MOBILE MONEY, FINANCIAL INCLUSION AND DEVELOPMENT: A REVIEW WITH REFERENCE TO AFRICAN EXPERIENCE

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Abstract. Survey literature on mobile money and its contribution in promoting financial inclusion and development, with a focus on sub-Saharan Africa. We use taxonomic, descriptive and analytical methods to evaluate the state of knowledge in the area. We analyse how mobile technology in general may contribute to economic development and financial inclusion in theory and practise. We explain the mechanics of mobile money using Kenya’s M-Pesa as a canonical example; and consider whether the literature has fully established the potential economic impact of mobile money especially its contribution to financial inclusion. We also consider market structure, pricing and regulatory implications of mobile money. We conclude by highlighting issues that require further investigation: the take-up of mobile money; mobile money and financial inclusion; substitutability between mobile money and conventional finance; and regulatory structures for institutions providing mobile money services.

Keywords. Development; Financial inclusion; Mobile money

JEL classification: G21; O16; O47

1. Introduction

Mobile phones have been credited *inter alia* with helping to control diabetes (Liang *et al*., 2011) and assisting smokers to quit (Whittaker *et al*., 2012). It does not seem a large step to argue that they could help increase financial inclusion, especially considering their importance in the dissemination of information and provision of financial services, particularly the innovations associated with mobile money services.

In this paper, we survey the literature on mobile technology and its potential for reducing financial exclusion. There is a considerable literature on these topics although much published work is concerned with the management of mobile technology (e.g. Davidson and McCarty, 2012), rather than with formal empirical investigation of its implications, costs and benefits. Our aim is to evaluate the state of research knowledge in the area and highlight issues where further research is required. We use taxonomic, descriptive and analytical methodologies to undertake the survey. We focus on two aspects of a large subject. First is *mobile money (m-money)*; it has been argued that m-money can contribute to the economy through its impact on financial and food security, employment, and on financial, human and social capital accumulation. See, for example, Yang and Choi (2007); Andrianaivo and Kpodar (2012); Aker and Wilson (2013); Beck *et al*. (2015); Carlson *et al*. (2015); and Ky *et al*. (2018). However, mobile

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technology may improve financial inclusion in more ways than in the provision of m-money, especially through enhancements to business communication and management information (Aker and Mbiti, 2010). We, therefore, also review some of the broader possibilities for mobile technology. Second, we concentrate particularly on Africa. Africa is the continent where financial exclusion is a particularly serious issue. In 2017, only 38% of adult males and 27% of adult females in sub-Saharan Africa had accounts at a formal financial institution (Demirguc-Kunt et al., 2018).

Beck et al. (2007) define financial inclusion as a state in which everyone can access a range of quality financial services at affordable prices in a convenient manner. Growing appreciation of the importance of financial inclusion for economic development has moved the subject up the development agenda in recent years (Soursourian and Lahaye, 2015). The definition of economic development can itself be debated, but there is a consensus that it is multi-dimensional in nature, including but not confined to steady improvements in living standards and the overall quality of life (Lewis, 1988; Sen, 1988). Financial development, on the other hand, relates to the existence of a well-functioning financial system, which has been generally accepted to be essential for economic development (Levine, 2005). The financial system performs functions, such as provision of information on investments and borrowings, monitoring of investments after funds are provided; it enables trading, diversification and management of risks; fosters the mobilization and pooling of savings, and facilitates the exchange of goods and services. Financial systems deliver these functions in different ways, so financial development refers to improvements in the provision of these functions, which help improve resource allocation and welfare (Levine, 2005).

McKinnon (1973) and Shaw (1973) argued that direct controls on financial markets were a major obstruction to development; and this idea increasingly metamorphosed into the view that financial development per se is a key causal factor in economic development (Levine, 1997; Beck et al., 2000; Levine et al., 2000; Beck et al., 2009). Early questions were raised about these conclusions on causal and methodological grounds: does finance cause development or vice-versa? (Demetriades and Hussein, 1996; Lee et al., 1997). Recent research has cast doubt more generally on the thesis that finance causes development. First, GDP per capita is an inadequate indicator of economic and human development and poverty reduction. Recently, human development indices (HDI) and inequality-adjusted indices (UNDP, 2016) have been used as more comprehensive national welfare measures. Beck et al. (2007) argue that a deeper financial system would help reduce income inequality and poverty. However, Claessens and Perotti (2007) find that inequality often increases as a country progresses from the early stages of financial development and only declines subsequently at more advanced stages. Second, the links between liberalization, finance and growth remain in dispute (Beck et al., 2009; Andersen et al., 2012), especially in Africa (Demetriades and James, 2011). There is also evidence that ‘excessive’ financial sector growth can draw resources away from the real side of the economy (Arcand et al., 2015; Sahay et al., 2015) and the positive relation between finance and growth disappears at low and high levels of financial development (Cecchetti and Kharroubi, 2012; Arcand et al., 2015). Third, financial development needs to be interpreted more broadly than increasing the size of the formal financial sector by incorporating quality and access to services.

These arguments lead to ‘financial inclusion’, a concept that, like development, admits of several interpretations, given the definition proposed by Beck et al. (2007). Sahay et al. (2015) and Dabla-Norris et al. (2015) argue that financial inclusion should consist of a combination of market depth (size and liquidity), efficiency (sustainable low-cost financial services) and access (ability of individuals to access financial services). According to Sarma (2012) on the other hand, inclusion is made up of three distinct but related factors: penetration (by financial firms), availability (of financial services) and usage (by customers). A further four-way taxonomy suggested by Hannig and Jansen (2010) consists of: usage, quality, impact of and access to financial services.

Recent research suggests that mobile phones can play a vital role in promoting financial inclusion (Demirguc-Kunt et al., 2018). They can be used to transmit market and other information (Jensen, 2007), particularly in geographically dispersed societies, such as in Africa where bank branch penetration is low.
(Allen et al., 2014); and they enable the establishment of m-money services. M-money involves the use of mobile phone networks to make financial transactions using customers’ funds maintained by mobile network operators (MNOs). M-money is not the same as mobile banking, where customers access their bank accounts through their phones. The distinctive feature of m-money is that customers transact only through MNOs and are not required to have an account with a financial institution (Aker and Mbiti, 2010). It has been argued that m-money can contribute to the economy especially through its impact on financial inclusion. M-money can increase the speed and reduce the cost of payments. It can enhance security by reducing the transport of cash; increase transparency through digital accounting and therefore reduce corruption; and it can provide an entry point into the formal financial system, and so help promote increased saving and self-insurance against small adverse shocks (Demirgüç-Kunt et al., 2018).

According to Sachs (2008): ‘Mobile phones and wireless internet end isolation and will therefore prove to be the most transformative technology of economic development of our time’. Few would dispute that mobile technologies have had transformative effects, especially in developing countries where now, more households own a mobile phone than have access to electricity or improved sanitation (World Bank, 2016a). However, sweeping claims were made for personal computers in the 1980s, and yet, as Solow (1987, p. 36) memorably remarked, these personal computers were to be seen ‘… everywhere except in the productivity statistics’. Just as for the personal computer and the internet (Acemoglu et al., 2014), the exact contributions of mobile communications and m-money to financial inclusion and development need to be empirically established.

The World Bank’s report on the Global Findex Database (Demirgüç-Kunt et al., 2018) documents worldwide progress on financial inclusion promoted by digital financial services, in general and m-money, in particular. The latter’s contribution is more pronounced in sub-Saharan Africa where the share of m-money accounts has more than doubled between 2011 and 2017 (Demirgüç-Kunt et al., 2018, pp. 20–22). This makes it all the more important to evaluate research on m-money in the African context.

There is already a substantial literature on the implications of mobile technology and m-money for financial inclusion and development; and, as we explain, there is agreement on some issues but disagreement on others, and many gaps in knowledge that new research is needed to fill. Table A1 summarizes the major empirical research papers that we consider. A first glance at this table reveals the extraordinary variety of research in this area, encompassing worldwide cross-country studies, using both macro and micro data, small and large-scale interview studies and randomized control trials (RCTs) in specific villages or regions. We organize our survey as follows. In Section 2, we set out the broad relationships among financial inclusion, growth and development and consider determinants of financial inclusion and exclusion (Table A1: 1.1 and 1.2). Section 3 provides an overview of mobile technology in general and its impact on financial inclusion and on the economy, especially for Africa (Table A1: 2.1 and 2.2). In Section 4, we briefly describe the nature of m-money, concentrating on Kenya’s M-Pesa for illustration, as it was the first scheme to be established successfully. In Section 5, we review the theory and evidence on m-money schemes and their effects, particularly on financial inclusion (Table A1: 3.1 and 3.2). In Section 6, we consider some of the industrial economics of m-money, particularly market structure, pricing, interoperability and regulation. The studies in this section are more analytical than empirical, but they seek to provide empirically relevant conclusions. Section 7 summarizes how we view the outstanding research agenda and challenges.

2. Financial Inclusion and Exclusion and their Determinants

There is considerable evidence that increased financial inclusion has positive effects on key welfare outcomes among poorer households and businesses. These include studies of: household poverty (Abor et al., 2018), savings (Ashraf et al., 2006), consumption (Pina, 2015), micro-entrepreneurs (Attanasio
et al., 2011; Dupas and Robinson, 2013), foreign remittances (Yang and Choi, 2007), female empowerment (Swamy, 2014) and risk mitigation (Karlan et al., 2014). A key issue for poor households is their ability to insure against or withstand adverse economic shocks; and a wide variety of coping strategies have been identified for this purpose. According to Heltberg et al. (2013), positive (‘good’) strategies include: the use of savings or credit, sales of consumer assets, such as appliances, informal risk-sharing through family or social networks and migration to seek work. Adverse (‘bad’) strategies include sales of productive assets, such as cattle, or cuts in consumption, especially on food, healthcare or education. In a 16-country study, Heltberg et al. (2013) conclude that households that enjoy greater financial inclusion are better able to use good strategies instead of bad ones. Carlson et al. (2015) report that financially included households in Nigeria experience an average 15% smaller decline in consumption in the face of adverse shocks than do those that are excluded.

Sarma (2012) proposed a single index of financial inclusion in terms of access to formal financial accounts and composed of supply and demand factors: penetration, availability and usage. Sahay et al. (2015) suggested a more supply-oriented approach based on depth, efficiency and access. Using an index constructed following Sarma, Sakyi-Narko (2018) finds that financial inclusion is as important as per capita growth rates in explaining cross-country variations in HDI in a panel of African countries. Donou-Adonsou and Sylvester (2016) find that greater access to bank accounts tends to promote poverty reduction, whereas greater access to microfinance does not. This could be due to differences in the structure of the institutions and the type of services accessed by account holders. Akhter and Daly (2009) argue that financial access can benefit the poor, but inadequate regulation may vitiate these benefits. In a worldwide study, Honohan (2008) argues that greater household access to formal finance is associated with less absolute poverty; however, access is only statistically significant if income per capita is excluded from the model.

Worldwide cross-country regressions suggest that growth in per capita income, low inflation, openness to trade and better institutional quality (such as rule of law and absence of corruption) all tend to promote financial development (LaPorta et al., 1997; Chinn and Ito, 2006; Huang, 2010). Financial inclusion in Sub-Saharan Africa is generally agreed to be less than elsewhere (Demirgüç-Kunt and Klapper, 2012; Allen et al., 2014) suggesting that Africa is lagging in the development of the key causal factors (Andrianaivo and Yartey, 2009). Exceptionally, population density is more closely linked to bank branch penetration in Africa than in other developing economies, and both are more strongly linked to firm-level access to external finance in Africa than elsewhere (Allen et al., 2012, 2014). Branch penetration in Africa remains low outside major cities especially in low-income or sparsely populated areas (Beck and Cull, 2013). However, a dispersed population is not unique to Africa, as population densities in US states are generally lower than in African countries (Figure 1). Moreover, poor communities in industrial countries also suffer from a lack of access to finance (Caskey, 1994).

This suggests that there is a need to look in more detail at barriers to access that confront households and businesses in different countries. On the supply side, Beck et al. (2007, 2008) find that barriers, such as minimum account balances, account fees, and documentation requirements, are associated with lower levels of banking outreach worldwide. However, measures of financial depth, such as creditor rights, contract enforcement mechanisms and credit information systems, are weakly related to these barriers. Barriers are found to be higher where there are restrictions on bank activities and entry, less disclosure and inadequate physical infrastructure, as well as where banks are predominantly government-owned (Beck et al., 2008). In a demand-side study of the determinants of household access to the financial system in 123 countries, Allen et al. (2016) report that richer, older, urban, educated, employed and married individuals are more likely to have a bank account and more likely to use it regularly. The most common reason for not having an account is that the individual does not have enough money to justify its use. Other perceived barriers to access include costs of opening and running an account, distance to a banking outlet, absence of documentation and lack of trust in banks. Barriers are lower where there is more foreign bank participation, a greater degree of government ownership and a prevalence of larger banks.
Figure 1. Population Density: Africa 2015 and US States 2010. [Colour figure can be viewed at wileyonlinelibrary.com]

Sources: UN World Population Prospects: https://esa.un.org/unpd/wpp/Download/Standard/Population/
US Bureau of the Census: https://www.census.gov/2010census/data/apportionment-dens-text.php
Notes: Excludes Mayotte (Africa) and the District of Columbia (USA).

Financial exclusion can be voluntary or involuntary. Voluntary exclusion occurs when individuals report that they have no need of the financial system, for example because another family member has an account. Involuntary exclusion arises when households are unable to use the financial system because of external barriers, such as cost or documentation (Beck et al., 2007; Allen et al., 2016). Other barriers include low income and levels of education that Nanziri (2015) identified as a key cause of financial exclusion in South Africa. Zins and Weill (2016) found that women and young people were among the groups that are financially excluded in Africa in general. Such external barriers may yield to policy intervention aimed at their removal. Thus, Allen et al. (2016) conclude that to encourage households to engage with the financial system, policy should provide an enabling environment, such as lower-cost products, proximity of financial services and use of financial institutions for government payments to individuals as a way of inculcating a banking habit.

Studies of individual countries reach different conclusions on these issues. Hannig and Jansen (2010) cite evidence from Peru of a supply-side constraint: the cost of establishing a single bank branch is equivalent to setting up 40 agents at distinct geographical locations. An Indonesian survey found that only 25% of creditworthy households had in fact sought credit, suggesting a demand side constraint (Johnston and Morduch, 2008). A study of Ghana by Akudugu (2013) finds that low income, lack of trust in banks and lack of documentation are all important in helping to explain why individuals do not have bank accounts. Documentation is a difficult issue partly because of international anti-money-laundering (AML) initiatives. The Financial Action Task Force (FATF) argues that formal finance increases transparency.
and reduces money laundering (FATF, 2011). However, poorer households may be unable to obtain documentation that satisfies AML regulations (Hannig and Jansen, 2010).

Arun and Kamath (2015) suggest that financial inclusion should involve a progression from informal to formal finance as consumer experience increases. Even so, they observe that households often retain informal accounts as they progress, implying that informal and formal finance may be complements rather than substitutes. Evidence for this hypothesis is provided in several studies. de Koker and Jentzsch (2012) find a strong positive relationship between the ownership of a formal bank account and the use of informal finance. Zins and Weill (2016) find that the probability of an individual having a formal savings account is determined by the same factors as that of having an informal account, suggesting that they are complements. Kostov et al. (2015) find that South Africa’s experiment with Mzansi (low-cost, ‘pre-entry’) bank accounts did not generate one-way traffic towards formal accounts; and there was a significant increase in dormant accounts following the initial take-up. Financial inclusion in China has been achieved largely through the informal sector (Fungáčová and Weill, 2015). Overall, therefore, the evidence suggests the need for policies to ensure that the provision of finance is balanced between formal and informal institutions.

3. Mobile Technology and Development

3.1 Mobile Technology in Africa: Basic Facts and Potential Benefits

The foremost reason that mobile technology has been touted as a new hope for economic development, especially in Africa, is seen in the evolution of fixed line and mobile penetration in the last 15 years (Figures 2 and 3). Worldwide, fixed line penetration has declined gradually. Meanwhile, mobile penetration
outside sub-Saharan Africa increased more than five-fold, but the ‘miracle’ occurred in sub-Saharan Africa where mobile penetration rose by 3200% from an admittedly low base. Africa has leapfrogged over its low infrastructure in fixed line direct to mobile (Aron, 2018). Most sub-Saharan African countries have recorded rapid growth in mobile subscriptions, although there are variations (Figure 4). The World Bank (2016a) stated that people in developing countries now value mobile phone use more than access to traditional basic necessities, such as electricity or even clean water.

The spread of mobile telephony is subject to network externalities (Katz and Shapiro, 1985). The wider is network coverage, and the more customers use it, the more effective it is: each user gains as other users join the network. Signal coverage in sub-Saharan Africa has increased substantially (Donovan, 2012), although service is still concentrated in urban areas (Buys et al., 2009). However, mobile statistics must be treated with caution. **Coverage** data show the proportion of the population able to access a signal; this differs from **penetration** data that represent mobile subscriptions. James and Versteeg (2007) report that in Tanzania, network coverage included over 95% of the population in 2005; but less than 5% of the population had a mobile subscription. African data are further complicated by the almost universal use of pay-as-you-go and the widespread sharing of phones and SIM cards. Therefore, penetration data may overstate or understate the true extent of usage (Donner, 2008; Aker and Mbiti, 2010). Moreover, usage can be limited in ways not captured by penetration statistics. Much of Africa lacks reliable electricity especially in rural areas. This limits the charging opportunities, which in turn affects actual usage (Donner, 2008).

Aker and Mbiti (2010) suggest five reasons why mobile phones have the potential to unlock substantial benefits for Africa. First, phones improve access to information, especially about geographically dispersed markets, which can reduce price dispersion and waste of unsold agricultural produce (Jensen, 2007; Aker, 2010). The use of phones reduces search costs and may increase the average price received by farmers (Nzie et al., 2018). Second, phones can improve firms’ communications with suppliers and customers enabling better management of supply chains and deliveries (Overa, 2008; Frempong, 2009). They enable...
Figure 4. Mobile Phone Subscriptions per 100 inhabitants. [Colour figure can be viewed at wileyonlinelibrary.com]

Source: Computed from data obtained from the World Development Indicators Database.

easier access to extension services and may have a more general impact in helping to promote the use of more modern technologies by small-scale producers (Issahaku et al., 2018). Third, mobile phones create jobs within the MNOs, and in the provision of ancillary services. New businesses have been created, such as the Village Phone pioneered by Grameen Bank in Bangladesh (Aminuzzaman et al., 2003). In Africa, the cheapest mobile handset can cost more than half the average monthly income (Aker and Mbiti, 2010); and small businesses have been set up to acquire and rent out phones and SIM cards for occasional users (Donner, 2008). Fourth, mobile phones are used within social and family networks, including requests for support for an unexpected personal or financial shock. M-money is used to send credits that are received instantaneously over long distances (Jack and Suri, 2014). Economists have recently paid greater attention to the importance of social networks (Jackson et al., 2017), but little is known about the impact of mobile phones on such networks. In principle though, mobile phones can increase social and economic inclusion, and improve economic efficiency (World Bank, 2016a; Okello et al., 2018). Fifth, mobile phones can be used to provide financial services, such as m-money. Mobiles have also been used in a wide range of activities, including the clinical trials cited in the introduction. In Kenya, Malawi and South Africa, mobile phone reminders have been used in HIV retro-viral therapy (Aker and Mbiti, 2010).

The benefits of mobile phones can be summed up as follows: they facilitate search and the transmission of information, so that households can make better-informed decisions and obtain improved access to financial services, promoting savings and consumption smoothing. Businesses benefit from increased trade and production, and enhanced competition. Government benefits from higher tax receipts due to greater economic activity. The positive impact of mobile penetration on risk-sharing, consumption-smoothing and social inclusion can particularly benefit poor households, especially among women, providing some independence, and helping to address the gender gap in poverty-incidence (GSMA, 2013). M-money gives low income households access to affordable savings opportunities and makes it possible for them to manage the cost of larger expenses, such as the death or illness of a family member. Poorer people may benefit disproportionately from better information-sharing, such as about prices (Jensen, 2007; Aker, 2010). Insofar as mobile penetration particularly provides benefits for more vulnerable citizens, it may also help address inequality (Asongu and Nwachukwu, 2016).
3.2 Cross-Country Studies on the Impact of Mobile

Given the network externalities associated with mobile phones, we might expect that the widespread use of phones in a country should promote improved economic performance. The overarching use of mobiles is in the transmission of information by voice or text. However, information about prices in geographically dispersed markets is no use without the means to ship products between these markets (Aker and Mbiti, 2010). Africa is lagging in infrastructure investment, especially transport and utilities; indeed, the majority of mobile phone masts in Africa are powered by diesel generators because mains electricity is unreliable (Aker and Mbiti, 2010). Arguably, therefore, an important reason why m-money has mushroomed so spectacularly in Africa is that the product is intangible: unlike agriculture or manufactured goods, finance can be moved across space and time, without requiring new infrastructure, such as a costly bank branch network.

Donner (2008) cautions that mobiles are used for pleasure as well as for business. Coverage, penetration and usage statistics give no idea of the actual balance of usage. The bridging of distances that mobile phones make possible can have two distinct effects. On the positive side, it can reinforce family, social and business networks by maintaining or increasing contacts within networks. On the negative side, phone calls and texts may appear to obviate the need for direct personal contacts; and this can corrode networks that rely on such contacts. Putnam (2000) has documented the long-term decline in civic society as American households replaced personal interactions by TV-viewing and remote contact through the internet.

Mobile phone history is quite short and there have been few systematic attempts to determine if mobiles have had significant effects on economic performance. Waverman et al. (2005) report that mobile penetration had a significant impact on growth and argued that Canada would have enjoyed average per capita GDP growth a full 1% higher, if it had achieved the Swedish level of mobile penetration between 1996 and 2003. Similar results were reported by Andrianaivo and Kpodar (2012) who state that the fixed line effect was larger than the mobile effect, but an interaction term provided evidence that fixed line and mobile are substitutes. Mobile penetration was also found to have a significant positive effect on financial inclusion; and they argued that mobile phones contribute both to financial inclusion and growth. Work on Africa that uses the UNDP’s measure of IHDI supports these arguments (Asongu, 2013; Asongu et al., 2016). Mobile and fixed line penetration also contribute positively to growth in Middle East and North African countries (Sassi and Goaied, 2013; Ghosh, 2016).

In theory, the main channel through which mobile telephony affects welfare and growth is by the more rapid dissemination of information at lower cost. These studies involve adding mobile penetration variables into Barro-type regressions (Barro and Sala-i-Martin, 2004), and therefore do not fully represent this channel, so the models lack a clear theoretical foundation. However, evidence from local and sector studies suggests that mobile phones do improve efficiency in settings where they bridge the geographic dispersion among economic agents (Aker, 2010). Regulation, industry structure and cost are also crucial factors in determining the distribution of mobile phone towers in Africa (Buys et al., 2009). Overall, therefore, mobile phones may promote growth, but existing cross-country evidence is too limited to argue with confidence that they have a distinctive and stronger effect on growth than other infrastructure investment.

4. Mobile Money: Its Operation and Development

The two most widely developed mobile financial services are mobile money (m-money), the main topic of this paper, and mobile banking (m-banking). Related services, such as mobile insurance, are mostly at an earlier stage. Differences between m-money and m-banking reside in the main service-providers, the access procedures and the regulatory framework. M-money is run by MNOs and consists of transactions conducted using mobile phone networks by accessing customers’ stored funds maintained by the MNOs.
These funds may have been originally purchased as airtime or have been deposited directly into the customer’s mobile wallet for future use in m-money transactions. Customers are not required to have an account at a financial institution to own and operate m-money accounts. The regulatory framework is based on company law and a telecoms regulator. M-banking on the other hand is the use of the mobile phone to access banking services. It is run by banks or other financial institutions and allows customers access to their bank accounts using mobile technology. M-banking is regulated under the existing bank regulatory regime.

In Africa, MNO-based services have grown more rapidly than bank-based mobile services (Masha, 2016). However, the distinction between m-money and m-banking is not always clear-cut. MNOs cannot provide banking services, but they use bank accounts to hold customers’ money as we explain below; and some banks do provide mobile services more akin to those provided by MNOs. Kenya’s M-Pesa is provided by Safaricom, an MNO; while competing mobile financial services are provided by other MNOs and Kenyan banks. Kenyan regulations do not require a formal partnership between the MNO and a bank, but in Uganda, for example, a formal MNO-bank partnership is required (Aron, 2018).

The growth and coverage of m-money varies across countries worldwide, but the overall rate of penetration is substantially higher in Africa than in other regions. The first m-money licence was issued in South Africa in 2004, but the success story is that of M-Pesa in Kenya. M-Pesa was introduced simultaneously by Safaricom in Kenya and Vodacom in Tanzania in 2007. Both companies are part-owned by Vodafone; M stands for mobile; pesa is Swahili for money. M-Pesa services spread rapidly in Kenya and by 2011, over 50% of the Kenyan adult population had an M-Pesa account, rising to 90% in 2016 (Jack and Suri, 2011, 2014; GSMA, 2017). Safaricom recorded more than 280 million transactions in 2013 totalling US$22 billion, equivalent to over one-quarter of Kenya’s GDP. The share of the previously financially excluded population that has adopted M-Pesa increased to about 50% by 2009 (Eijkman et al., 2010). By 2015, there were 80,330 M-Pesa agents in Kenya (retail outlets), and 123,700 m-money agents in total, compared to about 1400 commercial bank branches and 2700 ATMs (IMF, 2016; Aron, 2018). Distances of these outlets from a formal financial institution vary from a few hundred meters to over 25 kilometres. M-money expanded more slowly in Tanzania, which is a poorer country than Kenya, with lower financial literacy and no national ID card: an important factor in providing documentation for opening an account (Demombynes and Thegeya, 2012).

The basic service provided by M-Pesa is transfer and receipt of funds via secure SMS (text) message from a registered M-Pesa customer’s m-money account. The transfer can be carried out using an ordinary mobile phone; a smart phone is not required. Initially, a customer pays cash to an agent who converts it into electronic money (e-money) and credits the proceeds to the customer’s virtual account or mobile wallet. The customer can keep the e-money as deposits for later use or use it directly including payment for airtime, goods and services, remittances to friends and relatives. Recipients of payments or transfers can keep the receipts as e-money deposits (credits) or convert them into cash by withdrawing money at agents who are remunerated out of the transaction fees charged to customers. Agents are often referred to as CICO (cash-in-cash-out) outlets.

M-Pesa agents are organized in one of three streams (Jack and Suri, 2011). The standard model (stream 1) consists of the agency head office, which deals directly with M-Pesa (Safaricom), and several agents, which are subsidiaries of the head office. The agents manage cash and e-float balances through transactions with head office, but head office and agents both deal directly with customers. Stream 2 is the aggregator model. The aggregator is the head office that deals directly with Safaricom and manages the cash and e-float balances of agents. Individual agents can be independently owned but have a contractual agreement with the aggregator. A study of seven sub-Saharan African countries argues that the aggregator model is the one most conducive to a rapid expansion in the use of m-money, as the MNO can delegate the management and expansion of agency outlets to the aggregator (Denyes, 2014). In stream 3, a partner bank is designated as a super-agent that acts as an agent to other agents. The bank trades cash and e-float with individual agents but does not transact e-float directly with M-Pesa customers. The proceeds of

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M-Pesa deposits are transferred to trust accounts held by Safaricom at different commercial banks. These accounts are treated *pari passu* with other bank accounts in respect of withdrawals, reserve requirements and other regulations. In some jurisdictions, special reserve requirements have been imposed on MNO trust accounts (100% in the Philippines) (Jack and Suri, 2011). However, this is not the only model. In Tanzania, from 2014, the central bank authorized MNOs to pay interest on customers’ e-float and the first payment was made in September 2014 by Tigo (McKay, 2016). From 2015, e-money issuers in Ghana were required to pass through to e-money holders at least 80% of the interest earned on e-money bank balances (Bank of Ghana, 2015).

M-Pesa was initially conceived as a convenient means of transferring small sums of cash over long distances. Urban migrants send money home to support their families in rural villages where there are no formal financial institutions. Remittance services were provided by the Post Office and Western Union, but these were slow and expensive, and people regularly resorted to informal arrangements, sending cash via minibus drivers. These services were cheaper but more risky, as the cash often failed to reach the intended recipients. M-Pesa was perceived as much safer and cheaper; and it soon became the method of choice for small remittances. M-Pesa could also be used to store purchasing power safely, especially for people without bank accounts. For low-income households, the alternative was some ‘safe place’, such as in a mattress or storage box, which is vulnerable to loss due to theft, fire or family disputes.

Other features of M-Pesa developed over time, including free deposits, no minimum balance requirement, the facility to send money to Safaricom customers not registered for M-Pesa and the ability to deposit and withdraw cash from an ATM. However, the dominant use of M-Pesa is for remittances which account for about a third of all transactions. Savings account for over 10% of M-Pesa transactions. Payments for goods and services account for about one-quarter of transactions, including small businesses, such as salons, grocery stores, coffee shops, matatu and taxi fares. Safaricom developed its Lipa Na M-Pesa (PayBill) service, which provides formal arrangements for businesses to collect payments from customers through M-Pesa. In a 20-store survey conducted in Western Kenya in 2009, Eijkman et al. (2010) reported that the average number of daily M-Pesa transactions per store varied from 16 to 61 as between rural areas and town centres. Other uses of M-Pesa include payment of school fees, child allowances, wage payments, loan repayments and business-to-business transactions.

M-Pesa stimulated the creation of further mobile financial products in Kenya, including M-Kesho (kesho is Swahili for ‘future’). M-Kesho provides an integrated mobile/bank savings account. In 2012, Safaricom and the Commercial Bank of Africa jointly launched M-Shwari (shwari is Swahili for ‘calm’): a savings and loan product, with savings earning interest and micro-credit. As the interest on MNOs’ trust accounts corresponding to customers’ e-float is paid into a charity in Kenya, M-Shwari (like M-Kesho) was set up separately with a conventional bank so as to adhere to Kenya’s m-money regulations (Cook and McKay, 2015; Aron, 2018). The micro-credit access creates a credit score that can be based on as little as one month’s data (Aron, 2018). However, preliminary evidence suggests that the take-up of M-Shwari was slow in the first two years, with 30% of users taking out a loan but only 14% saving (Kaffenberger, 2014). M-Pesa (mobile) health insurance became available in Kenya in 2014. Elsewhere, in Africa and Asia, mobile insurance schemes cover diverse risks related to health, crop failure, assets, accidents and political violence (Wiedmaier-Pfister and Leach, 2015).

5. Mobile Money: Theory and Evidence

5.1 Key Benefits and Issues in Mobile Money

Gains from m-money arise from the fact that it permits rapid, secure and low-cost transmission of money over space and time. These gains can be classified under four heads. First, transactions costs are reduced. The cash costs of m-money remittances are substantially lower than other means of sending money in

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Africa. There is a convenience gain compared to visiting a post office or engaging a taxi-driver. Lower transaction costs mean that senders can remit smaller amounts at a higher frequency. There is also a gain in certainty and security: an m-money transfer arrives rapidly, securely, privately and without risk of a deduction, or loss. It eases the difficulty in saving and storing enough cash to reach the threshold required to pay the fixed costs of remitting funds; and it increases the amount received by beneficiaries. On all these issues, see especially Jack and Suri (2014). Nzie et al. (2018) report more mixed transaction cost effects for farmers in Cameroon.

The second gain stems from recording of transactions which, among other benefits, enables the creation of individual transaction histories and credit scores (Aron, 2018). Increased transparency helps bring users into the formal financial system (Comninos et al., 2009). Gosavi (2015, 2018) shows that East African firms that use m-money are more likely to obtain loans or lines of credit. Several countries allow tax payments to be made through m-money: Mauritius reported a 12% increase in receipts during the first year of mobile payments (Scharwat, 2014). The third gain is in liquidity. People who do not have access to a financial institution may have to save in the form of physical assets (e.g. jewellery). M-money is liquid and convenient for small savings. Fourth, mobile transactions are private, a feature which is particularly important for African women whose personal cash savings could create arguments with their spouses. In interview studies, housewives acknowledge that it enables them to keep secret savings, which provides some financial independence.

These benefits enable individuals and households to save small sums of money, contributing to more effective consumption-smoothing. Savers build up a safety net to help pay for unexpected exigencies. Africa lacks effective social security arrangements, so these funds also serve as a ‘private-social’ safety net allowing households to provide mutual assistance to family, friends and others in their social network at times of distress. M-money can be particularly important in the face of larger crises. During the 2007–2008 Kenyan political crisis, rural areas were cut off from the cities, and families depended on m-money to receive support from relatives and friends. M-money is, therefore, likely to have some impact on social networks. Networks may be strengthened by more frequent phone contacts, text messages and increased remittances; but they might be weakened if the ease of transferring money leads to the network becoming more transactional in nature, confined to text messages and m-money transfers.

A further important issue is the relation between m-money and conventional finance. Insofar as m-money promotes small savings, it can help the financial system mobilize financial resources more efficiently. However, if these resources are largely used within existing social networks, they will function in parallel to the formal financial system. Improved consumption-smoothing increases household welfare, but if users remain outside the formal financial system, the economy will forego some of the gains a unified capital market can bring.

Empirical research on m-money is limited because of its relatively recent provenance, but there is an increasing amount of survey-based data on financial inclusion, including m-money. The World Bank Findex survey uses a broadly consistent set of questions worldwide (Demirgüç-Kunt et al., 2015); and there are numerous single-country surveys. However, there is a lack of consistency among surveys, across countries and over time (Jiang, 2017). A complementary approach that has scarcely been explored is to utilize MNO data. These provide an electronic record of every phone call and m-money transaction made on every account. In principle, these data would enable a wide range of investigations, including the analysis of consumer response to price changes (Economides and Jeziorski, 2015) and the estimation of individual household incomes (Blumenstock, 2014).

There are several major questions to be asked about the economic and social impact of m-money. First, what conditions are needed for m-money to take off; second, what determines the type and extent of usage by individuals; third, what is its impact on household and business activities, especially on poverty; and finally, what are the optimal government policies in terms of market structure, pricing, regulation and monetary policy? We review the first three questions in Sections 5.2–5.4 and discuss market structure and policy in Sections 6.1 and 6.2.
5.2 Why Does Mobile Money Take-Off in Some Countries and Not Others?

The effectiveness of m-money depends on the enabling environment: the coverage and reliability of the mobile network and the agent network, access to phones, including affordability, knowledge of how to operate them and regulation. M-money services are little-used in many countries, even those with widespread coverage and ownership of mobile phones. The first question, therefore, is why m-money services are taken up in some countries, and not in others.

The Kenyan experience has been widely discussed (Hughes and Lonie, 2007; Kimenyi and Ndung’u, 2009; Muthiora, 2015). Kimenyi and Ndung’u (2009) attribute Kenya’s success to three main factors. First was a liberal regulatory regime for MNOs, a willingness by the authorities to resist opposition especially from commercial banks, and a stable macroeconomic environment. The Central Bank of Kenya (CBK) allowed M-Pesa to proceed initially on an experimental footing (Alliance for Financial Inclusion, 2010). Second, was a strong public–private partnership. Safaricom was involved in a donor-funded micro-credit experiment involving the use of m-money, and it used this experience to learn about the mechanics of m-money. Third was the guarantee of a contestable market discouraging dominance by initial entrants and enabling competition.

Network effects are crucial to m-money success. Only 13 of 255 service providers worldwide were breaking even by 2014 (Aron, 2018). In Kenya, notwithstanding the intent for contestability, Safaricom’s mobile network had a dominant quasi-monopoly position, and it was able to invest in technology upgrades, the agent network and marketing with little competition. The cost of remittances using M-Pesa was substantially lower than those of the incumbents (about one-third that of the Post Office in 2007). They were also quicker and more reliable. Finally, having established a base of users, M-Pesa then benefitted from standard network effects: the more people used it, the more others would sign up for it.

How far can Kenya’s experience be generalized? Evans and Pirchio (2015) studied 22 m-money schemes in Africa, Asia and Latin America. They concentrate on the market structure and regulatory framework; other factors are not explicitly examined, notably the geographical dispersion of the population. Within these limitations, they identify four key factors that can foster the take-off of m-money. First is a conducive regulatory environment. For example, they argue that the growth of m-money will be inhibited if banks take the lead in rolling it out, with MNOs acting as junior partners. In Ghana, however, explosive growth in m-money between 2013 and 2015 preceded changes in e-money regulations, which were rolled out by the Bank of Ghana in 2015 (Bank of Ghana, 2015). Second, m-money is more likely to succeed in countries that are poorer and have little infrastructure. Entry costs are lower because MNOs face less competition in the phone market from incumbent fixed line operators. Third, the agent network must grow with the coverage of the phone network. At the macro level, there is an obvious endogeneity problem: growth in the agent network may stimulate demand for m-money, but the reverse may also be true. However, at the household level, agent location may be determined partly by household density but not the reverse. In Tanzania, Abiona and Koppensteiner (2016) found an inverse relationship between household take-up of mobile money and the distance to the nearest agent. This underlines the importance of agent proximity and agent network coverage as causal factors. Arguably though, it is equally important that the agent network should be well trained and trustworthy, so that customers can rely on the system. Fourth, growth tends to occur quickly or not at all.

A worldwide GSMA survey concludes, like Evans and Pirchio (2015), that MNO-led m-money services fare better than bank-led services but finds that wealthier countries with higher population density tend to have deeper m-money penetration (GSMA, 2016). This argument is somewhat more consistent with the network literature. Overall though, we cannot yet provide a single unifying account as to why mobile money has taken off in some countries but not others. Regulatory environment, an adequate mobile network and well-trained agent network are obviously important but there is insufficient cross-sectional evidence to be able to state comprehensively which factors matter and by how much.
5.3 Users and Use of Mobile Money

The most thorough work on m-money use is by Jack et al. (2013) who surveyed a stratified sample of 3000 Kenyan households in 2008. They returned to the same households in 2009 and 2010 and reached 2016 (in 2009) and 1594 (in 2010) of the original group. Jack and Suri (2011) document an increase in M-Pesa usage from 43% of those surveyed in 2008 to 70% in 2009, and concluded that early adopters were generally wealthier, more educated, have a formal bank account and lived in an urban area (Aker and Mbti, 2010; Mbti and Weill, 2011; Yenkey et al., 2015). This is consistent with the findings of cross-sectional research using Kenya’s FinAccess surveys (FinAccess, 2016). Research on other Africa countries report similar results (Uganda: Munyegera and Matsumoto, 2014; West African Economic and Monetary Union: Coulibaly, 2017). Given that other research suggests that younger Africans are less likely to be connected to the formal financial system than older Africans (Zins and Weill, 2016), m-money may offer an important route for younger people to connect with the financial system. By 2015, mobile subscriptions in Kenya amounted to 80% of the population, 84% of whom were m-money users implying that about 6 out of 10 people in Kenya used m-money (Evans and Pirchio, 2015). These figures confirm that m-money penetration has gone well beyond the growing urban middle-class in Kenya to poorer and more rural households.

According to Jack and Suri (2011), the most important reason for not using M-Pesa was not owning a mobile phone (60% of non-users in the second round). Telecenters and cybercafes may help provide access to mobile phones, but these are most likely to be in urban areas (Sey, 2005). Jack and Suri (2011) document higher remittances by M-Pesa users compared to non-users, particularly from children to their parents. However, Yenkey et al. (2014) find that parents, rather than children, are the most frequent sending group. The use of M-Pesa for saving increased between the surveys; lower risk and ease of use were the most frequent reasons given for saving through M-Pesa instead of traditional repositories at home. M-Pesa is also used for secure transport of cash or ‘self-transport’ as cash is converted into e-money for secure overnight storage (Eijkman et al., 2010; Demombynes and Thegeya, 2012). Beck et al. (2015) find that Kenyan small businesses that purchase supplies on credit are 17% more likely to use M-Pesa than other means such as cash. They argue that m-money facilitates trade credit, because it reduces the security risks associated with cash.

Several papers study the connections between M-Pesa and formal finance with conflicting results. Jack and Suri (2011) find that M-Pesa users are more likely to be banked but later users include those who do not use the formal financial system. Mbti and Weill (2011) report that the use of M-Pesa is associated with less reliance on informal finance, and increased use of formal finance. But Yenkey et al. (2015) disagree. They confirm that later adopters of M-Pesa are increasingly drawn from the rural, unbanked and female population, but find no evidence that use of M-Pesa draws individuals into the formal financial system. Many users are simply substituting M-Pesa for informal finance without any further steps towards the formal financial system; others continue to use informal finance exactly as before. Further insight into the relationship between M-Pesa and formal finance was provided by Johnson and Krijtenburg (2015) following interviews with a stratified sample of (62) Kenyans. Interviewees reported an aversion to formal finance as it creates obligations, based on ‘borrowing and lending’. They viewed remittances (including through M-Pesa) as involving ‘ask and assist’; and were consequently reluctant to move from M-Pesa into formal financial arrangements.

M-Pesa accounts do not pay interest, but they may be attractive as a vehicle for small savings for poorer households with no formal account, and for women, because the data provided by the phone facilitate mental accounting of the amounts saved (Thaler, 1999). Spouses might not remember how much was hidden under the mattress and accuse the other of theft, but e-money is private to the account-holder and the amount clearly shown on entry of a pin number. M-Pesa users tend to save more in formal accounts than non-users, in addition to any savings within M-Pesa itself (Mbti and Weill, 2011; Demombynes and Thegeya, 2012). Nevertheless, there has not been a significant take up of the savings accounts available.
via M-Kesho. Demombynes and Thegeya (2012) speculate that this is attributable to the greater burden of paperwork required in relation to the relatively modest gain in interest income.

Research on Africa outside Kenya is more limited, because of the later penetration of m-money. Based on a RCT conducted in Ghana, Aker and Wilson (2013) report that free phones were effective in promoting m-money usage, but these are not a practicable option in any resource-limited environment. However, free m-money SIM cards with information and support for their use were viable and useful, even though recipients paid for activation. Agent accessibility was also important, corroborating research arguing that m-money has particular value in geographically dispersed societies with a consequent need for an equally well-dispersed agent network (Jack and Suri, 2014; Munyegera and Matsumoto, 2014; Abiona and Koppensteiner, 2016). Tobbin and Kuwornu (2011) report that trust, risk and ease of use were the key factors in individual decisions to begin using m-money in urban area of Ghana. According to Overa (2008), small-scale agricultural traders in Ghana understand the benefits of a mobile phone but reported either that they could not afford a phone or the boss would not supply one. Sey (2011) observes that many of her interviewees obtained a mobile phone as a gift and in some cases, were unable to maintain it because of cost, underscoring the income constraint to phone ownership. She also agrees with Donner (2008) that, since mobiles are used for pleasure as well as for business, which affects the interpretation of penetration and usage statistics. For example, if many phones in a sample are used largely for pleasure, regressions of poverty or inclusion measures on phone use may lead to incorrect inferences about their impact.

5.4 Impact of Mobile Money on Households and Businesses

If m-money helps increase welfare and reduce poverty, households and business have an incentive to begin using it; and studies of the impact of m-money on welfare report broadly positive effects. Jack and Suri (2014) study how M-Pesa aids risk-sharing through family and social networks. Households in their sample without access to m-money experienced an average 7% cut in consumption following a negative income shock. Households that did have access to m-money experienced a lesser cut in consumption, a finding that is robust to a variety of specifications controlling for household characteristics. For non-users, the impact of the shock fell primarily on non-food consumption, including health spending. Food consumption tended to hold up for users and non-users alike. M-Pesa users received more remittances in number and cash value than did non-users in the face of negative shocks; and they received remittances from more people. M-Pesa users also experienced greater reciprocity in remittances (Jack et al., 2013) suggesting that m-money strengthens family and social networks (Okello et al., 2018). The role of agents is also important: if there was an agent nearby, households tended to use their M-Pesa accounts more regularly and were less likely to suffer adversely from a negative shock.

Other household research in Africa generally supports these results, especially that: first, m-money users are better able to withstand shocks than non-users; second, the burden of adjustment for non-users falls mainly on non-food consumption; and third, food consumption tends to hold up for users and non-users alike (Kenya: Mbiti and Weill, 2011; Uganda: Munyegera and Matsumoto, 2014; Tanzania: Riley, 2016; Burkina Faso: Ky et al., 2018). In a sample of 500 households in Burkina Faso, Ky et al. (2018) find that m-money users are better able to withstand adverse shocks than non-users, but the main coping mechanism, particularly for health emergencies, is the use of short-term m-money savings instead of remittances. In Niger, women receiving m-money from a cash transfer programme following a drought had a better diet, as did their children, than those receiving cash (Aker et al., 2014). This was due to saving of time; but also, women who received m-money gained increased intra-household bargaining power and other welfare improvements. However, a study of Uganda finds that m-money use has virtually no impact on household strategies for coping with adverse shocks, or on the effect of shocks on consumption (Maweije, 2017). In a related research, Porteus (2007) concludes that m-banking services
in South Africa have extended financial inclusion but have not improved access to other banking services. This is consistent with the results of Kostov et al. (2015) on the impact of Mzansi accounts, and those of Yenkey et al. (2015) for M-Pesa in Kenya.

Overall though, the consensus of evidence is that m-money users are better able to insure against risks because they are more likely to obtain remittances from their family or social networks through M-Pesa; and this suggests that m-money has strengthened these networks (Jack and Suri, 2014; Okello et al., 2018). However, it could also be argued that this views social networks entirely through the transactional lens of cash transfers. The ease of making cash transfers could weaken personal ties, so that the network simply becomes a series of paths along which cash is transferred, rather than as the framework for fostering closer social relationships. Data based on financial diaries and (350) interviews suggest that urban migrant workers in Nairobi use M-Pesa because it is cheaper and less time-consuming to send money home, so they could spend more time working in the city (Morawczynski, 2009). However, rural recipients, invariably wives, often viewed matters differently: first, with fears that the husband became less accountable; and second, that she became more tied to the farm because her husband returned home less frequently, contributing to the disintegration of marriages. Some urban users also had reservations about M-Pesa, explaining that they were regularly pestered for money by people in their network (Morawczynski, 2009).

In general, M-Pesa promoted higher living standards and greater female independence; but on occasion, it led to marital problems or less female independence. In some cases, the family or social network was strengthened; in other cases, it became purely transactional and was weakened.

Riley (2016) studied the impact of idiosyncratic and aggregate shocks on household consumption at the village level using Tanzania’s National Household Panel Survey, and an ingenious model specification that distinguishes between the effects of household and village m-money use on household and village (collective) consumption. She finds that in villages where there are m-money users, all households are fully insured against idiosyncratic shocks (e.g. illness), irrespective of whether they have an m-money account. This can be explained by sharing within social networks, facilitated in part by mobile phone use. M-money creates an insurance externality: all households are better insured against idiosyncratic shocks if the village as a whole has some m-money users. However, aggregate village shocks (e.g. rainfall) are not fully insured and their incidence is m-money dependent. Households without m-money are uninsured: consumption falls by the amount of the shock; but households with m-money remain fully insured. M-money users may be more reluctant to facilitate sharing for an aggregate shock as the aggregate cut in consumption is larger than for an idiosyncratic shock.

6. Market Structure, Regulation and Taxation of Mobile Money

6.1 Market Structure and Competition

Regulatory and market structures are important in determining how markets for m-money work and how they grow over time (Donner, 2008). The mobile telecommunications market is two-sided: it involves a platform that imposes user charges to bring buyers and sellers together and is characterized by network externalities that cannot be internalized by direct negotiation between buyer and seller (Rochet and Tirole, 2004). The price structure has to attract sufficient buyers and sellers so that both sides find it worthwhile to use the platform. The key feature that distinguishes a two-sided market from a standard market is that the platform can affect the volume of transactions by charging more to one side of the market than to the other in order to attract customers. A mobile network consists of the platform provided by the MNO, and the users who send and receive calls and texts and use other features. The MNO must set a pricing structure to attract sufficient users on both sides so that it can earn the market rate of return. Rochet and Tirole (2004) argue that monopolistic and competitive platforms each have an incentive to attract users on both sides, but they do not generally set the same level or structure of prices to achieve this.
M-money is also a two-sided market, insofar as consumers or non-financial businesses transact on both sides, with the MNO providing the platform for senders (payers) and receivers (payees). In general, and in line with theory (Rochet and Tirole, 2003), payers and payees face different prices for cash transfers. Charges for cash withdrawals (by payees) are typically larger than for cash transfers (by payers), with deposits being free of charge. A distinguishing feature of m-money is that the market is segmented between registered and non-registered users. Phone users who are not registered for an m-money service do not have a SIM card activated for m-money and therefore cannot be charged by the MNO for m-money transfers. MNOs typically allow payments from registered to non-registered users but the whole cost of the transfer is borne by the registered sender (payer). The market for other mobile financial services, such as insurance, where a financial institution is involved on one side, is generally not two-sided, as the tariff for end-users is set jointly and the proceeds shared between the MNO and the financial institution.

A further interesting feature of m-money is that the price paid by payees is partly voluntary. The charge to payees is generally for a cash withdrawal, not the receipt of m-money per se. As the network of m-money users expands, recipients may choose to save the m-money temporarily instead of cashing out, and then subsequently use it to make a further m-money payment. As the m-money network spreads more widely, users can choose to cash out less frequently. If this does occur, the costs of transfers will increasingly fall on payers (senders); the average charge paid by recipients per dollar received will decline; and the total price of a transfer (the sum of payer and payee costs) will also decline as the cash-out charge is increasingly avoided. However, the consequent effect on the pricing structure is unclear.

In the theory of two-sided markets, considerable emphasis is placed on the pricing structure as an incentive to stimulate network growth. However, users rarely give cost as the main reason for the up-take of m-money or for choice of provider. The most common factors are safety and convenience (Jack and Suri, 2011), and proximity to agent (Munyegera and Matsumoto, 2014; Abiona and Koppensteiner, 2016). Nevertheless, studies in Kenya and Tanzania show that users are price-sensitive to changes in the cost of m-money transfers (Mbiti and Weil, 2011; Economides and Jeziorski, 2015). Economides and Jeziorski (2015) estimated the demand curve for m-money by Tigo customers in Tanzania using data on every Tigo m-money transaction during December 2012 through February 2013 around the step change in pricing structure in January 2013. They found a high demand for short-lived self-transfers, that is a deposit cashed out next day or sooner by the depositor, to avoid carrying cash through a particular location or time. Self-transfers formed a substantial proportion of the transactions, confirming that, in Tanzania, security is a key factor in determining the demand for m-money transfers. Clearly, there is more work to be done along these lines.

Kimenyi and Ndung’u (2009) argue that maintaining market contestability was a key factor in the successful growth of M-Pesa in Kenya but this is debatable, especially insofar as it concerns the initial take-up of m-money. Networks involve substantial fixed costs (Katz and Shapiro, 1985). These favour the first mover especially if it enjoys a quasi-monopoly, and this is exactly the situation in which Safaricom initially found itself in the provision of ordinary mobile phone services in Kenya. The systematic promotion of competition in m-money provision within Kenya was given a legal backing only in 2014 with The National Payment System (NPS) Act. A key feature of NPS is that it outlawed agent exclusivity (Muthiora, 2015). In Uganda, the 2013 guidelines for m-money operations outlawed agent exclusivity from the start (Muthiora, 2015). Agent exclusivity makes it difficult for new entrants to disrupt an incumbent, because of the high fixed costs of establishing an agent network.

In a comparison among Kenya, Tanzania and Zimbabwe, Robb and Vilakazi (2015) concluded that agent exclusivity could be a significant barrier to competition, but a more important barrier is the existence of a dominant mobile phone provider. In Kenya, even after the NPS Act was passed, Safaricom retained a dominant position. In Zimbabwe, Econet is the dominant MNO. In Tanzania on the other hand, the networks were of more equal size and, from the outset, agents did not have to be bound to a single MNO. Vodacom invested heavily in its agent network seeking to gain a first-mover advantage from its association with Safaricom and about 60% of its Tanzania agents were exclusive in 2013 (Mas and John,
Nevertheless, m-money charges in Tanzania in 2015 were appreciably lower than in the other two countries (Robb and Vilakazi, 2015). However, m-money took off more slowly in Tanzania than Kenya despite being introduced essentially simultaneously.

A further competitive issue is that of interoperability. Network interoperability means that phone customers can make and receive calls and texts using MNOs other than those on which they are registered. Countries with complete network interoperability, such as Kenya and Tanzania, have higher percentages of their population using m-money. For example, as of 2015, m-money in Kenya included 58.4% of mobile phone users, whereas in Nigeria it included just 2.3%, although, almost half of its population (45%) had a mobile phone subscription (Table 1). M-money interoperability means that customers can make a deposit and transfer cash using one MNO, while the recipient can collect cash from another MNO. As of 2016, m-money interoperability was enabled in 15 countries (GSMA, 2017), including in Ghana, where it became mandatory from May 2018. M-money interoperability has proceeded relatively slowly especially because it raises important issues about relationships between MNOs and banks, as some form of clearing is required for inter-MNO transactions.

6.2 Regulation and Taxation

M-money spans finance and telecommunications, which are typically subject to two independent regulators. Telecoms regulators are usually more concerned with competition, access and network interoperability, whereas bank regulators are concerned with risks, and consumer protection in the face of asymmetric information. The cost to MNOs of collecting deposits is typically much less than that of selling airtime scratch cards, even allowing for agent commissions (Leishman, 2010). Since deposits can be used to purchase airtime, m-money enables MNOs to attract airtime at lower cost than through the conventional route and may give m-money incumbents a competitive advantage. MNOs may also try to use m-money to ring-fence and retain telecom customers who particularly value the provision of m-money.

In principle, regulatory issues associated with banking functions would seem to be more troublesome than those associated with telecom functions; and banking-focussed regulatory regimes for m-money are still in their infancy (Jones et al., 2016). Klein and Mayer (2011) contend that banking regulation of m-money can be straightforward subject to two key conditions. First, customer funds deposited in an m-money scheme must be ring-fenced from the MNO, otherwise the MNO is acting as a deposit-taking institution. Second, since m-money services constitute an unbundling of traditional banking services, each service should be evaluated separately for its regulatory needs. They argue that only investment services should be conducted so that a bank rather than an MNO bears the supplier risk, and these services should be subject to prudential banking regulation. Most other m-money activities can be classified as payments services; and Klein and Mayer (2011) argue that they only require standard conduct of business regulation. These include exchange of one type of money for another (cash for an e-money balance in the customer’s mobile wallet); safe storage of cash as e-money; and remittances. Since agents transact with customers using their own cash, it is not possible to have a run on an agent or MNO in the same way as a bank run. The agent is exchanging one form of money for another and may run out just as an ATM can run out of cash. Jack and Suri (2011) report that 69% of the delays experienced by Kenyans in obtaining cash from an agent were because the agent had insufficient cash; and 52% of these delays took at least a day to resolve. Aker and Wilson (2013) report similar experiences in Ghana.

According to Klein and Mayer (2011), the unbundling of a country’s payments system initiated by m-money is a positive development, because the payments mechanism is a public good and is better separated from the risky lending and borrowing business of banks. They argue that regulation should be functional, and each function fulfilled by m-money should be regulated separately. This approach is widely accepted in the literature (di Castri, 2013; Khiaonarong, 2014), but there are important objections.
Table 1. Mobile Money Usage in Sub-Saharan Africa, 2015.

| Country               | Mobile Money Usage\(^a\) |
|-----------------------|--------------------------|
| Benin                 | 2.0%                     |
| Botswana              | 20.8%                    |
| Burkina Faso          | 3.1%                     |
| Burundi               | 0.7%                     |
| Cameroon              | 1.8%                     |
| Chad                  | 5.8%                     |
| Congo, Dem. Rep.      | 9.2%                     |
| Congo, Rep.           | 2.0%                     |
| Cote d’Ivoire         | 24.3%                    |
| Gabon                 | 6.6%                     |
| Ghana                 | 13.0%                    |
| Guinea                | 1.5%                     |
| Kenya                 | 58.4%                    |
| Madagascar            | 4.4%                     |
| Malawi                | 3.8%                     |
| Mali                  | 11.6%                    |
| Mauritania            | 6.5%                     |
| Mauritius             | 0.9%                     |
| Namibia               | 10.4%                    |
| Niger                 | 3.9%                     |
| Nigeria               | 2.3%                     |
| Rwanda                | 18.1%                    |
| Senegal               | 6.2%                     |
| Sierra Leone          | 4.5%                     |
| Somalia               | 37.1%                    |
| South Africa          | 14.4%                    |
| Tanzania              | 32.4%                    |
| Togo                  | 1.4%                     |
| Uganda                | 35.1%                    |
| Zambia                | 12.1%                    |
| Zimbabwe              | 21.6%                    |
| Sub-Saharan Africa    | **11.5%**                |

\(^a\)Percentage of respondents who report personally using a mobile phone to pay bills or to send or receive money through a GSM Association (GSMA) Mobile Money for the Unbanked (MMU) service in the past 12 months; or receiving wages, government transfers or payments for agricultural products through a mobile phone in the past 12 months (% age 15+).

Source: World Bank Financial Inclusion Database (World Bank, 2016b).

To regulating purely on the basis of function. First, any specific financial service is fundamentally the same irrespective of how it is delivered. M-money savings, credit and insurance plans can potentially constitute a re-bundling of these services under the umbrella of an MNO instead of a bank. Second, a distinctive feature of m-money, albeit one it shares with m-banking, is the issue of cyber security. M-money balances may be less well protected than bank balances in the event of an account being hacked, unless the MNO and bank regulators co-ordinate their rules. Third, it can be argued that purely functional regulation misses
the point that it is institutions that fail and not functions, and therefore there is an independent case for regulating institutions per se irrespective of their exact functions (Llewellyn, 2006).

It cannot be assumed that the bankruptcy of any institution engaged in m-money operations will not have external effects like a bank failure, especially as the ring-fencing of m-money balances varies across countries. In common law countries, trusts are widely recognized, and m-money schemes often use a trust fund as repository for customer balances. However, some countries only require that customer funds be ‘protected’ but no clear fiduciary responsibilities for the funds are set out. In civil law countries, the position is worse, as trusts have limited applicability, and beneficiaries may have few rights in respect of funds held on their behalf by a fiduciary. M-money regulations generally provide for some protection of customer funds, but it is not clear how effective this protection would be in the event of a bankruptcy of a bank or MNO.

Customer money held in a trust fund at a bank should be protected by local banking regulations in the event of bank failure. The main protection is likely to be through deposit insurance; but as of 2013, more than half the countries with m-money systems worldwide did not have an operational deposit insurance scheme (Grossman, 2016). M-money customers in these countries would stand pari passu with the unsecured creditors and have little chance of recovering more than a small fraction of their deposits. Deposit insurance invariably imposes a ceiling on the amount of each deposit insured. If the trust fund is treated as a single deposit, m-money holders would stand to lose virtually all their m-money in the event of failure as only a fraction of the whole fund would be insured. If instead the trust fund is treated as a pass-through for deposit insurance purposes, each individual m-money holder would be entitled to a payment from the deposit insurance scheme up to the statutory maximum permitted for their own m-money deposit, and irrespective of the total in the trust fund. As of 2017, only US and Kenyan regulations explicitly provided for pass-through deposit insurance along these lines, and the recently introduced Kenyan rules are explicitly intended to protect m-money deposits (Kenya Deposit Insurance Corporation, 2017).

Further issues arise in connection with the bankruptcy of an MNO that has m-money operations, especially if there is limited m-money interoperability. Agents will be unable to transact using the bankrupt MNO, and their funds and those of their customers will effectively be frozen until the network is sold or the MNO wound up. In addition, agents are known to manage m-money balances to some extent, for example when they receive m-money transfers from their head office or aggregator without a corresponding transfer back of cash, effectively creating money, if only temporarily (Jack et al., 2010). The agents are unsecured creditors and therefore likely to lose any unpaid commissions or cash not immediately exchanged for m-money. The collapse of a large agent network could be just as severe as the closure of a mid-sized bank.

Nevertheless, Klein and Mayer (2011) concluded that m-money permits the payments system to ‘... be operated with virtually no risk to the tax-payer ... [and without] ... the need for prudential regulation’. However, this conclusion appears to us to be unduly complacent. No m-money scheme has yet been tested either by the failure of an MNO or of a bank acting as trust agent. Given the absence of deposit insurance and explicit pass-through rules, and the minimal oversight of agent–MNO relationships in most countries where m-money is widely used, there would seem to be a clear need for more research and action on regulatory issues.

A final regulatory issue concerns the operation of monetary policy. The impact of m-money on the aggregate stock of money in the economy depends on bank regulations and on the exact form in which the counterpart of m-money is held within the banking system (Aron, 2018). When cash is converted to m-money, its counterpart becomes a deposit in the banking system, typically within some form of trust fund. In the Philippines, where banks are required to hold 100% reserves against mobile money trust fund deposits, there can be no effect on the supply of money as a result of acquisitions or liquidations of m-money. In other countries like Kenya where banks are subject to a fractional cash reserve ratio on all deposits, there is a potential effect on the quantity of money if an increase in m-money is associated with
a decrease in the demand for cash by the public, that is a switch in demand from cash to m-money. Since banks are only required to hold a fraction of deposit liabilities in cash, provided that trust deposits are treated pari passu with other deposits, then banks can lend the trust money in the normal way. This will tend to increase the supply of money through the usual bank reserve multiplier argument. Even so, this may not require any structural change in monetary policy as the effect on the quantity of money will be directly reflected in the deposit liabilities of the banks.

Taxation on m-money transactions has been introduced in several African countries, including Kenya, Uganda, Tanzania and Ghana, although broader consideration of tax policy and m-money is still in its infancy. A tax on m-money was reversed in Malawi after a public outcry including by economists and tax professionals (Mzale, 2019). The obvious reason for taxing m-money transactions in Africa is to widen the revenue base of the government, considering the size and rapid growth in the sector, as well as the relatively narrow base of the tax system in many African countries. However, taxation on m-money transactions could reduce activity and possibly reverse the benefits recorded so far, particularly in improving financial inclusion. Ndung’u (2019a) argues that any tax on m-money transactions is likely to have only a small positive impact on the revenue base. In Kenya, for example, the tax on m-money transactions accounts for about 1% of total revenue. Moreover, the tax is likely to encourage a reversion to cash, and therefore will have a disproportionate effect on low-income earners (Ndung’u, 2019b). However, there is as yet essentially no substantive research evidence on this issue.

7. Research Agenda and Challenges

This survey has highlighted several important areas where further research is needed.

1. What are the determinants of the take up of m-money at the country and at the household level? Most work on this so far has been essentially descriptive and there are some endogeneity problems to tackle before these questions can be answered fully. In theory, pricing is a key issue in fostering a two-sided market, but customers usually refer to other factors, such as security in their decision to take up m-money. Further research on the role of m-money pricing is needed.

2. How does m-money contribute to financial inclusion and poverty-reduction (if at all)? So far, this question has been considered only in the context of the impact of remittances on consumption-smoothing. There are other possible implications of remittances. They can help foster economic growth through consumption-smoothing if the money received is used for productive purposes. However, they can also contribute negatively, if the receiving households perceive them as substitutes to their income generating-activity and rely on them for subsistence. There is, therefore, a need to establish more the main use of the remittances, particularly in rural areas. In addition, m-money is increasingly used for a range of other purposes, such as savings and insurance.

3. Research suggests that m-money can engage with marginalized groups in society especially females, and particularly in rural areas. However, given the cost of a mobile phone, it is unclear whether this engagement can be spontaneous as the market grows or requires policy intervention. Consideration needs to be given to this issue and possible policies.

4. An important issue concerns the relationships among m-money, micro-finance and more formal (bank-based) finance. How far is m-money a substitute or a complement for other forms of finance, and what are the implications, especially for financial inclusion?

5. A durable conclusion from the literature, especially from interviews, is the security concerns that underpin usage of m-money. It is striking that so many interviewees, as well as the available phone records, show that a substantial use of m-money is for self-transfer for security reasons. Therefore, as m-money develops further, MNOs and regulators may face the opposite problem of ensuring that e-money is cyber-safe and not liable to large or small-scale hacks.

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6. The pricing and market structure of m-money operators has scarcely been investigated. Some of this is data-dependent following Economides and Jeziorski (2015). The pricing structure generally displays notches that can be exploited to estimate demand curves and suggest pricing rules (Blinder and Rosen, 1985). Current pricing schemes provide an incentive for users not to cash out, and the implications of this for MNO profitability, pricing and market structure should be considered.

7. M-money raises a host of regulatory issues, many of which are being explored like the CBK by cautious experimentation. It is important to study and learn from these experiments and use them to help devise more rigorous regulatory principles for m-money. It cannot be assumed that separating payment functions from the deposit and loan business of banking necessarily makes regulation more straightforward or obviates the need for independent regulation of m-money.

8. Finally, it seems clear that customers engage with mobile money for a variety of reasons. It would be unwise to assume, as some economists have done, that an increase in cash transfers by phone necessarily signifies increased engagement with the counterparty; it could mean exactly the reverse. More research is, therefore, needed to investigate how the many different uses of m-money affect traditional family and social networks.

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## Appendix A: Summary of Selected Empirical Studies

| Authors                  | Countries and Regions                                                                 | Data                  | Method                        | Main Findings                                                                                                                                                                                                 |
|--------------------------|----------------------------------------------------------------------------------------|-----------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Allen et al. (2012)      | 149 countries worldwide; o/w 38 African                                               | Cross-section macro data | OLS                           | Income, inflation, natural resources and institutional development help explain financial development worldwide; population density the main determinant of financial development in Africa.                                    |
| Allen et al. (2012)      | 149 countries worldwide; o/w 38 African                                               | Cross-section firm-level data (*Investment Climate Surveys*)       | OLS, Probit estimators        | Bank branch penetration promotes financial access worldwide; population density and bank branch penetration help explain financial access in Africa.                                                               |
| Allen et al. (2014)      | 112 low-middle-income countries, o/w 40 African                                        | Cross-section macro data | OLS                           | Income, natural resources, institutional development and population density help explain financial development and financial inclusion in Africa; population density does not determine mobile phone penetration.                  |
| Allen et al. (2016)      | 123 countries worldwide                                                               | Cross-section household survey data (*Findex*)                    | OLS, Probit, selection models | Demand-side barriers: cost, documentation, distance to outlets and poverty. Barriers high where banks are mainly non-government owned. Inclusion associated with wealthier, older, urban, educated, employed and married individuals; and better legal and political rights. |
| Andrianaivo and Yartey (2009) | 53 African countries                                                           | Panel macro data for 16 years                                     | Panel regression (GMM)        | Income, openness creditor rights and high institutional quality help explain banking development.                                                                                                                |
Table A1. Continued

| Authors             | Countries and Regions            | Data                              | Method                          | Main Findings                                                                 |
|---------------------|----------------------------------|-----------------------------------|---------------------------------|-------------------------------------------------------------------------------|
| Beck et al. (2008)  | 62 countries worldwide           | Cross-section survey data for 209 banks | Correlation; OLS, ordered Probit estimators | Supply-side barriers to financial inclusion include: cost of opening and running the account, minimum balance requirements and documentation; barriers high where banks are mainly government owned. |
| Chin and Ito (2006) | 108 countries worldwide          | Panel macro data for 20 years      | Pooled OLS on time-averaged data | Legal/institutional quality, income and financial openness help determine financial development and financial access. |
| de Koker and Jentzsch (2012) | 8 African countries | Cross-section household survey data (mainly Finscope) | Country-by-country logit estimators | Main barrier to financial inclusion is documentation, including anti-money laundering rules. Formal and informal finance are complements. Income, costs and inequality are the main factors in financial access. Cost of financial services contributes to non-performing loans. |
| Dabla-Norris et al. (2015) | 6 low and middle-income countries | Calibrated data; firm-level model | Simulation of GE model | Income, age and education help explain financial inclusion; being female, bank charges and lack of trust impede inclusion. |
| Fungacova and Weill (2015) | Brazil, Russia, India, China, South Africa (BRICS) | Cross-section household survey data (Findex) | Probit estimators | Age and education help explain financial inclusion, low income impede inclusion. Controls for distance, cost, religion and assets. |
| Zins and Weill (2016) | 37 African countries             | Cross-section household survey (Findex) | Probit estimators | |
| Authors              | Countries and Regions | Data                        | Method          | Main Findings                                                                                                                                                                                                 |
|---------------------|-----------------------|-----------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| **1.2 Determinants of Financial Inclusion and Exclusion: Single Country Studies** |                       |                             |                 |                                                                                                                                                                                                             |
| Akudugu (2013)      | Ghana                 | Cross-section household     | Logit estimators | Age, educational level and having a family member with an account help explain account ownership decisions; distance, documentation and lack of money help explain financial exclusion.                                   |
|                     |                       | survey data (Findex)        |                 |                                                                                                                                                                                                             |
| Johnston and        | Six provinces in      | Cross-section survey of     | OLS, Probit      | Bank borrowing explained by desired loan amount, income, fixed assets, age, return on assets, education and household size. Evidence of voluntary exclusion was found.                                              |
| Morduch (2008)      | Indonesia             | 1438 households             | estimators      |                                                                                                                                                                                                             |
| Kostov et al. (2015)| S. Africa             | Cross-section household     | Logit estimators | Literacy and financial education help explain take-up of informal finance but does not necessarily progress to use of formal finance.                                                                       |
|                     |                       | survey data (Finscope)      |                 |                                                                                                                                                                                                             |
| Nanziri (2015)      | S. Africa             | Pseudo-panel household      | OLS and quantile | Low levels of education and income help explain low uptake of financial services. Controls for well-being and ownership of physical assets.                                                                     |
|                     |                       | survey data (Finscope)      | regression      |                                                                                                                                                                                                             |
| **2.1 Mobile Technology, Financial Inclusion and Development: Cross-Country Studies** |                       |                             |                 |                                                                                                                                                                                                             |
| Andrianaivo and     | 44 African countries  | Panel macro data for 20     | Panel GMM       | Mobile phone penetration helps increase growth; mobile phones are substitutes for fixed lines. Mobile finance, greater bank branch coverage and good institutions help increase financial inclusion.                      |
| Kpodar (2012)       |                       | years                       |                 |                                                                                                                                                                                                             |
| Authors                  | Countries and Regions          | Data    | Method      | Main Findings                                                                 |
|-------------------------|--------------------------------|---------|-------------|-------------------------------------------------------------------------------|
| Asongu and Nwachukwu (2016) | 52 African countries | Cross-section macro data | OLS and IV | M-finance and rule of law reduce inequality; inflation helps increase inequality. Controls for government expenditure and money growth. |
| Asongu (2013) | 52 African countries | Cross-section macro data; 52 countries | OLS | Mobile phone penetration helps growth; m-money increases access to informal finance but reduces access to formal finance. |
| Asongu et al. (2016) | 49 sub-Saharan African countries | Panel macro data for 13 years | Pooled Tobit estimators | Mobile phone penetration increases human development (UNDP: IHDI), especially where technical knowledge is high, but education (pupil–teacher ratio) reduces it. |
| Comninos et al. (2009) | 17 sub-Saharan countries | researchICTafrica household survey data | Descriptive | Mobile airtime is widely used and accepted as a means of payment. Mobile platform is an acceptable alternative platform to banking system. |
| Ghosh (2016) | 12 MENA countries | Panel macro data for 12 years | Panel 3SLS | Mobile phone penetration and financial inclusion increase growth. Relation between growth and mobile phone penetration is convex. |
| Sassi and Goaied (2013) | 17 MENA countries | Panel macro data for 49 years | Panel GMM | ICT penetration helps increase growth; financial development tends to reduce it; but ICT–financial development interaction increases growth. |
| Authors | Countries and Regions | Data | Method | Main Findings |
|---------|-----------------------|------|--------|---------------|
| Waverman et al. (2005) | 92 countries worldwide | Panel macro data for 23 years | Pooled OLS and panel GMM | Mobile phone penetration helps increase growth, especially in developing economies; mobile phones are substitutes for fixed lines in poor countries but are complements to fixed lines in wealthy countries. |

### 2.2 Mobile Technology, Financial Inclusion and Development: Single Country Studies

| Authors | Countries and Regions | Data | Method | Main Findings |
|---------|-----------------------|------|--------|---------------|
| Abor et al. (2018) | Ghana | Cross-section of household survey of 16,772 | Discrete choice: probit model and IV technique | Mobile phone ownership/usage is associated with higher income per capita and poverty reduction. No difference between households that are female- and male-headed in terms of benefits derived from mobile phones. |
| Aker (2010) | Niger | Panel data: survey of 415 traders in 2005 and 2007, and other primary and secondary data | Panel GMM: difference-in-difference model | Adoption of mobile phones reduces price dispersion with a larger impact for markets with higher transport costs. Mobile phones have a stronger effect on price dispersion once a critical mass of market pairs is reached. Mobile phones effective low-cost means of providing information. |
| Aminuzzaman et al. (2003) | Bangladesh | Cross-section survey of 350 village phone owners, operators and users by authors | Descriptive statistics | Education and occupation help explain ownership and use of mobile phones. Phone use increased access to information, improved communication between business partners and reduced need for journeys. Controls for age, gender and marital status. |
| Authors           | Countries and Regions                          | Data                                      | Method                     | Main Findings                                                                 |
|-------------------|------------------------------------------------|-------------------------------------------|----------------------------|------------------------------------------------------------------------------|
| Frempong (2009)   | Ghana                                         | Cross-section survey of 600 SMEs by the author | Descriptive statistics     | Mobile phones improved SMEs’ communications with suppliers and customers, and reduced need for journeys; controls for age, mobile phone ownership, education and transactions type. |
| Jensen (2007)     | Kerela, India                                  | Panel data: weekly survey of 300 fishing units from 1996 to 2001 by the author | Panel FE estimator; difference-in-difference model | Adoption of mobile phones by fishermen reduced price variations across regions; raised fishermen’s welfare and reduced waste in the industry. |
| Nzie et al. (2018)| Cameroon                                      | Cross-section data based on the survey by authors | OLS                        | Mobile phone breaks the monopoly structure of market information among vegetable farmers in Cameroon. However, this leads to a higher transaction cost. |

### 3.1 Mobile Money: Cross-Country Studies

| Authors           | Countries and Regions                          | Data                                      | Method                     | Main Findings                                                                 |
|-------------------|------------------------------------------------|-------------------------------------------|----------------------------|------------------------------------------------------------------------------|
| Coulibaly (2017)  | West African Monetary Union: (9 countries)     | Cross-section data (Findex and FinAccess) for 2014; 7008 observations | Probit and selection estimator | M-money users more likely to be female, younger, urban, less educated and poorer. M-money adoption also determined by distance to agencies and desire for greater financial freedom. |
| Evans and Pirchio (2015) | 22 countries: 14 African, 6 Asian, 1 Caribbean and 1 South American | Cross-section data (Findex, World Bank and country central banks) | Taxonomic and descriptive | M-money is more likely to take off with MNO-led, with an established mobile phone network, lower incomes, less infrastructure, bank branches and bank account penetration. |
| Gosavi (2015)     | Kenya, Tanzania, Uganda and Zambia             | 2013 Worldbank Enterprise Survey data    | Probit model               | Mobile money services are used by firms that are older, smaller which have bank accounts. |
Table A1. Continued

| Authors                          | Countries and Regions          | Data*                                      | Method                          | Main Findings                                                                 |
|----------------------------------|--------------------------------|--------------------------------------------|---------------------------------|--------------------------------------------------------------------------------|
| Issahaku et al. (2018)           | Ghana                          | Ghana Living Standard Survey Round Six (GLSSR6) household survey data 2012 and 2013| Propensity score matching procedure | Mobile phone ownership and use improve agricultural productivity in terms of higher yield. Phone ownership and use have higher impact than using of phone alone. |
| Robb and Vilakazi (2015)         | Kenya, Tanzania and Zimbabwe    | Panel-type data on mobile money use 2011–2015 | Taxonomic and descriptive       | M-money remittances are cheaper than other methods; non-price benefits of mobile payments are convenience, accessibility, safety and reliability. |
| Abiona and Koppensteiner (2016)  | Tanzania                       | Panel household survey data (World Bank Living Standard Measurement Studies) using two waves; 18,700 individuals | Panel linear probability model; IV with difference-in-difference model | M-money helps households mitigate negative shocks; smooth consumption and health expenditures; the poorest households benefit more during these periods. It has no impact on school expenditure or enrolment, but it reduces school absenteeism. M-money also has longer-run positive effects on financial inclusion. |
| Aker and Wilson (2013)           | Jirapa and Northern Ghana      | Cross-section interview survey of 97 individuals around Jirapa in 2012 by authors | RCT; analysis using descriptive statistics, OLS with treatment dummies | Free SIM cards, accessibility and trust promote take-up of m-money. Village meetings provide an alternative format for formal identification of users. Agent availability a major constraint on m-money use. |
| Authors                  | Countries and Regions | Data                          | Method                          | Main Findings                                                                                                                                                                                                 |
|-------------------------|-----------------------|-------------------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aker et al. (2014)      | Niger                 | Panel data: author-interview survey of 1081 households and village focus groups in three waves (2010–2011); and other primary data | RCT; analysis using two-period panels by pooled OLS with treatment dummies | M-money remittances have more impact on women’s lives. Mobile phones reinforce family, social and business networks. Controls for household characteristics, including gender, age, education, income, mobile phone ownership and usage. |
| Beck et al. (2015)      | Nairobi and Kenya    | Cross-section data (FinAccess) for 2014; 1047 SMEs | Probit with sector FE           | SMEs’ payments to suppliers more likely to be by M-Pesa if supplies bought on credit, and if business employs an accountant. Controls for business characteristics and education of owners. |
| Demombynes and Thegeya (2012) | Kenya               | Cross-section data (FinAccess) for 2010; 6083 individuals and 2692 M-Pesa users | Descriptive statistics          | M-Pesa used as a general repository for funds; and M-Pesa use associated with increased savings. M-Pesa users also save more in formal accounts. Documentation an important obstacle to m-money use by poorer households. |
| Economides and Jezierski (2015) | Tanzania            | M-money transactions among 1.4 m Tigo Telecom subscribers; 2012:12 through February 2013:02 | Censored regression using simulation moments; price effects simulated | A high proportion of transactions are self-transfers: deposits and later withdrawals by the same user despite high cash-out fees. Estimates of willingness to pay to avoid carrying cash when travelling (up to 1.24% of the amount per km) and to avoid keeping cash at home (up to 0.8%). Price discrimination is found. |
| Authors                  | Countries and Regions       | Data                        | Method                  | Main Findings                                                                                                                                                                                                 |
|--------------------------|-----------------------------|-----------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Eijkman *et al.* (2010)  | Kenya                       | Panel data: July–December 2009 | Descriptive statistics  | M-money supports liquidity management at lower cost for small traders. They can pay excess balances to agents at the end of each day and can self-transport cash, reducing costs and time of travel especially in rural areas. |
| Gosavi (2018)            | Kenya, Tanzania, Uganda and Zambia | Panel of 3000 firms from World Bank enterprise survey data | Ordered Probit model     | Firms that use mobile money are more likely to obtain bank loans/line of credit. Use of mobile money leads to stronger the use of formal financial institutions, such as banks. Mobile money contributes to the firms’ productivity. |
| Jack and Suri (2011)     | Kenya                       | Panel data: household interviews by authors in 2008–2010 and 2016 | Descriptive statistics  | M-Pesa users are more likely to be rich, younger, male, urban, educated and banked. M-Pesa leads to higher remittances, saving, investment, risk spreading and insurance. Agent availability and running out of cash are major constraints on m-money use. |
| Jack *et al.* (2013)     | Kenya                       | Panel data: household interviews by authors in 2008–2010 and 2016; survey of 7700 M-Pesa agents in 2010 | OLS with treatment dummies | M-pesa users make more remittances over longer distances and experience greater reciprocity than non-users. M-pesa users interact more with their personal networks and make larger transfers than non-users. M-pesa users use their accounts more regularly and suffer less from shocks, the closer is the proximity of the nearest agent. |
| Authors                  | Countries and Regions | Data                                                                 | Method                                                                                                                                                                                                 | Main Findings                                                                                       |
|-------------------------|-----------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Jack and Suri (2014)    | Kenya                 | Panel data: two-period panel of 2282 household surveys by authors in 2008–2010 | Panel OLS and IV with fixed time effects and a difference-in-difference model                                                                                                                           | M-pesa is used for risk-sharing through family and social networks. M-pesa users had a smaller cut in consumption after negative income shocks than non-users. Food consumption was unaffected for users and non-users. M-pesa users made more remittances over longer distances and experienced greater reciprocity. |
| Johnson and Krijtenburg (2015) | Kenya              | Cross-section data: 62 interviews stratified by poverty and ethnicity | Qualitative, descriptive and analyses                                                                                                                                                                      | M-money is a route to financial inclusion, through remittances, but not all interviewees wish to move to more use of formal finance. M-money transfer facilitates exchanges over long distances. |
| Ky et al. (2017)        | Burkina Faso          | Cross-section data: survey by authors in 2014; 500 households          | Logit estimators                                                                                                                                                                                        | M-money increases savings for rural, female, less educated, with irregular income. M-money users better insured against negative shocks. Users and non-users save equally for predictable events. |
| Mawejje (2017)          | Uganda               | Cross-section data (Finscope) for 2013; 1549 households                | Probit estimators                                                                                                                                                                                       | Financial inclusion helps coping strategies; households more likely to adopt market and less likely to adopt non-market strategies. But, m-money use has little impact on coping strategies or on the impact of shocks on consumption. |
| Authors                  | Countries and Regions | Dataa | Method                                      | Main Findings                                                                                                                                                                                                 |
|-------------------------|-----------------------|-------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mbiti and Weill (2011)  | Kenya                 | Panel data (FinAccess) for 2006 and 2009 | Descriptive statistics, Panel FE IV estimators | M-Pesa users are more likely to be urban, educated, banked and affluent. M-Pesa increases the use of formal finance and decreases the use of informal finance. M-Pesa caused cuts in the price of remittances by competitors. |
| Morawczynski (2009)     | Kibera (Nairobi) and Bukara (Western) Kenya | Cross-section data: 350 individual and 21 group interviews | Qualitative, descriptive and analyses | M-Pesa helps individuals and households to adjust and recover from temporary shocks more quickly and from longer term shifts in income or household circumstances. |
| Munyegera and Matsumoto (2014) | Uganda               | Panel household survey data (RePEAT survey for 2009 and 2012); 838 households | Panel Probit, and Tobit with treatment dummies | M-money adoption is determined by phone ownership and proximity to agents. Users more likely to be wealthier and educated. M-money is used for risk-sharing through family and social networks. Users had smaller cuts in consumption after income shocks than non-users. |
| Okello et al. (2018)    | Uganda                | Cross-sectional data of 400 samples from a survey by the authors | Regression analysis | Positive relationship between mobile usage and financial inclusion. Mobile money increases financial inclusion. Social network has positive effect on financial inclusion and can also moderate the relationship between mobile money usage and financial inclusion. |
| Authors                   | Countries and Regions            | Data                          | Method                        | Main Findings                                                                                                                                 |
|--------------------------|----------------------------------|-------------------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Riley (2016)             | Tanzania                         | Panel household survey data  | Panel FE estimator            | M-money facilitates higher consumption; households are insured against idiosyncratic shocks, because of sharing within social. For aggregate shocks, households with m-money are insured, but those without are not uninsured. |
|                          |                                  | (National Panel Survey); three waves of 3300 households | with difference-in-difference model |                                                                                                                                            |
| Sey (2011)               | Accra, Prampram and Apemanim, Ghana | Cross-section data: 17 author-interviews; June 2006–August 2007 | Qualitative, descriptive and analyses | Mobile phones offer ability to connect for multiple purposes. Seen as a means of nurturing kinship, friendship and business ties, which could also generate resources if needed. |
| Tobbin and Kuwornu (2011)| Ghana                            | Cross-section data: 298 interviews at shopping malls | Structural equation model      | Intention to adopt m-money determined by trust, risk and ease of use.                                                                           |
| Yenkey et al. (2014)     | Kenya                            | Cross-section data (FinAccess) for 2012; 6100 individuals | Descriptive and taxonomic      | M-Pesa used mainly for remittances and interaction with informal finance.                                                                       |
| Yenkey et al. (2015)     | Kenya                            | Cross-section data (FinAccess) for 2012; 6100 individuals | Logit and ordinal logit estimators | Later adopters of M-Pesa more likely to be rural, unbanked or female. M-money use is a substitute to informal finance and does not lead to increased use of formal finance. |

**Notes:** This table summarizes the elements of the main empirical studies cited in the paper. In this table, we report only those studies where empirical data have been used to test or explore hypotheses. Full details of the authors and their papers are given in the references. For RCTs, the data described are that collected during and after the trial(s) and subsequently analysed to determine its impact.

For household survey data, where the number of available observations is different from those actually used in the research, we report the number used in the research.

SMEs, small and medium-size enterprises; OLS, ordinary least squares; FE, (group) fixed effects; RCT, randomised control trial; M-money, mobile money; M-Pesa, the name for Safaricom’s mobile money accounts in Kenya.