplier relationships are important for adoption of mobile money in the initial stages. After the mobile money market has reached a certain level of maturity, this relationship is no longer important. This can be supported by earlier evidence that mobile money is not a substitute for formal banking alternatives, but rather a complement (Comminos et al., 2009).

For many firms and households, mobile money represents a first step to enter the formal financial system.

Third, it may be related to the increased focus and implementation of business development programmes enabling linkages between the value chains and input programmes. The mining industry has had the most exceptional growth performance Zambia. Although small and centralized, it creates spillovers and value added through the creation of linkages in other sectors such as the manufacturing and constructing industries. This also implies that the economy is vulnerable to external shocks and fluctuations in prices of raw materials. After the financial crisis of 2008, more business development plans were put forward to help SMEs diversify away from depending on one major supplier, increase the value chains of production and enhance inter-sectoral linkages between core sectors (GRZ, 2011; 2015). The largest mobile money provider, Zoona, started its business in the rural areas with a business model aiming to connect larger suppliers and credit constrained farmers with mobile money. Increased focus on business development programs may have led to more integrated value chains in Zambia. This is consistent with earlier research suggesting that stronger business linkages can promote mobile money adoption along the value chain (Higgins et al., 2012).

Since the agricultural sector is the largest employer, development programmes are often focused in rural areas. For example, early efforts have been implementation of finance programmes and rapid roll-out of ICT services to support expansion and increased use of financial services with value chain programmes (GRZ, 2011; 2015). The cotton company Dunavant Limited Zambia partnered with Cargill Cotton to offer trade credit for credit constrained farmers through a structural loan package. Together they employed more than 100,000 farmers. According to AgriPro Focus (APF) (2014), more than 99 percent of the farmers participated, Dunavant's annual sales and yields increased, and the target of repayment of loans was 87.5 percent. The system relied on trust and strong mutual incentives as the contracts are not enforceable. In 2009, Dunavant Limited further implemented a program together with Mobile Transactions Zambia Limited (MTZL)<sup>31</sup> in which farmers were paid through mobile money. More than 100,000 farmers in four districts were offered mobile money payments. By further partnering with schools, cooperatives and input dealers, MTZL was able to build a relationship with farmers and quickly expand their services to other parts of their daily life. API (2014) claim that this is an example of a case in which larger companies offering mobile money payments have had a large trickle-down effect along the business value chain. In addition to being paid by Dunavant, farmers could use their mobile phones to access other services such as store money and make retail purchases for agricultural inputs and services of other SMEs. Many of the agents also operated as agricultural retailers accepting mobile money for seeds, fertilizers, chemicals and other farming inputs. Today, Zoona is the largest mobile money provider and has partnered with other large distributors such as the Zambian Breweries. This is unusual as the company did not have an established agent network as the MNOs. Byun (2015) argues that Zoona's business model targeted on large suppliers is crucial for its success and potential for diffusion. This example illustrates how larger firms can create a trickle-down effect of mobile money adoption and usage. The business model put forward is replicable for other firms who see the importance of downward integration on a wide range of commercial intermediary functions. Partnerships between mobile money providers and suppliers to target SMEs would therefore be a plausible strategy to expand diffusion. When financing can be done with low risk is an important enhancement to many traditional and manufacturing roles.

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<sup>31</sup> MTZL is Zoona's former brand.

## 6.3 Comparison between Kenya and Zambia: Why are firms not adopting mobile money in Zambia?

Firms in Zambia are significantly less likely to adopt mobile money for any type of transaction compared to the other countries in the sample. Zambia was the first country to launch digital financial services in Africa<sup>32</sup>, but has since then been struggling to get off the ground. Analysing the early success factors of M-PESA in Kenya, we can follow the analysis of Heyer and Mas (2011) and to compare countries' readiness for mobile money<sup>33</sup>. They point to five determining factors related to access, adoption and usage, that can be used as a "checklist". These are the regulations, the retail infrastructure and mobile money landscape; potential clients' demand for mobile money and their current outside options, and the quality of the services delivered.

### 6.3.1 Access

Physical access and regulations are prerequisites for adoption. According to FINclusion Lab (2015), there are now 3,225 active mobile money agents in Zambia, representing 45 percent of the access points in the country. Presence in rural areas is still limited. For MNOs to be able to operate, financial sector and telecommunication regulation must be enabling. Despite initial fierce competition between the commercial banks and mobile money operators, the Central Bank of Kenya quickly realized the potential in financial inclusion and levelled the playing ground for Safaricom, which has created spillovers to the development of regulatory initiatives in the neighbouring countries. A recent report by FST Zambia (2017) argues that financial inclusion in general has not been a core focus from governmental institutions in Zambia. Limitations in financial sector include lack of experience in strengthening finance and legal framework for the use of collateral substitutes and low understanding of how to design value-chain financing by FSPs. The case of Dunavant Ltd. illustrates the value of strengthening such programs. However, with the revised Sixth National Development Plan (R-SNP, 2015), the government has put increased focus on infrastructure development and the importance of ICT and digitalization of businesses and build networks and set up centres of excellence. The Bank of Zambia has been committed to implement the Financial Education Strategy through the Financial Education Coordination Unit established in 2012 to address the low levels of financial literacy (BOZ, 2014). The Bank has also committed to the Maya Declaration of 2011<sup>34</sup>. So far, Zambia has reached all its committed targets (AFI, 2013).

Furthermore, one can assess the mobile market landscape in terms of competition, interoperability between providers and excludability of agent networks that is put forward by regulation and policies. The mobile money market in Zambia is fractured with no dominant market leader as in the other countries. The market has become increasingly competitive with five rather equal players which can potentially spur innovation and reduce prices. Zoono has 33 percent of the agent network distribution, followed by MNT and Airtel (27 percent each). Strict requirements for excludability in the use of agent networks decreases profitability for the agents and limits customer usage. However, in 2013, Zoono and Airtel partnered to allow Airtel

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<sup>32</sup> Celpay launched mobile money services together with six financial service providers already in 2002, but ceased to function in 2013 (Kahn and Anthony, 2016).

<sup>33</sup> This version is slightly modified focusing mainly on the adoption of mobile money by firms.

<sup>34</sup> The Maya declaration is a network of Central Banks and financial regulatory institutions obliged to create an enabling environment for the financial sector as members of the Alliance for Financial Inclusion (AFI).

customers to use both Zona and Airtel agents (Worley, 2013), and measures towards less excludability are being debated.

### 6.3.2 Demand

To assess the potential for mobile money, it is important to understand the target market in terms of their perception, need and usage of financial services. Initially, Safaricom exploited the emerging urban-rural migration and need to send remittances. The rural nature of the population is an important driving force of mobile money adoption<sup>35</sup>. Zambia consists of 14.2 million people<sup>36</sup> of which 40 percent live in urban areas (CIA World Fact Books, 2016). Rural poverty is widespread and extreme (78 percent compared to 27.5 percent in urban areas), and is difficult to access due to poor infrastructure (APF, 2015). The annual rate of urbanization is at 5 percent, implying that there are large potentials for using mobile money for remittances. In geographic terms, the population is evenly spread with a low population density<sup>37</sup>. This makes the geographic reach of agent network more difficult (Ngavi, 2016).

For expansion into the business sector, one need to know how large the SME sector is and how integrated the supply chain channels are. The SME sector accounts for most of the firms Zambia, and employs 10 percent of formal employment outside the agricultural sector, which comprise more than 50 percent of employment. Trade, wholesale and retail comprise 12.2 percent, while the rest of the sectors employ less than 5 percent of the labour force. The manufacturing base is low but has potentials to absorb entrants from the education sector and is important for facilitating private sector development and competitiveness of SMEs and rural based industries. However, almost half of the population do not have secondary education and 7 percent does not have any formal education, which adversely affects mobile money adoption.<sup>38</sup> The government of Zambia has improved entrepreneurship training and development, technological skills development and tried to enhance linkages in the SME sector but also towards multi-national corporations (MNCs) (GRZ, 2015). Most the firms in the Zambian sample stated that lack of requests from suppliers where the main reason for not adopting mobile money. Therefore, there seems to be great potentials for mobile money adoption along the value chains.

Adoption of a mobile money depends on the coverage and quality of the current alternatives. Therefore, one need to assess the share of people and firms with access to bank accounts, credit lines externally of internal finance, and the cost of using these existing alternatives. The most common way to handle transactions are by carrying cash or issuing checks in a bank, and informal savings groups and member-based organizations have a strong presence in rural areas. Only 13 percent of the population has access to bank accounts (FST-Zambia, 2015). Most firms in this sample do have access to bank accounts (83 percent), but access to credit is far lower (22 percent), and access to finance is generally lower in Zambia compared to the other

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<sup>35</sup> Typically, wealthier, more educated males in urban areas are the early adopters of mobile money sending remittances home, before spreading to other segments of society such as the SME sector (Jack and Suri, 2011; Mbiti and Weil, 2012).

<sup>36</sup> The adult population accounts for 8.1 million

<sup>37</sup> The Lusaka and Copperbelt provinces are the most populated followed by the Southern and Eastern provinces, while Muchinga and North Western are the smallest regions.

<sup>38</sup> There is a direct correlation between education and financial behaviour and literacy (API, 2014).

countries<sup>39</sup>. The main barrier the low geographical reach and physical distance to banks and other financial institutions. However, a report by FST Zambia (2015) found that 20 percent of urban adults with physical accessibility still relied on informal services. Therefore, high costs and affordability are also important barriers for accessing formal services. Lending rates have slowly gone down, but remains high (BOZ, 2014). This is generally high due to large collateral requirements to compensate the high risk, and lack of efforts to create substitutes for collateral (WBES, 2013). Lack of alternatives increases the latent demand of mobile money.

### 6.3.3 Usage and Quality

Actual usage of mobile money depends the quality of the existing services provided. Factors that can be constraining for diffusion relates to services the functioning of the agent network, awareness, knowledge and financial literacy of the customers, and appropriateness of the products. The agents play a crucial part in the mobile money ecosystem, bridging the gap between cash and e-float for customers and are important for increasing customer awareness of the services. Median daily transactions are comparable to Uganda and Tanzania, but slow growth of agents is explained by their low profitability (UNCDF, 2016). This can be explained by low commissions and limited use of mobile money in general. According to Kahn and Anthony (2016), are the barriers for agent's expansion lack of resources to buy e-float from the providers, pressure of competition, and low customer awareness (Kahn and Anthony, 2016). Zambia is different to the other countries in that Zoono, the largest provider of mobile money services<sup>40</sup> is not a mobile network operator but a third-party provider. Zoono was launched in 2008 aimed at supporting entrepreneurs and small scale businesses (McNally, 2014). According to the MIX (2016), initial focus on payments in the corporate businesses instead of transfers may be detrimental in nascent markets. Kahn and Anthony (2016) suggest that insufficient marketing and awareness is one of the reasons for low levels of mobile money adoption.

Other studies indicate that people in urban Zambia are both aware of and would prefer using mobile money, but the usage of mobile money is constrained by the limits of the ecosystem. In a survey by Dzokoto et al. (2016) businesses indicated that lack of trust, transaction records, unreliability and the possibility of fraud limited the adoption of mobile money in daily business (Dzokoto et al., 2016; Lesa et al., 2016). This is consistent with other studies in which that has found businesses not eager to market acceptance of mobile money (Mas and Higgins, 2012) and businesses are unenthusiastic towards, and untrained with regards to mobile money usage (Owusu-Agyeman and Offe, 2014). The agents are important facilitators and can be used to market the awareness and usefulness of the service. This means that the providers should try to restructure the commissions and increase operability with partners.

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<sup>39</sup> Only 7 percent of the firms in Zambia have access to finance from commercial banks compared to 18 percent in Kenya.

<sup>40</sup> As of 2014, Zoono had more than 650 agent-based entrepreneurs and more than 600.000 active users (McNally, 2014).

## 7 Conclusion

### 7.1 Research aims

Before diffusion of mobile money can be possible, an established infrastructure together with enabling regulation must be in place. Mobile phones are the basic platform to which mobile money is accessible. However, there seems to be an asymmetry in penetration rates and mobile money (Mosheni-Cheraghrou, 2013; Asongu, 2015). This is also true for East Africa. Mobile phone penetration rates in Kenya and Zambia are rather similar, 95 percent and 90 percent respectively, but only 3.6 percent of the firms in Zambia have mobile money accounts compared to 49 percent in Kenya. The aim of this thesis has been to gain a better understanding of how SMEs in different countries adapt to mobile money. Specifically, why some countries such as Zambia do not adopt mobile money whereas other relatively similar neighbours do, and what are the crucial factors behind the lack thereof. The research literature tends to focus on success factors for adoption and is concentrated on countries that are relatively successful. Applying formal econometric analysis using a unique cross-country comparable dataset on firm-level characteristics from the World Bank Enterprise Surveys, this paper has complemented the research that tries to understand what types of firms tend to use mobile money and why they do so. This provided the basis for the discussion of why firms in Zambia are less likely to adopt mobile money, a question that has not yet been raised before. Such a two-folded approach analyses firm-level determinants and incentives of mobile money adoption distinguishing between least- and best-performing countries in the East African region. The last part of the thesis will summarize the main results and discuss practical implications and future research.

### 7.2 Summary of Main Results

First, paying suppliers for raw materials and inventory and receiving payments from customers via mobile money is generally the most common type of transactions among SMEs. Earlier evidence suggests that firms that have stronger linkages to suppliers through trade credit will generate incentives to use mobile money for transactional exchange (Beck et al., 2015). *Ceteris paribus*, the estimations show that businesses that purchase supplies on credit are 6.32 percentage points more likely to use mobile money for any financial transaction, and are associated with a 9.2 percent higher share of supplies paid with mobile money.

Second, smaller firms and older firms are more generally more likely to adopt mobile money than larger and younger ones. Small firms are disproportionately affected by lack of finance, and would potentially be in greater need of, and benefit more, from using it. Older firms have typically longer and stronger relationships with customer and suppliers. Lastly, mobile money is not used as a substitute for formal bank accounts, and could provide a gateway into the formal financial system.

Lastly, the results further indicate that the association between trade credit and mobile money adoption is solely driven by firms in Uganda and Zambia. Assuming that the data issue does not significantly affect the results, the thesis proposed two main explanations for this. The paper argued that these significant and positive relationships are more important in less mature mobile markets. Since the global financial crisis in 2008, Zambia has implemented several business development programs where supplier linkages and trade credit has been crucial. This may explain why the trade credit relationship is important determinant of mobile money adoption. As the case of Dunavant, Cargill Cotton, and Zoon illustrates, larger companies and

suppliers can potentially play a crucial part in spreading mobile money adoption along the value chain.

### 7.3 Practical Implications

We now better understand how businesses adapt to mobile money in different countries. The cross-country comparisons outlined here provide value added information to the many case studies that exist in the literature. Specifically analyzing why Zambia is lagging provides a deeper understanding of the phenomena that is still evolving. This thesis has illustrated that more resources could be devoted to least-performing countries based on lessons from the best-performing counterparts (Asongu, 2015). The practical implications stem from weaknesses of the quality of the products provided and the opportunities to exploit established infrastructure and business models.

Latent demand for mobile money seem to present in Zambia. However, weaknesses in the quality of the infrastructure are can potentially hinder diffusion. This is mainly related to 1) slow growth of agents, and 2) lack of customer awareness and inappropriateness of types of payments and transfers.

The agents play a crucial part in the mobile money ecosystem, bridging the gap between cash and e-float for customers and are important for increasing customer awareness of the services. Low profitability reduces agents' incentives to market mobile money. The mobile money providers must therefore solve the problem of its slow growth of agent networks, as these are the core facilitators of the services. Enhancing their marketing strategies and a shared agent model can increase customer registration and increase profitability of agents.

The mobile money market in Zambia is still emerging, but with great potentials. By partnering with mobile money providers, this can generate a trickle-down effect in which SMEs can use mobile money for a large range of purposes. The mobile money providers have since its beginning been focused on the corporate segment of society. This may hamper development in a nascent market, but also offers opportunities to exploit strong linkages between suppliers and SMEs to promote mobile money along the value chain. This requires that MNOs and third-party providers such as Zoona develop their network and improve the quality of the services provided. This has the potential to create large trickle-down effects.

### 7.4 Limitations and Future Research

Reliable data and limitations in data coverage are constraining issues when doing research on developing countries, especially for countries in Sub-Saharan Africa. Efforts are made in gathering reliable data that can be used not just for cross-sections but also comparisons across countries and time. With the WBES, it has been possible to investigate the differences in early mobile money adoption rates among firms in East Africa. However, the mobile money market is in rapid change, and much have happened since the data collection in 2013. New rounds of surveys are expected to be done in the coming years, which will shed light on the development of mobile money and other innovative applications that has started to evolve. Adding a geospatial dimension to the research can add valuable information with the application geographical information systems to further get a better understanding of determining factors for adoption. Point data on the geographic locations of the distribution of mobile money agents is gradually becoming available. This would be a task for future research.

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## Appendix

**Table A.1 List of Variables**

Variable	Description
Mobile Money adoption	Response to the questions: "Does this establishment use mobile money for any of its financial transactions?" (1 if yes, 0 if not adopted or no payment)
Reasons for adoption of mobile money	Response to the question: "Why use MM for financial transactions?"
Reasons against adoption of mobile money	Response to the question: "Why not use MM for financial transactions?"
Use Mobile money for employees	Response to the question: Did this establishment use mobile money to pay employees?" (1 if yes, 0 if not adopted or no payment)
Use Mobile Money for Suppliers	Response to the questions: Did this establishment use mobile money to pay suppliers?" (1 if yes, 0 if not adopted or no payment)
Use Mobile Money for Utility Bills	Response to the questions: Did this establishment use mobile money to pay utility bills?" (1 if yes, 0 if not adopted or no payment)
Use Mobile Money for Customers	Response to the questions: Did this establishment use mobile money to receive payment from customers?" (1 if yes, 0 if not adopted or no payment)
% of raw material cost paid using MM	Response to the question: "What Percentage of the annual cost of raw materials/intermediate goods paid using Mobile Money?" (0 if not adopted or no payment)
Female Owner and Manager	Response to the question: "Is the top manager female?" and "Are any of the owners female?" Dummy equal to "1" if any yes, "0" otherwise
Firm size	Small firms: Dummy is equal to "1" if firm is >20 workers, "0" otherwise. Medium firms: Dummy is equal to "1" if firm is between 20-99 workers, "0" otherwise. Large firms: Dummy is equal to "1" if firm is < 99 workers, "0" otherwise. Large firm the omitted category
Sector of the firm	Manufacturing firms: Dummy is equal to "1" for manufacturing firms, retail firms: Dummy is equal to "1" for retail firms; Other sector firms: Dummy is equal to "1" for services firms. Service sector the omitted category
Firm age	Young Firms: Dummy is equal to "1" if firm is aged five to 10 years, "0" otherwise. Middle firms: Dummy is equal to "1" if firm is aged 10 to 99 years, "0" otherwise. Old firms: Dummy is equal to "1" if firm is aged more than 99 years, "0" otherwise. Old firms the omitted category.
Bank account	Establishment has checking or savings account at this time. Dummy is equal to "1" if yes, "0" otherwise
Country dummies	Kenya, Tanzania, Uganda, Zambia. Tanzania the omitted category.
Centre	Dummy equal to "1" if yes to the question "this city the main business city? Or "if this city is the capital city?", "0" otherwise
Investment (% annual sales)	The Share of Total Annual Expenditure For Purchases Of Equipment, Land and Buildings to Annual Sales.
Top Manager experience (years)	Answer to the question: "How Many Years Of Experience Working In This Sector Does The Top Manager Have?"
Establishment uses cell phones for operations	Cell phones used in operations of the establishment. Dummy is equal to "1" if yes
Foreign ownership	Dummy is equal to "1" if yes
Firms use email to interact with clients/customers	"Do You Currently Communicate With Clients And Suppliers By E-Mail?" Dummy is equal to "1" if yes
Bank financing for working capital (%)	% Of Working Capital Borrowed From Banks
Supplier Credit financing for working capital (%)	% Of Working Capital Purchased On Credit/Advances From Suppliers /Customers
Export Activity	Takes the value "1" if a firm export more than 10% of its sales, and "0" otherwise.
Trade Credit	Takes the value "1" if a firm has a trade credit and "0" otherwise.

**Table A.2 Summary Statistics of the Main Variables**

Variable	Obs	Mean	Std. Dev.	Min	Max
dMM	3056	.3465314	.4759428	0	1
dMM employees	1056	.1685606	.3745407	0	1
dMM suppliers	1054	.4250474	.4945849	0	1
dMM bills	1051	.3729781	.4838266	0	1
dMM customers	1054	.6413662	.4798271	0	1
MM suppliers (%)	3056	20.76152	20.4088	0	100
small	3076	.5796489	.4936955	0	1
medium	3076	.2886866	.4532256	0	1
large	3076	.1316645	.3381806	0	1
experience	2940	14.84626	9.562788	1	61
dFemale	3076	.3761378	.484494	0	1
manufacturing	3076	.5217815	.4996066	0	1
retail	3076	.1869311	.3899196	0	1
service	3076	.2912874	.4544295	0	1
center	3076	.4856957	.4998766	0	1
dBank	3076	.8592328	.3478378	0	1
phone	3072	.8782552	.3270441	0	1
bankfinance	2675	10.44224	21.80149	0	100
supplierfinance	2679	9.107876	19.84535	0	100
dInvest	3018	.4221339	.4939815	0	1
ownerforeign	3001	11.67711	30.06435	0	100
largerfirm	3076	.1570221	.3638808	0	1
productivity	2265	.0001111	.0008722	1.67e-09	.033
dSup	3076	.8709363	.335325	0	1
dExport	3076	.1703511	.3760021	0	1

**Table A.3 Robustness Analysis. Additional controls: export and city**

VARIABLES	(1) dMM (Y:1, N:0)	(2) dMMsup (Y:1, N:0)	(3) MMsup (%)
dSup	0.0751*** (0.0258)	0.123** (0.0496)	19.02*** (4.985)
kenya	0.110*** (0.0275)	0.0477 (0.0463)	9.423** (3.792)
uganda	0.0217 (0.0253)	0.105** (0.0431)	2.557 (3.621)
zambia	-0.409*** (0.0145)	0.0668 (0.108)	-43.13*** (5.835)
ob_finance	0.0278*** (0.00739)	0.0409*** (0.0131)	5.101*** (1.096)
manufacturing	-0.0401* (0.0215)	-0.0135 (0.0376)	-3.291 (3.146)
retail	-0.0201 (0.0260)	-0.0158 (0.0451)	1.415 (3.776)
medium	-0.0724*** (0.0201)	-0.0529 (0.0365)	-8.271*** (3.109)
large	-0.122*** (0.0243)	-0.0905* (0.0512)	-14.36*** (4.511)
middle	-0.0146 (0.0235)	0.0233 (0.0416)	0.173 (3.368)
young	-0.0447* (0.0238)	-0.0977** (0.0426)	-9.654** (3.865)
dBank	0.0660*** (0.0246)	0.0875* (0.0478)	8.585** (4.250)
dExport	-0.0541** (0.0243)	-0.0494 (0.0437)	-4.432 (3.721)
city	0.0957*** (0.0181)	-0.0471 (0.0318)	3.952 (2.651)
Observations	2,965	1,043	2,978

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Table A.4 Robustness Analysis. Additional controls: export, city, female management**

VARIABLES	(1) dMM (Y:1, N:0)	(2) dMMsup (Y:1, N:0)	(3) MMsup (%)
dSup	0.0751*** (0.0258)	0.121** (0.0500)	18.81*** (4.956)
kenya	0.109*** (0.0277)	0.0276 (0.0471)	7.461* (3.813)
uganda	0.0213 (0.0254)	0.0935** (0.0432)	1.412 (3.625)
zambia	-0.409*** (0.0146)	0.0460 (0.108)	-44.83*** (5.875)
ob_finance	0.0278*** (0.00738)	0.0409*** (0.0131)	5.014*** (1.092)
manufacturing	-0.0399* (0.0215)	-0.0110 (0.0376)	-2.864 (3.139)
retail	-0.0203 (0.0260)	-0.0184 (0.0451)	0.971 (3.768)
medium	-0.0724*** (0.0201)	-0.0598 (0.0365)	-8.544*** (3.106)
large	-0.122*** (0.0243)	-0.0820 (0.0517)	-13.84*** (4.488)
middle	-0.0146 (0.0235)	0.0241 (0.0417)	0.130 (3.361)
young	-0.0446* (0.0238)	-0.0936** (0.0428)	-9.336** (3.851)
dBank	0.0660*** (0.0246)	0.0839* (0.0482)	8.187* (4.226)
dExport	-0.0545** (0.0243)	-0.0568 (0.0435)	-5.270 (3.725)
city	0.0955*** (0.0181)	-0.0484 (0.0318)	3.739 (2.645)
dFemale	0.00480 (0.0188)	0.0879*** (0.0329)	9.028*** (2.696)
Observations	2,965	1,043	2,978

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Table A.4 Robustness Analysis. Additional controls: export, city, female management, manager experience**

VARIABLES	(1) dMM (Y:1, N:0)	(2) dMMsup (Y:1, N:0)	(3) MMsup (%)
dSup	0.0754*** (0.0271)	0.115** (0.0524)	18.09*** (5.047)
kenya	0.0896*** (0.0286)	0.0187 (0.0484)	6.068 (3.859)
uganda	0.00930 (0.0259)	0.108** (0.0442)	1.916 (3.628)
zambia	-0.420*** (0.0148)	0.0232 (0.108)	-46.17*** (5.990)
ob_finance	0.0297*** (0.00760)	0.0417*** (0.0134)	5.038*** (1.095)
manufacturing	-0.0426* (0.0223)	-0.0298 (0.0388)	-4.214 (3.153)
retail	-0.0165 (0.0269)	-0.0287 (0.0459)	-0.526 (3.788)
medium	-0.0757*** (0.0205)	-0.0594 (0.0373)	-8.323*** (3.104)
large	-0.113*** (0.0255)	-0.0741 (0.0522)	-12.84*** (4.474)
middle	-0.00832 (0.0250)	0.0322 (0.0441)	0.554 (3.496)
young	-0.0310 (0.0269)	-0.0710 (0.0489)	-7.362* (4.145)
dBank	0.0743*** (0.0253)	0.0956* (0.0499)	8.418** (4.280)
dExport	-0.0611** (0.0244)	-0.0575 (0.0441)	-6.211* (3.714)
city	0.0991*** (0.0186)	-0.0419 (0.0324)	4.151 (2.643)
dFemale	0.000874 (0.0192)	0.0849** (0.0336)	8.666*** (2.693)
experience	0.00157 (0.00110)	0.00213 (0.00192)	0.217 (0.151)
Observations	2,850	1,011	2,861

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table A.5. Baseline estimations with interaction terms**

VARIABLES	(1) dMM	(2) dMMsup	(3) MMsup
dSup	-0.0695 (0.0427)	-0.0632 (0.0867)	-8.674 (7.304)
kenya	0.0890*** (0.0299)	0.0928* (0.0503)	12.30*** (4.100)
uganda	-0.00113 (0.0259)	0.0826* (0.0469)	-3.235 (3.974)
zambia	-0.421*** (0.0149)	0.0389 (0.136)	-45.49*** (6.752)
ob_finance	0.0247*** (0.00733)	0.0379*** (0.0131)	4.717*** (1.083)
manufacturing	-0.0468** (0.0214)	-0.00330 (0.0371)	-3.448 (3.096)
retail	-0.0233 (0.0256)	-0.00976 (0.0453)	1.204 (3.728)
medium	-0.0754*** (0.0197)	-0.0579 (0.0364)	-8.344*** (3.062)
large	-0.125*** (0.0232)	-0.117** (0.0491)	-15.58*** (4.362)
middle	-0.0149 (0.0232)	0.0158 (0.0415)	0.0263 (3.327)
young	-0.0335 (0.0240)	-0.103** (0.0425)	-9.043** (3.810)
dBank	0.0794*** (0.0240)	0.0722 (0.0481)	8.640** (4.172)
sup_ken	0.116* (0.0618)	0.00548 (0.103)	7.209 (8.542)
sup_ug	0.226*** (0.0679)	0.202* (0.105)	36.15*** (8.886)
sup_zam	0.353*** (0.0915)	0.166 (0.221)	35.30*** (12.67)
Observations	2,965	1,043	2,978

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1