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Innovations in emerging markets: the case of mobile money

Adeline Pelletier,[1] Susanna Khavul ,[2] and Saul Estrin [3]

[1]Institute of Management Studies, Goldsmiths University, Centre for Economic Performance, London School of Economics, London. e-mail: a.g.pelletier@lse.ac.uk, [2]Lucas College and Graduate School of Business, San Jose State University, Department of Management, London School of Economics. e-mail: susanna.khavul@sjsu.edu or s.khavul@lse.ac.uk and [3]Department of Management, London School of Economics. e-mail: s.estrin@lse.ac.uk

Abstract

Mobile money is a financial innovation that provides transfers, payments, and other financial services at a low or zero cost to individuals in developing countries where banking and capital markets are deficient and financial inclusion is low. We use transaction costs and institutional theories to explain the growth and impact of mobile money. Having developed a new archival dataset that tracks mobile money deployment across 90 emerging economies during 16 years between 2000 and 2015, we address the question of relative economic impact of the banking and telecoms sectors in the provision of mobile money. We show that telecom groups and not banks are more likely to launch mobile money in countries where legal rights are weaker and credit information less prevalent. However, it is when mobile money is offered via a banking channel that the spillover effects on the economy are greater. Findings have significant implications for policy and strategy.

JEL classification: F63, G21, M13, O33

1. Introduction

People in developed economies usually have access to financial services via a variety of institutions, through which they securely spend or save money. Indeed, access to financial services is an important institutional foundation to the efficient functioning of the market economy (North, 1990; Greenwald and Stiglitz, 1992). However, in developing economies, institutional barriers significantly raise the cost of providing financial services (Khanna and Rivkin, 2001; Khanna and Palepu, 2006, 2010; Mair and Marti, 2009). One important consequence is that approximately half of the population in developing economies is not integrated into the financial system and are "financially excluded" (Beck *et al.*, 2008; Demirguc-Kunt *et al.*, 2018). When people are financially excluded, they cannot easily or cheaply smooth their income and spending over time, rendering them vulnerable to market shocks or personal dislocations (Collins *et al.*, 2009). Moreover, those living in poverty feel the impact disproportionately. Historically, providing financial services to this population created higher levels of risk and greater information asymmetries for financial institutions (Banerjee and Duflo, 2011). Therefore, people excluded from financial services have had to disproportionately rely on cash. Money, and particularly cash, is less efficient, costlier to store, and more dangerous to transport for individuals than for financial institutions (Keynes, 1930; Prahalad, 2006). Moreover, those excluded from

the financial system use costly informal financial alternatives provided by moneylenders or make physical cash transfers to undertake transactions over space and time (Besley, 1995, Beck *et al.*, 2009).

Recently, this situation has begun to change (Goedhuys, 2007; Jack and Suri, 2014; Suri, 2017). The evolution of information and communication technology (Aboal and Tacsir, 2018) has led to the provision of mobile money: a potentially transformational innovation that offers low cost transfers, payments, and financial services (Aron, 2015; Dodgson *et al.*, 2015). Mobile money products have put financial services onto mobile phones and hence into the hands of a much wider segment of the population (Jack and Suri, 2011). As a result, mobile money diffused widely across developing economies over the last 10 years. The best known of these, M-Pesa, was introduced into Kenya by Safaricom in 2007, and by 2011 was processing more transactions domestically than Western Union did globally (IMF, 2011: 50). M-Pesa offered a cheap and efficient way to transfer money and to make payments, especially for workers who had to send home remittances. Its large networks of agents make payment facilities accessible to more than 90% of Kenya's adult population. Similarly, in the Philippines, mobile money was introduced through the entry of SMART-Money in 2000 and Globe Telecom, which in 2004 offered G-Cash. In 2016, mobile money services were offered in 90 emerging countries, with 500 million accounts leading to 43 million transactions per day (GSMA, 2017a).

However, high transaction costs still permeate most economic exchanges in developing countries (Khanna and Palepu, 2006; Khanna and Yafeh, 2007; Fainshmidt *et al.*, 2016) notably in the financial services sector (Khanna and Rivkin, 2001; Khanna and Palepu, 2010; Khavul, 2010). Hence, the introduction and spread of mobile money may create new commercial opportunities and increase the convenience and security of transactions (Mbiti and Weil, 2013). In addition, the use of mobile money may facilitate the integration of economic activities from the informal to the formal financial system, which may result in further positive spillover benefits for broader economic growth (Levine, 1997; Raj, 2015).

In fact, despite the potential significance of this innovation, our understanding of the forces driving the successful launch of mobile money remains preliminary (Duncombe and Boateng, 2009; Dodgson *et al.*, 2015). For the most part, the literature has concentrated on excellent but single country studies about user adoption or specific regulatory or institutional issues in important but isolated geographies (Porteous, 2006; Hughes and Lonie, 2007; Chatain *et al.*, 2008; Jack and Suri, 2011, 2014; Mbiti and Weil, 2013). Thus, as yet, there are few studies that examine in depth the factors explaining the spread of mobile money or the form that the diffusion takes in different institutional contexts (Boor *et al.*, 2014). Moreover, though the literature has considered the impact of mobile money on financial inclusion (Klein and Meyer, 2011; Dermish *et al.*, 2012; Suri and Jack, 2016), the broader impact of this innovation on the development process, and its conditionality on the forms that mobile money has taken, remains to be explored.

Therefore, in this article, we deepen the analysis of mobile money by considering for the first time how firms compete to introduce and diffuse mobile money. We focus primarily on the differences between firms in the international telecommunications (telcos) and banking (banks) sectors across a wide variety of countries. We develop hypotheses about the relationships between the different business approaches of banks and telcos to mobile money and the resulting heterogeneity in the diffusion process. We test these ideas using a new dataset we have constructed; a novel panel that captures the provision of mobile money by nearly 259 firms across 90 emerging economies during the 16-year period between 2000 and 2015.

We focus on two related research questions. First, what explains the introduction and diffusion of mobile money? Mobile money is typically associated with lower levels of economic development, but there is considerable heterogeneity in its prevalence and form across countries (Bamberger and Ang, 2016). This leads us to consider whether firms from the banking or the telecommunications sector are better able to address the institutional complexities of financial innovation in developing countries, and how the relative advantages and disadvantages of each are contingent on the institutional and policy context. Second, we explore how the spread of these different models for mobile money affects the generation of economic spillovers, in terms of volume and frequency of financial transactions in the local economy. That is, in the provision of mobile money systems, are the spillover effects on national economic performance contingent on whether banks or telecoms companies drive the innovation?

Unlike mobile telephony, which has gradually diffused starting in developed economies and increasingly throughout the world (GSMA, 2017b), mobile money services were initially introduced in OECD countries, then closed, and have since taken decades to revive (GSMA, 2017a). However, mobile money is much more common in many, though not all, developing economies, especially in Africa (Linklaters, 2017) and parts of South East Asia and Latin America (Aron, 2015) where there is considerable country-specific heterogeneity in the form and quality of institutions (Estrin *et al.*, 2019). Moreover, the channel through which mobile money is provided also varies greatly from country to

country (Camner, 2012) and as a result, mobile money is positioned at a complex sectoral and regulatory interface between the telecommunication and banking sectors (Porteous, 2006; di Castri, 2013). In some places, like Kenya (Jack and Suri, 2014), Tanzania, Brazil, or Iran, the dominant service provider is a telecommunication company (telecoms); in others like Bangladesh, Nigeria, or Argentina, it is a bank. In a few places, like India and South Africa, both co-exist and share the market (GSMA, 2017b). While regulatory arrangements are surely relevant (Klein and Meyer, 2011), we argue that it is also very important to understand what systematic national characteristics, for example level of development, infrastructure, institutions, or geography, are driving country-level heterogeneity in the channel of mobile money provision across the two sectors. Moreover, we explicitly consider how the existing and evolving capabilities of banks and telecoms foster the introduction and adoption of mobile money.

Our second research question concerns the economic impact of the mobile money phenomenon. It is widely argued that the evolution of the financial sector is key to development because it accelerates and stabilizes the process of national economic growth (Levine, 1997; Beck *et al.*, 2009). Mobile money could be particularly significant in this respect because it reduces the transactions costs of engaging in the market economy and given that it engages a large number of businesses and consumers who were previously excluded or marginalized by their reliance on cash and their limited liquidity. The development policy literature has also placed emphasis on mobile money as a tool to facilitate financial inclusion and thereby to reduce poverty and inequality (Jack and Suri, 2011; Demirgüç-Kunt *et al.*, 2015, 2018; Raj, 2015).

We establish that systematic national characteristics do in fact play a significant role in determining whether telecom groups or banks are the main providers of mobile money in different countries. By exploiting their existing network of agents, telecom groups reach the new market opened up by the lower transactions costs of this technology more cheaply, often bringing into the system hitherto financially excluded individuals and firms. In contrast, banks need to build up a new structure of agents and may face greater levels of regulation. Thus, we show that telecom groups, rather than banks, are more likely to launch mobile money in countries where legal rights are weaker and credit information is less prevalent. However, we have also found that mobile money systems based on banks may have a greater impact on economic development than those based on telecom groups, because banks offer a wider range of products and their activities can stimulate a money multiplier.

To begin, we examine theoretically the diffusion and impact of mobile money (Section 2). We then introduce our dataset and methodology (Section 3) before presenting our results (Section 4) and concluding with policy implication (Section 5).

2. The spread and impact of mobile money: the competing capabilities of banks and telecoms

Prior to the introduction of mobile money in developing economies, the transaction costs of both delivering and using financial services was high (Jack and Suri, 2011; Mas and Klein, 2012; Weil *et al.*, 2012). The economics literature has stressed the impact of high costs of coordination between individuals, between firms, their suppliers as well as buyers. In addition, the leakage costs of undertaking transactions can be attributed to corruption and reliance on middlemen and the informal system of money transfers that are costly, and insecure (Aron, 2015, 2018), and expose individuals and firms to significantly higher risks of outright theft or extortion.

Traditional branch banking business in developing countries had limited reach and lacked the dynamic capabilities to change. Indeed, the geographic and population coverage of bank networks was concentrated in a few large cities and served individuals of high net worth or formal businesses (Claessens, 2006; Beck *et al.*, 2008; De Castro *et al.*, 2014). This was largely because the costs of creating and running a branch-based banking network rise considerably as population density falls or in countries where the proportion of the population living in urban areas is relatively low, as is common in developing economies (Mills and Tan, 1980). Moreover, high transactions costs have meant that banks have found it difficult to offer services that are profitable to the bulk of the population in developing countries, in part because of the low savings rate of low-income populations (Prahalad, 2006; Banerjee and Duflo, 2011). The banking network therefore provided only partial coverage by population and geography, foregoing significant potential positive network externalities. Banks had well-entrenched organizational capabilities focused on delivering financial services to narrow segments of the population. These ordinary capabilities conformed to existing business models and largely performed their intended function (Helfat and Winter, 2011; Teece, 2019). Initially, they did not seek opportunities to develop dynamic capabilities that would allow them to identify the needs

of a different group of customers nor mobilize resources in order to capture value from the emerging mobile money innovation. In many countries, banks put up a significant resistance to the introduction and diffusion of mobile money systems. They were not ready for the transformational change this would entail (Teece, 2018, 2019).

The initial opportunity to introduce mobile money to a larger population did not come through established local banks or the financial sector but rather through the entry of international telecommunication firms. The core capabilities of telcos differ from those of banks and the incentives for exploiting the new mobile moneys technology created radically different consequences from the point of view of transactions costs in their business models (Teece, 2010, 2019). The difference becomes apparent when we analyze value creation and value capture. Specifically, *value creation* reflects how banks and telcos engage with customers and *value capture*, how they monetized value (Baden-Fuller and Haefliger, 2013: 420).

For banking groups, undertaking the provision of mobile money services conflicts with the established capabilities of the traditional banking business model, which is based upon intermediation and interest margin profits with the former established typically in developed economies through a local branch structure.[1] The firm capabilities required for this model differ from those associated with the provision of mobile money because mobile money transfers are a high volume, low value transaction business. Telcos, on the other hand, are better positioned from the outset for the provision of mobile money. As Donovan (2014: 2) points out, "telecommunications is transaction based, meaning revenue comes from a fee on each transaction; banks are float based, earning money through holding deposits." For this reason, small transfers are easier to monetize by firms in the telecom, rather than banking sector. For mobile operators in developing countries, their usage-based revenue model implies that each transaction is profitable on a stand-alone basis. In contrast, customers in developing markets represent relatively high operating costs for banks, in terms of monitoring their banking activities, compared to the revenues that can be generated from reinvesting the small value of their deposits. In addition, banks have traditionally adopted a "brick and mortar" approach, setting up branches to serve local customers, which is costly in countries with sparsely populated rural areas, thus limiting their outreach. This approach limits banks' ability to detect opportunities and capture value in the mobile money space. In addition, banking regulation, in particular anti-money-laundering, "know-your–customer," rules, constrain banks' appetite and ability to deal with risks. We argue that this is especially true in economies in which missing institutions weaken capital market development. Even so, regulatory authorities may sometimes favor banks over telcos in mobile money provision. In the next section, we argue that missing institutions create different environmental conditions and incentives for entry and provision of mobile money by international banks and telecoms groups.

2.1 Innovation, transactions costs, and weak institutions

As we have noted, the constraints on the provision of financial services primarily bind in developing countries; however, developing countries are not homogeneous in their institutional contexts (Wright *et al.*, 2005; Estrin *et al.*, 2019). The transactions cost approach to this issue is referred to as the missing institutions (institutional voids). This literature analyzes the gaps in market-supporting infrastructure that can limit or prevent the arms-length contracting underpinning market transactions (Khanna and Palepu, 2006; Khanna and Yafeh, 2007; Gao *et al.*, 2017). Missing institutions are particularly prevalent in the financial services sector because of the high risks and asymmetries of information that require complex contractual arrangements and effective enforcement (Khanna and Rivkin, 2001). Our hypothesis in this section concerns the ways that missing institutions affect differentially the way that transactions costs for financial services change because of the provision of mobile money when undertaken by banks or by telecommunication providers.

Consider the impact of institutional environments on the relative transactions costs of introducing mobile money for firms in these two sectors. Banking relies on standardized processes primarily operating through a branch network to evaluate lending risks, combined with a significant degree of collateralization via the borrower's assets to limit losses in the case of default. Indeed, banks are regulated closely to ensure that they evaluate carefully the risks within their own portfolio and maintain adequate liquidity for their risk profile. When banks enter overseas jurisdictions, they have to examine closely the impact of the new legal systems on their risk profile and their capital adequacy ratios. Weak protection of legal rights or ineffective enforcement of contracts raises their risks, leading them to hold more liquidity, which increases the costs of doing business and reduces profitability. Such risks are further raised

1 Banks are now increasingly diversifying into web-based provision, but that is not in the remit of this article.

when we consider innovations such as mobile money services, especially in situations where loans are available through the mobile provider, because the standard mechanisms of risk assessment cannot be applied.

Hence, banking groups considering the introduction of mobile money face three fundamental issues. The first is the impact of institutional voids on risk assessment and Know Your Customer (KYC) requirements might generate costs that more than offset the benefits from market growth because the costs of screening customers are raised. The second relates to regulation, because any additional business generated is subject to the same regulatory scrutiny as their other, higher margin, lower volume activities. Finally, banks rely on expanding business to spread around the large fixed costs of their branch network and rely on high margins or commissions rather than low margins but high volume of transactions.

By contrast, telecoms groups do not face such costly barriers to entry, because their infrastructure is different, benefitting from a pre-existing airtime distribution network which is directly linked to the development of mobile money, and because missing institutions do not create such insurmountable hurdles for them. Telecoms groups do not fall under banking regulations and in countries where they are allowed to offer mobile money and transfer services, although they may be regulated by specific mobile money directives or regulations, these are less demanding than full banking licenses, especially in terms of KYC requirements (Pelletier *et al.*, 2019). In addition, the type of financial service that they can offer is generally limited to transfer and payments. This limits both the risk of default ("bank runs") and the risk of financial contagion via other banking products is limited. Consequently, the additional risks to the revenue base of telecom groups posed by missing institutions, such as weaker legal rights, are much less than for banks. In fact, in the provision of mobile money services, the risks of fraud or payment uncertainty are automatically constrained because telecom groups can monetize value based on transaction fees that are charged to the customer at the time of the exchange. Low depth of credit information is also not a deterrent for telecom groups who often count as telecommunication customers those without formal credit histories well ahead of creating value for them with mobile money services. As such, they already have "telecommunication" information on these registered mobile phones customers. Specifically, in many developing economies, those who live in poverty purchase mobile telecommunication services on a pay as you go basis by using prepaid cards. Furthermore, by tracking the purchase histories of telecommunication customers and tying these to specific phones, telecom groups over time can create meaningful profiles of millions of their customers. Such information can complement or substitute for low depth of credit information, the standardized information underlying banking procedures. Telecom groups rather than banking groups can therefore compensate with internal structures for the lack of credit information because they create value for the mobile customer through their core telecommunication services. Thus, we predict:

H1: Telecoms groups are significantly more likely than banking groups to set up mobile money services in countries where institutions are weaker.

2.2 The impact of mobile money in developing economies: spillovers and sectoral effects

2.2.1 The transactions and savings effects

We have seen that the institutional context combines with sector-specific business capabilities to generate different incentives for banks and telcos in the introduction of mobile money. This difference concerns the private returns to the companies involved in bringing the innovation to market. However, mobile money may also have a broader economic impact that, even if not captured by the providers, can improve the economic performance of the host countries (Meyer and Sinani, 2009). We therefore now analyze the mechanisms driving these spillovers; in particular, how differences between firms in the banking and telco sectors lead the external benefits from the introduction of mobile money to differ according to which introduces mobile money.

Money has long been understood to play a special role in the economy. It is sought not as a good in its own right but as a facilitator of market transactions (Keynes, 1923). This characteristic also applies to mobile money. Allen (1999) points out that there are costs resulting from the transfer of property rights between firms or individuals from the process of market exchange. When the returns from buying and selling capital assets are small, relative to the costs of trading goods, individuals will hold cash balances, even though they yield zero return (Hicks, 1935). In other words, frictions in the economy determine the demand for money and these "costs of trading" (Demsetz, 1964) are contingent on the transaction technology (Pesaran and Timmermann, 1994; Jouini and Kallal, 1995). High costs of

trading increase the demand for money, while improvements in transactions technology reduce it. When a technological advance lowers the demand for money, the given money stock, determined by the central bank, can in principle be used more intensively to facilitate economic transactions. This is referred to as increasing the velocity of money. This process of increasing the demand for money therefore provides an economy-wide external benefits through what is, in effect, an injection of liquidity; the so-called "transactions effect" (Thornton, 1983).[2]

However, there may be also a countervailing spillover effect through the impact on savings; the "savings effect." Thus, in addition to facilitating transactions, mobile money may also provide a safe way for people to save, and thereby facilitate and encourage individuals and businesses to save. Under this countervailing effect, if the share of a given stock of money used for savings is increased, the amount left for transactions is reduced and so the velocity of money will fall. This will have a dampening effect on the economy. The net effect of mobile money on the broader economy depends on the balance of these two effects. If mobile money is primarily used as a way to save, the positive spillover benefits on GDP via the transactions effect could be reduced or even eliminated.[3]

The empirical evidence to date about the balance of these two effects is based on single country studies and identifies an increase in both the propensity to transact and to save (Jack and Suri, 2011; Mbiti and Weil, 2011; Blauw and Franses, 2016; Kochar, 2018; Riley, 2018). For example, Jack and Suri (2011) find that M-Pesa users sent and received remittances more frequently than nonusers and were more likely to use a bank account to save. Furthermore, M-Pesa users who own a bank account are much more likely to save using M-Pesa than those who do not. Mbiti and Weil (2011), using data from two waves of individual surveys on financial access in Kenya (Finaccess survey[4]), have similar findings, namely that increased use of M-Pesa lowered the propensity of people to use informal savings mechanisms, and raised the probability of being banked.

Since the transactions and savings effects have the opposite impact, it is important to consider which will predominate. In the context of developing economies, with initially low levels of financial development and personal savings and high numbers of informal transfers (remittances transferred informally, and in-kind type of remittances), the transaction effect seems likely to predominate. This judgement is reinforced by the fact that there are relatively low limits on the account size within mobile money, which effectively places a cap on mobile savings. In addition, the predominance of the transaction effect may be particularly marked if the alternatives to mobile transactions are less attractive than the alternatives to mobile savings. In practice, while there are few alternatives to mobile transactions for the financially excluded, there are many alternatives for private savings such as Rotating Savings and Credit Association, gold or cattle. Hence, we propose:

H2: An increase in the number of mobile money services in an economy leads to an increase in the total value of transactions in that economy.

2.2.2 Spillovers from mobile money by banks and telcos

Telcos are often limited in their product offers by the fact that they do not have a banking license while banking groups, which traditionally rely on cross selling through their branch network, are able to offer a larger range of mobile money services than can telecom companies (loans, insurance, etc.). Of course, some of these additional services will generate a savings effect but in practice, the wider product range is related to more differentiated transactions products and as such stimulates a positive transactions effect on GDP.

There is a second mechanism by which banking and telecom groups may differ in terms of the spillovers they generate, which operates via their differential impacts on the supply of money. It is generally required by national regulations that nonbank mobile money providers maintain liquid assets equal in value to the amount of money issued electronically. Hence, any money that goes through the mobile money system must be backed 100% by the pooled account (di Castri, 2013). This must be held, ring-fenced, in an account at a fully prudentially regulated institution.

2 In contrast, innovations that lower the cost of holding money, relative to nonmonetary assets should have the converse effect, reducing the frequency of transactions; an hypothesis confirmed by Bordo and Jonung (1987, 1990).

3 As an example of the two effects, Mbiti and Weil (2013) have shown that in Kenya, some users are keeping their cash on phones for significantly longer than 1 week. A simple deposit-transfer-withdraw transaction might involve e-money being created (in the sense that it is transferred from an agent to a customer), transferred, and extinguished (transferred back to an agent's phone) in much less than a day.

4 http://fsdkenya.org/finaccess/

Therefore, telecom mobile money providers are not able to create additional money through intermediation, namely by expanding their volume of loans in an economy based on the deposits that they have accepted.[5] This contrasts with banks, which are only required through regulation to keep a relatively small proportion of their overall deposits in liquid form. Instead, they are allowed to use the remainder of their deposits to expand their loan portfolio, the so-called "money multiplier." Thus, banks are able to create new money based on mobile money deposits while telecom groups cannot.[6] We therefore hypothesize that bank-led providers will have a greater impact on economic transactions than telecom-led providers, both through the larger variety of products they offer and through their ability to on-lend deposits.

H3. The positive spillover effects from the number of mobile money services to the economy are more pronounced for services launched by banking groups than for those launched by telecom groups.

3. Data and methods

3.1 Data

We have drawn on multiple sources to construct a unique archival dataset about the prevalence of mobile money. The resulting panel data covers 90 developing economies containing 259 providers over 16 years, 2000–2015. The database was constructed by combining information from Global System for Mobile Communication Association (GSMA) (www.gsma.com),[7] ownership information on the companies providing mobile money services derived from the Orbis database, and national economic and institutional data. The GSMA Mobile money for the Unbanked Deployment Tracker (MMU) monitors the number of live and planned mobile money services in developing countries and contains information on both foreign-owned and domestic organizations which have launched a mobile money service, the launch date of the service, the products offered,[8] and the company partners (technology partners, bank partners, Western Union, etc.). We use ownership information from Orbis to separate mobile money providers into two categories, firms ultimately owned by a banking group or by a telecom group. We also identify a third category, firms owned by independent mobile money providers.[9] Our analysis above suggested that telcos may have advantages in introducing mobile money and there is evidence for this in the data. Thus, we can see from Figure 1 that telecom providers are the larger player on the mobile money market globally; in our sample, 59% of mobile money services are provided by telcos, 23% by banking groups, and 18% by third party providers. Pelletier *et al.* (2019) argue that fast penetration of mobile phone technology, limited prior access to formal banking services, and significant flows of money transfers such as workers' remittances facilitated the spread of mobile money services in countries with low levels of development and with a relatively large population. They also provide further descriptive information about the factors associated with mobile money prevalence, the choice of banking or telco as provider and the services offered. To examine the impact of contextual factors empirically, we collected a large variety of data about economic and institutional conditions in the 90 countries of our sample from the IMF (World Economic Outlook and IMF International Financial Statistics), the World Bank (World Development Indicators), and the Heritage Foundation (Economic Freedom indicators).

3.2 Data and model specification and methodology for mobile money provision model

In our approach, we consider how heterogeneity in institutional quality affects the spread and impact of mobile money. Hypothesis 1 explores the way that the variation in institutional contexts might differentially affect the diffusion of

5 The exception is when they partner with banks to offer mobile loans such as the MShwari loan products, which is offered through a partnership between CBA Bank and MPesa in Kenya.

6 To the extent that they are required to deposit customers' funds in a bank however, the value stored as e-money will lead to money creation if this bank then provides loans to borrowers with the deposits they have accepted (di Castri, 2013).

7 Through its MMU; http://www.gsma.com/mobilefordevelopment/programmes/mobile-money-for-the-unbanked/insights/tracker

8 These include: air time top up, bill payment, p2p transfer domestic, other bulk payment; merchant payment, product g2p, mobile microinsurance, international remittances, loan disbursement/repayment, and link to other banking products.

9 For instance, Zoona in Zambia, Afrimarket in Senegal, Cote d'Ivoire, Benin, and Togo.

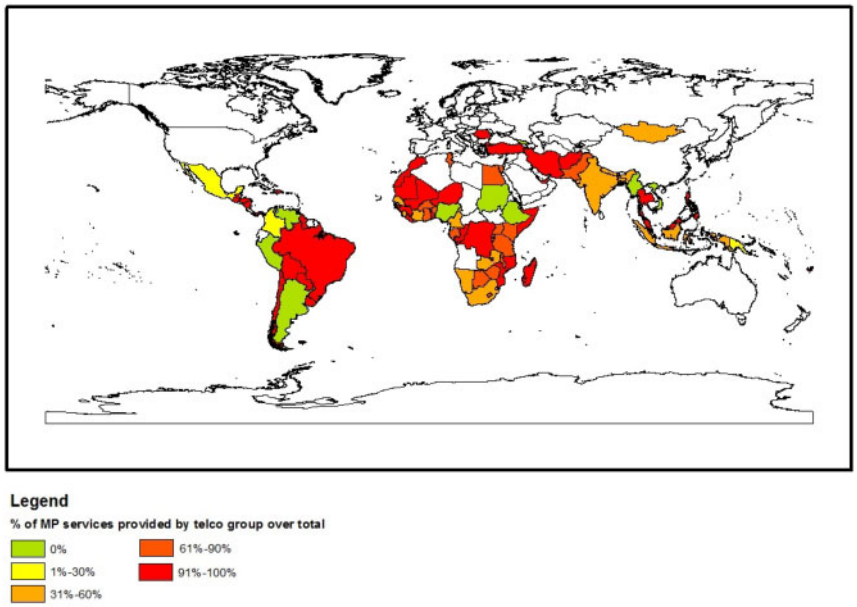

Figure 1. Geographic mapping of mobile money services in emerging and developing countries.

mobile money contingent on whether the firm is in the banking or telecommunications sector. Given that we want to understand how institutional contexts affect mobile money provision, the appropriate sample for testing hypothesis 1 is the set of firms that make choices about (country) entry and mobile money provision dependent on institutional context; this is the foreign banks and telcos. Specifically, we model the impact of institutions of on mobile money provision by analyzing the choice of location by each bank or telco for mobile money services across countries, each representing a different institutional alternative context.[10] We also distinguish between the decision of a bank or telecom operator to enter a particular country and their subsequent choice to launch a mobile money service in that location. These two decisions are not necessarily explained by the same factors, and therefore not all banks and mobile operators offer mobile money. For example, a bank may enter a country which has close historic or economic links to the home economy, but be motivated subsequently to offer mobile money because, for example, of a booming market in migrant worker remittances. A telecom firm may be given generous terms for entry in the auction for radio bandwidths, but then may consider that mobile money provision weakens its strategy and brand in that country.

Our empirical approach is to treat the two decisions as linked but separate. We therefore examine the determinants of the launch of a mobile money service in a given country, conditional on the firm having already entered the country to provide another service. Our sample of firms offering mobile money services is therefore nonrandom, because the outcome "launching a mobile money service in a country" is only observed when the outcome "entering the country" (to open a bank subsidiary or a telco operation in that location) has also been observed. We employ a two-step method. First, we estimate separately the determinants of entry for banking and telecom groups, using conditional logit estimation methods because the observations are not independent (Greene, 2011). We perform Chi-square tests to examine whether the coefficients on the host country variables are significantly different between the bank and telco samples. If the coefficients are not significantly different, we conclude that the two groups of foreign subsidiaries are attracted by similar country characteristics. This would provide reassurance that sample selection is not biasing our results when comparing the host country determinants of the launch of mobile money between telecoms and bank subsidiaries.

In our second step, we compare two types of foreign firms: the foreign banks and telecom subsidiaries who entered a given host country but did not launch a mobile money service, to the foreign banks and telecom subsidiaries

10 Firms restricted to the domestic economy do not make these cross-country location choices and so are excluded from the sample in this analysis.

who entered the same host country and did launch a mobile money service. To that end, we use a simple logit equation with the dependent variable, *launch choice*, being coded as 0 when a foreign subsidiary (bank or telco) has not launched a mobile money service and 1 when it has launched a mobile money service. In this step, we use two subsamples of our dataset, one composed of 109 foreign bank subsidiaries and the other composed of 157 foreign telco subsidiaries in 90 different countries. The traditional methodology for examining the determinants of location choice in the second step is to use a conditional logit (C-logit). In this type of model, the coefficients reflect the attractiveness of locations to the firms in the respective samples. Thus, for every possible firm-host country dyad, the dependent variable of investment location choice takes the value of 1 if the pertinent country is chosen by the firm, and zero for all other countries.

For the first step, we introduce a standard set of independent variables as used to analyze foreign entry (e.g., Estrin *et al.*, 2018). Thus, we follow international trade and migration research (e.g., Bernard *et al.*, 2011; Chaney, 2014) and code geographic *distance*, in logs, between the most populated cities in kilometers (thousands), and sourced from the GeoDist database made available by Mayer and Zignago (2011) (see Table A.1 in the Appendix for a full list of variable definitions). Given the importance of language patterns in the costs factors shaping trade and investment (Rauch, 1999; Selmier and Oh, 2013), we further control for *common language*, a dummy variable which takes the value of 1 if home and host countries have the same official language and 0 otherwise, using data from CEPII. We also introduce the GDP per capita of the host economy in 2007 (World Economic Outlook, IMF) to capture levels of development and host economy labor costs; ceteris paribus, a given level of labor force skill will be less attractive in countries with higher income per capita.

We further include *population* of the host country in 2007 as a standard proxy for the size of the market (Loree and Guisinger, 1995), with data obtained from the World Bank's World Development Indicators, introduced in 100,000 s, and using logarithms to ensure normality. *Population density* is also included (World Development Indicators, 2015) since a sparser population since a sparser population may increase the demand for cheap and efficient money transfer services. This is especially relevant for countries with major labor migration flows that generate high volumes of remittances. Given its importance in our empirical discussion above, we also include a measure of *personal remittances* received in the host country (as a percentage of GDP) from the World Bank Development Indicators. Institutions have also been key in the analysis of location choice (Peng *et al.*, 2008) so we include three variables capturing the quality of the institutions. We introduce the *polity index*, which is a measure of the market-supporting character of the political regime and ranges between −10 (total autocracy) and 10 (total democracy) (Acemoglu and Johnson, 2005; Acemoglu and Robinson, 2012). This is extracted from the Polity IV database. In addition, to address the issue of financial development (Claessens and Laeven, 2004) we introduce an indicator of *financial freedom*, measuring banking efficiency as well as independence from government control and interference in the financial sector, and ranging from 0 (repressive) to 100 (negligible government intervention). Finally, we include an indicator of *freedom from corruption* (Estrin *et al.*, 2018), which ranges from 0 to 100. Both the latter indicators come from the Heritage Foundation. We select all the host country variables for the year that the firm (subsidiary) was incorporated (year of entry). We cluster the standard errors at the firm level to correct for the presence of within cluster correlation.

In the second step equations, which we use to test Hypothesis 1, we consider only the firms that had entered a given host country, using a logit estimation method to compare firms that launched a mobile money service to firms that did not.

$$\log\left(\frac{p}{1-p}\right) = \alpha + X^{c}_{t-1} + Z^{c}_{t-1} + \delta^{r} \quad (1)$$

Where p is the probability that the event Y (launching a mobile money service) occurs, $p(Y=1)$. X^c are host country determinants capturing the strength of institutions, lagged by 1 year before launch, Z^c is a vector of control variables at the country level, lagged by 1 year before launch and δ^r is a set of regional dummies.

In this equation, our independent variables include both variables upon which we have hypothesized and control variables. We operationalize the former—indicating the strength of institutions in Hypothesis 1—with three measures which the literature has identified as being critical for the provision of financial services (Claessens and Laeven, 2004; Khanna and Yafeh, 2007). These are the *strength of legal rights*, the *depth of credit information*, and the *levels of corruption*. To measure the strength of legal rights, we use the World Bank's "strength of legal rights index" (0 = weak to

12 = strong; World Bank, World Development Indicators, 2015). For the availability of credit information, we use the World Bank's 'depth of credit information index' (0 = low to 8 = high; World Bank, World Development Indicators, 2015); and to measure corruption, we use the "index of control of corruption" (−2.5 = weak control to +2.5 = strong control), also from the World Bank (World Bank, Worldwide Governance indicators).

Some of the factors such as the size of the market, factors underlying the costs of entry and the institutional quality, affect both the choice to enter a country and the choice to set up a mobile money service. Hence, we use as control variables some of the factors that were found to influence location choice in the first step equation, namely *population*, *population density*, *common language*, *distance*, *remittances*, and *financial freedom*. However, the location choice to enter is not driven by exactly the same factors as the decision to supply mobile money, and we include some variables specific to the mobile money launch choice and whether this is undertaken by banks for telcos. The first of these is an indicator of the *size of the shadow economy* (Schneider, 2012), because, as we have noted, higher informality generally translates into fewer banked individuals and companies and this may increase the demand for mobile moneys. The *regulatory environment* as it affects mobile money is also clearly an important factor in the mobile money launch decision. While some countries, such as Kenya and Tanzania, have adopted an enabling legal and regulatory approach for telecoms to provide mobile money services, others, such as Bangladesh, have favored a bank-led approach. These regulations will determine in part whether the provision of mobile money is led by banks or by telecoms. The GSMA has created a dummy indicator of an "enabling regulatory approach" defined as "a functional and proportional regulatory approach that allows banks and non-bank providers to compete as well as to establish different types of partnerships for the provision of mobile money services." In essence, this dummy indicates to what extent telecoms are allowed to operate in the mobile money space.[11] We propose that less government control and interference in the financial sector will be favorable to bank entry as well as to the development of bank products.

We also include the *total number of mobile money providers* (foreign and domestic) in a given host country 1 year before product launch. This variable, indicating the maturity and degree of competition within the mobile money market in the host economy, might influence the decision by a potential entrant to launch a mobile money service; more competition might deter entry. In addition, in a subsequent estimation, we decompose this measure into four subcomponents: the total number of mobile money services provided by foreign banks, foreign telecoms, domestic banks, and domestic telecoms. Finally, we include a set of *regional fixed effects* (sub-Saharan Africa, East Asia, Europe/Central Asia, Latin America, Middle East/North Africa, and South Asia being the omitted dummy) to take into account regional differences in the institutional, economic, and cultural context which may influence the diffusion of mobile money.

One might also be concerned about endogeneity in this specification related to reverse causality; namely, when banks or telecoms launch mobile money services, this will lead to an alteration of our country-level variables, in particular the institutional ones. An example might be the amendment of national regulations following the launch of the service. We address this by lagging our right-hand side variables by 1 year before launch, for the subsidiaries who have launched a mobile money service, to ensure that entry decisions are explained by previous levels of institutional quality. For the subsidiaries who have not launched a mobile money service—for which the dependent variable is 0, we use the same lagged year as the other multinational group member that has launched a mobile money service, except when the subsidiary was set up later on, in which case we use the year of entry of this subsidiary. We also cluster the standard errors at the destination (host country) level, allowing for potential correlations of errors across years within a country.

3.3 Data and model specification for spillover model

To investigate spillover effects from mobile money (Hypotheses 2 and 3), we examine the relationship between velocity of money (the ratio of money stock to GDP) and the existence of mobile money services, controlling for the other factors from the literature that are known to influence money velocity.

11 This is an important variable but it has limitations. Thus, it does not vary over time—it only indicates the state of regulations in December 2014—and we do not know exactly when the regulator in each country adopted such an approach. For some comfort, we therefore also include again the regulatory indicator of financial freedom from the Heritage Foundation Index of Economic Freedom (2015). This variable does have a time dimension and we lag it by one year before the mobile payment service was launched to reduce the potential reverse causality.

This leads us to estimate the following model:

$$V_t^c = \ MMS_t^c + \ X_t^c + \ \gamma^c + \delta_t + \epsilon_t^c \quad (2)$$

where V_t^c, the velocity in country c at time t, is calculated as the log of the ratio of Gross National Income to Broad Money (GNI/M3) (IMF, 2015). MMS_t^c is the number of mobile money services providers in country c at time t. X_t^c is the vector of the economic and financial determinants of money velocity in country c at time t outlined below.

The extent of mobile money provision in each country is therefore operationalized as the *total number of service (mobile money) providers* in the economy in each year. In this framework, we employ the whole sample of mobile money providers,[12] with data on the 90 countries where mobile money services have been launched and for which we have information about the launch date. We include in our regressions a large number of other variables which might influence the relationship between the stock of money and GDP (the velocity of money), all of which have been included in previous quantity theory of money equations (see Friedman, 1988; Bordo and Jonung, 1990, Duck, 1993; Caruso, 2001; Pradhan and Subramanian, 2003; Çakan and Özmen, 2002). These are:

i. A proxy for the state of financial innovations and of payment system technology (Bordo and Jonung, 1990), measured by NM/M, the logarithm of [(money + quasi money)/money] (IMF, 2015); and
ii. A measure of *inflation* (IMF, 2015), as higher inflation is expected to increase money velocity, everything else constant.

We also include the logarithmic *rate of change of nominal income*, dY (World Bank National Accounts data), to proxy for the nominal yields on real assets (see Friedman, 1988). This also captures the opportunity cost of holding money and is expected to have a positive effect on money velocity. The short-term interest rate on *Treasury Bills* (Treasury Bills, percent per annum; IMF, 2015) is a proxy for the opportunity cost of holding money; higher short-term interest rates should increase money velocity (by raising the opportunity cost of holding base money). We include the *risk premium on lending* (IMF, 2015), which is calculated as the interest rate charged by banks on loans to private sector customers minus the "risk free" Treasury bill interest rate at which short-term government securities are issued or traded in the market. A higher risk premium on lending (reduced access to finance) may lead to lower money velocity through a reduction in the circulation of money in the economy (from banks to companies) and potentially also a reduction of GDP growth related to higher financing constraints for firms. We also include a governance indicator, the *control of corruption*. According to Bordo and Jonung (1990), improved economic security and stability should lead to an increase in velocity. We could therefore expect a positive relation between control of corruption and money velocity. However, if higher control of corruption leads to an expansion of commercial banking and makes the holding of bank money more desirable, then there might be a negative relation between the control of corruption and velocity.

To address potential omitted variable bias, we introduce country fixed-effects γ^c to control for any missing time-invariant country level variable. We also introduce time fixed effects, δ_t, to control for time trends and ϵ_t^c is an error term. We correct the standard errors for heteroskedasticity and cluster them at the country level. Finally, we examine several specifications to test the robustness of our results, employing a variety of lagged independent variables to address potential reverse causality.

4. Results

4.1 Results from the mobile money provision model

4.1.1 The determinants of host country entry

We first examine the results of the determinants of host country entry. The correlation matrix for the independent variables on the full sample allows us to consider potential collinearities (Table 1a). For the most part, the correlation coefficients are low, less than 0.3, which indicate that there is no serious multicollinearity issue in our estimating sample.

12 That is, all domestic and foreign firms, and from all three categories of providers (telecom groups, banking groups, and third party independent).

Table 1a. Correlation matrix (Obs = 12,173)

	1 Financial freedom	2 Freedom from corruption	3 Personal remittances	4 Population density	5 GDP per capita	6 Polity Index	7 Population	8 Distance	9 Common language
1	1.000								
2	0.387	1.000							
3	0.052	−0.057	1.000						
4	−0.169	−0.106	0.158	1.000					
5	0.212	0.478	−0.156	−0.089	1.000				
6	0.302	0.181	0.052	0.026	0.172	1.000			
7	−0.236	−0.140	−0.232	0.237	−0.049	−0.063	1.000		
8	0.083	0.067	−0.001	0.030	0.090	0.154	−0.022	1.000	
9	−0.014	−0.001	−0.016	0.012	−0.081	−0.073	−0.096	−0.176	1.000

Table 1b. C-logit, determinants of location choice

Sample of foreign subsidiaries	(1)	(2)	(3)	Test difference coefficients Chi^2
Variables	All	Telecoms	Banks	[Prob >chi^2]
Distance	−0.673	−0.633	−0.667	0.04
	(0.076)	(0.131)	(0.107)	[0.841]
Common language	1.291	1.061	1.381	0.51
	(0.201)	(0.380)	(0.241)	[0.474]
GDP per capita	−0.000	−0.000	−0.000	0.34
	(0.000)	(0.000)	(0.000)	[0.560]
Population	0.144	−0.002	0.176	1.26
	(0.066)	(0.141)	(0.076)	[0.262]
Population density	0.001	0.001	0.001	0.06
	(0.001)	(0.001)	(0.001)	[0.807]
Polity Index	−0.003	0.022	−0.010	0.60
	(0.018)	(0.037)	(0.021)	[0.440]
Financial freedom	0.018	0.027	0.017	0.37
	(0.007)	(0.014)	(0.008)	[0.543]
Freedom from corruption	−0.014	−0.023	−0.012	0.21
	(0.008)	(0.023)	(0.009)	[0.644]
Personal remittances	−0.026	−0.012	−0.033	0.18
	(0.023)	(0.043)	(0.027)	[0.668]
Pseudo R-squared	0.116	0.163	0.105	
Observations	9,538	2,443	7,095	

Note: Robust standard errors in parentheses, clustered at the firm (subsidiary) level.

The results of first (selection) equation, estimating the determinants of location choice using C-logit on the sample of foreign subsidiaries (banks and telecoms) are presented in Table 1b. We report the results on the whole sample in the first column. We find that the log of distance has a significantly negative impact on the probability to enter a country, while a common language between home and host country increases the choice of a particular country. This conforms to existing findings in the literature. Thus, both population and financial freedom have a significant and positive impact on the probability to enter a country: a larger market and less financial restrictions increases the attractiveness of a host country. Population density also increases the choice of a country, but it is only significant at the 10% level. Freedom from corruption is negatively correlated with entry choice, which is contrary to expectations; however, the coefficient is only very weakly significant (at the 10% level).

We then split the sample into two subgroups—telecoms and banks—to see if the determinants are sensitive to the sector. We find that distance decreases the choice of a country for both banks and telecoms and the coefficients are very similar (−0.633 for telecoms and −0.667 for banks). In fact, the Chi^2 shows that the difference in coefficient between both groups is not significant. Common language positively and significantly affects entry choice for both groups, but the coefficient is larger for telecoms than for banks (1.061 for telecoms, 1.381 for banks) though the Chi^2 indicates that the difference is not significant. Population enters positively and significantly, the model in the bank subsample, but the coefficient is negative and not significant in the telecoms subsample. In fact, the Chi^2, at 1.26, reveals that the difference is not also significant between both coefficients. Financial freedom attracts both telecom groups and banking groups, and the coefficient is significant at the 5% level for banks (it is only significant at the 10% for telecom groups), and the results of the Chi^2 test indicates that the difference between both coefficients is not statistically significant. None of the other variables (GDP per capita, population density, polity index, freedom from corruption, and personal remittances) is significantly different in the two subsamples.

Overall, the results of this analysis of the determinants of host country entry for banks and telecoms show that the two sectors do not differ greatly in the factors that motivate their country location decisions. This provides some reassurance that self-selection issues with regard to host country entry should not bias our analysis of the decision to launch a mobile money service, conditional upon the decision to enter, in the second stage of our estimation.

4.1.2 Determinants of mobile money launch and tests of hypothesis 1

The correlation matrix for the variables in the second stage logit equation determining the provision of mobile money is presented in Table 2a. Almost all the coefficients are relatively low, below 0.30, with the exception of the total number of mobile money provided by foreign banks, which has a coefficient of correlation of 0.581 with the total number of mobile money provided by domestic banks.

In Table 2b, we report the results of our logit estimation of mobile money service launch. In the first column, we report estimates based on the whole sample. We find that the strength of legal rights decreases the probability of mobile money launch; the coefficient is negative and significant at the 5% level. The odds ratio is 0.79, meaning that a one unit increases in the strength of legal rights decreases the odds of launching a mobile money service by 21%. One interpretation of this result is that in countries with weak legal rights, financial systems are underdeveloped and the need for mobile money services is high. In other words, weak legal rights increase the business case for fast and cheap mobile money services. Interestingly the distance between the host and home country is positive and significant in the whole sample, although distance traditionally deters foreign investments. This might reflect the possibility that the decision to launch mobile money is grounded in local factors, once a company has entered a country, and not by home country factors. The control of corruption has a positive effect but it is only significant at the 10% level. However, as we will see in the split samples, this is the result of opposite effects of corruption for telecoms and groups. The size of the shadow economy also has a positive effect but this is only very weakly significant (at the 10% level). Informality also increases the need for mobile money services, presumably due to the unavailability of formal transfer services through the banking system. The other variables are not significant; however, we will see that some become significant when we split the sample into banks and telecom to test our hypothesis.

Column (2) reports the results of the logit estimation on the sample of foreign telecom subsidiaries and Column (3) reports the results of this estimation on the sample of foreign bank subsidiaries. Our hypothesis test relies on the difference between the estimated coefficients on legal rights, credit information, and corruption between Columns (2) and (3). Taken together, the coefficients on the three proxies for the levels of institutional voids provide some clear support for Hypothesis 1. The results indicate that telecom groups are more likely to launch mobile money in countries where credit information is limited. The coefficient is negative and significant at the 5% level in the telecom-led sample, while it is positive, but nonsignificant in the bank-led sample. The Chi^2 test confirms that the difference in the coefficients is statistically significant (5% level). Moreover, banking groups are more likely to launch a mobile money product in countries with low corruption (high control of corruption), and the difference in the coefficients between the banking groups and telecom groups samples is also statistically significant. Further, we find a negative relation between the strength of legal rights index and mobile money providers' entry in both the telco and bank samples though the coefficient is lower for banks and both coefficients are nonsignificant. However, the Chi^2 test does not support the view that the difference between these two coefficients is statistically significant.

Table 2a. Correlation matrix (Obs = 173)

	Strength of legal rights index	Depth of credit information index	Control of Corruption	Distance	Common language	Population density	Population	Financial freedom	Size of the shadow economy	Personal remittances	Enabling mobile money regulatory approach	tot number of mobile money services provided by foreign banks	tot number of mobile money services provided by domestic banks	tot number of mobile money services provided by foreign telecoms	tot number of mobile money services provided by domestic telecoms
1	1.000														
2	−0.237	1.000													
3	−0.059	0.313	1.000												
4	−0.022	0.153	−0.093	1.000											
5	0.061	−0.132	0.271	−0.088	1.000										
6	0.161	−0.073	−0.097	0.075	−0.195	1.000									
7	0.204	0.063	−0.273	0.197	−0.329	0.280	1.000								
8	0.068	0.211	0.277	0.029	0.025	−0.296	−0.155	1.000							
9	0.142	−0.196	−0.214	0.004	0.025	−0.149	−0.132	0.075	1.000						
10	−0.057	0.016	−0.053	−0.191	−0.041	0.170	−0.194	−0.084	0.065	1.000					
11	−0.018	−0.187	−0.038	0.016	0.143	−0.239	−0.318	0.054	0.208	−0.084	1.000				
12	0.196	−0.178	−0.069	−0.077	0.174	−0.024	0.071	−0.084	0.164	0.216	−0.059	1.000			
13	0.262	−0.117	−0.150	0.006	0.123	0.096	0.379	−0.049	0.047	−0.085	−0.217	0.581	1.000		
14	0.195	−0.275	−0.156	−0.107	0.047	0.078	0.038	0.086	0.127	−0.035	0.139	−0.034	0.008	1.000	
15	0.204	0.066	−0.081	0.120	−0.081	0.095	0.338	0.010	−0.262	−0.080	−0.011	−0.088	0.231	−0.001	1.000

Table 2b. Logit of mobile money service launch (1/2)

	(1)	(2)	(3)	(4) T-test difference coefficients
Variables	All	Telecoms	Banks	[Prob>Chi^2]
Strength of legal rights index	−0.232	−0.587	−0.160	0.87
	(0.111)	(0.372)	(0.292)	[0.351]
Depth of credit information index	−0.174	−0.168	1.025	3.68
	(0.114)	(0.173)	(0.595)	[0.055]
Control of corruption	0.703	−1.182	2.868	9.31
	(0.411)	(0.482)	(1.281)	[0.002]
Distance	0.605	−0.049	0.514	0.51
	(0.283)	(0.437)	(0.671)	[0.473]
Common language	−0.314	−0.927	2.042	6.46
	(0.391)	(0.728)	(0.885)	[0.011]
Population density	0.000	0.002	−0.009	1.72
	(0.001)	(0.002)	(0.008)	[0.190]
Population	−0.155	−0.347	1.120	1.30
	(0.191)	(0.345)	(1.134)	[0.254]
Financial freedom	0.016	0.034	−0.070	3.63
	(0.013)	(0.031)	(0.044)	[0.057]
Size of the shadow economy	0.027	−0.053	0.147	7.78
	(0.016)	(0.042)	(0.054)	[0.005]
Personal remittances	0.036	0.002	0.225	2.53
	(0.027)	(0.083)	(0.102)	[0.111]
Enabling mobile money regulatory approach	−0.251	−0.619	−1.931	1.18
	(0.341)	(0.680)	(0.926)	[0.277]
Tot number of mobile money providers in host country	0.023	−0.047	0.526	3.62
	(0.092)	(0.153)	(0.264)	[0.057]
Pseudo R-squared	0.133	0.392	0.410	
Observations	163	109	46	

Notes: Robust standard errors in parentheses, clustered at the host country level. Regional fixed effects included. We have tried to add additional controls for both telecommunication infrastructure and banking infrastructure. However, where we could add variables, the results remained the same and in cases where, because of high correlations or missing data we could not, we opted to retain the current specifications.

Turning to the control variables, they largely conform to expectations. An indicator of proximity, common language between host and home countries, has a positive and significant coefficient at the 5% level for banks and a negative but not significant one for telcos though geographic distance is not significant in either of the two subsamples. The size of the shadow economy increases the probability of banks launching mobile money, with the coefficient being significant at the 1% level. The odds ratio for this variable is 1.16, meaning that a one percentage point increase in informality (calculated as a percentage of GDP) increases the odds of foreign banks subsidiaries launching a mobile money service by 16%. However, this coefficient is not significant in the telecom sample. The difference between the two coefficients is significant at the 1% level. This is an interesting result given that we would have expected banks to be reluctant to launch these services in economies with large informal markets. However, it is also possible that banks seize the opportunity offered by mobile money to capture part of these informal cash flows, while telecoms are not driven by these factors because they do not differentiate their market between formal and informal actors.

The scale of remittances in an economy is also found to be an important determinant of mobile money launch; it increases the probability of banks to offer mobile money and the coefficient is significant at the 5% level. A one-percentage point increase in personal remittances received increases the odds of banks launching a mobile money service by 25%. However, the coefficient on personal remittances is not significant for telecoms though the difference between the coefficients in the bank and telecom sample is not significant. One explanation for this result is that banks are more likely than telecoms to be able to offer international remittances services, given that they have a

banking license, and as a result, are better able and more interested in taping into this market by providing mobile money.

We suggested that regulation would be an important factor for mobile money launch, and we find as expected that banks are less likely to launch mobile money when the regulator allows telecoms to operate in the mobile money space. Given that telecom groups are usually very efficient in offering these products thanks to their large retail network, the strength of the competition from these groups might deter banks to launch mobile money. That said, the coefficient is not statistically different between the two samples. Finally, the number of existing mobile money providers in an economy (including domestic/foreign and telecom and banks) has a positive impact on the probability of foreign banks subsidiaries launching mobile money but has no significant impact for telecoms. The difference between both coefficients is only significant at the 10% level. This might be because telecom groups have tended to be pioneers in this field and therefore it might be less likely for banks to launch mobile money unless this has occurred. This would explain the positive coefficient on this variable.

To explore this issue further, in Table 2c, we decompose this measure of the total number of mobile money providers in an economy in a given year into its four subcomponents: mobile money provided by foreign banks, domestic banks, foreign telecoms, and domestic telecoms (all lagged by 1 year). The results on the other variables are similar to what we obtained in Table 2b. The first observation is that the coefficient on mobile money provided by foreign banks and mobile money provided by domestic banks are either significantly negative (foreign banks) or positive (domestic banks) across the three samples (whole and the two split samples). The coefficients on mobile money provided by foreign telecoms and domestic telecom are significant in none of the samples. One explanation for this result is that, though previous foreign bank entrants may deter firms from launching mobile money, a large number of domestic bank entrants may signal high profits and therefore attract their entry. This would imply that foreign bank entrants have ownership advantages that make them more than competitive against domestic bank suppliers. However, potential entrants are neither attracted nor deterred by telecom suppliers, whether foreign or domestic, perhaps because they are seen as offering a more differentiated product.

4.2 The economic impact of mobile money: hypotheses 2 and 3

We examine in Table 3 the estimates of the model linking money velocity with mobile money. We report estimates of two different specifications; a restricted model and one with the full set of controls. The latter, reported in Models (2)–(4)–(6), provide a framework similar to the literature; however, the sample size is reduced by a factor of almost 3, due to the lack of availability of financial variables for a few countries and years in the sample. Hence, we also report a reduced version of the set of control variables, using only three control variables (NM/M, inflation, and dY), in Models (1)–(3)–(5). In each specification, we include three variants of the lag structure to allow for the likelihood that the impact of money on GDP is not instantaneous, giving six models in total. In the baseline estimations, Models (1) and (2), the left-hand side variables are contemporaneous to our dependent variables (i.e., no lag). In the remaining columns, we re-estimate with lags of 1 year [Models (3) and (4)] and 2 years [Models (5) and (6)], to control for potential reverse causality and lagged effect of mobile money on GDP.

Overall, we identify a significant positive relationship between the total number of mobile money providers at t, t-1, and t-2 and money velocity at time t, with p-values of the coefficients ranging from 0.01 to 0.04, depending on the model. Thus, these regressions provide the first empirical evidence that mobile money has positive benefits for the broader economic environment, by stimulating increased business activity in the economy as a whole and provide support for Hypothesis 2.

The result is robust.[13] In the sense that the magnitude of the coefficient on mobile money does not change when the additional controls are included. The coefficients on the control variables also largely conform to expectations. Financial innovations (NM/M) are positively associated with velocity, as found empirically by Caruso (2001). The coefficient on dY, which proxies nominal yields on real assets, is also significantly positive (coefficient = 0.34 and p-value = 0.00 in Model 1), which is conform to the theoretical (Friedman, 1988) and empirical (Caruso, 2001) literature. We find that velocity is lower in less corrupt countries. This could reflect the fact that commercial banking is

13 The R-squared are very high (ranging between 0.94 and 0.96) due to the inclusion of year-fixed effects and country-fixed effects. Without fixed effects, the R^2 is 0.45 in Model 1 and 0.67 in Model 2.

Table 2c. Logit of mobile money service launch (2/2)

Variables	(1) All	(2) Telecoms	(3) Banks	(4) T-test difference Chi^2 [prob>Chi^2]
Strength of legal rights index	−0.226	−0.758	−0.332	0.49
	(0.131)	(0.550)	(0.241)	[0.483]
Depth of credit information index	−0.171	−0.294	3.285	4.14
	(0.120)	(0.256)	(1.745)	[0.042]
Control of corruption	0.908	−0.804	3.184	1.80
	(0.442)	(0.637)	(2.954)	[0.180]
Distance	0.701	0.123	2.461	1.61
	(0.279)	(0.548)	(1.820)	[0.205]
Common language	−0.545	−2.126	3.394	5.93
	(0.432)	(0.943)	(2.057)	[0.015]
Population density	0.001	0.002	−0.030	1.58
	(0.001)	(0.002)	(0.026)	[0.209]
Population	−0.166	−0.503	3.585	2.96
	(0.211)	(0.462)	(2.282)	[0.086]
Financial freedom	0.007	−0.014	−0.064	0.31
	(0.015)	(0.039)	(0.081)	[0.578]
Size of the shadow economy	0.024	−0.057	0.201	5.26
	(0.022)	(0.056)	(0.095)	[0.022]
Personal remittances	0.105	0.151	0.658	2.44
	(0.049)	(0.095)	(0.300)	[0.118]
Enabling mobile money regulatory approach	0.025	−0.187	−1.600	1.55
	(0.388)	(0.620)	(0.827)	[0.213]
Tot nb of mobile money services provided by foreign banks	−3.000	−5.663	−3.336	1.45
	(0.741)	(1.508)	(1.215)	[0.229]
Tot nb of mobile money services provided by domestic banks	2.106	3.322	6.588	1.15
	(0.491)	(1.079)	(2.785)	[0.283]
Tot nb of mobile money services provided by foreign telecoms	−0.183	−0.169	0.076	0.08
	(0.202)	(0.515)	(0.642)	[0.783]
Tot nb of mobile money services provided by domestic telecoms	−0.371	−0.165		
	(0.314)	(0.495)		
Pseudo R-squared	0.207	0.470	0.579	
Observations	163	109	41	

Note: Robust standard errors in parentheses, clustered at the host country level. Regional fixed effects included.

more diffused in countries with lower corruption, leading to a more rapid growth in the demand for money than in nominal income, and consequently to a downward trend in velocity (Bordo and Jonung, 1990).

We further explored the robustness of our results by testing the effects of using alternative measures of the velocity of money. We re-estimated the full model of Table 3, Column (2) using the following alternative measures of the velocity of money: GNI/M2, GNI/M1, GDP/M3, GDP/M2, and GDP/M1. The coefficients on the total number of mobile money providers in the economy in a given year remained positive and significant at the 5% confidence level in all these alternative regressions and we do not report them here. The magnitude of the coefficients also did not change greatly, from 0.021 to 0.025. We also examined an alternative way to treat the standard errors. In the reported regressions, we use robust standard errors clustered by country, to take into account potential within-country correlation of errors over time, also called "Rogers standard errors."[14] We explored the use of Newey-West standard errors to correct for heteroscedasticity and for autocorrelation in the panel (AR-1).[15] The results with the

14 White standard errors adjusted to account for possible correlation within a cluster.
15 We use the xtpcse command in Stata.

Table 3. Impact of mobile money on velocity of money

	Money velocity (GNI/M3), c, t					
	Baseline models		With one lag		With two lags	
Variables	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)	(Model 6)
Total number of mobile money providers, c, t	0.025	0.025				
	(0.007)	(0.010)				
NM/M, log, c, t	0.483	0.567				
	(0.087)	(0.155)				
Inflation, consumer prices (annual %), c, t	0.001	−0.003				
	(0.001)	(0.003)				
dY, c, t	0.343	0.552				
	(0.097)	(0.114)				
Treasury bills, percent per annum, c, t		0.005				
		(0.004)				
Risk premium on lending, c, t		−0.001				
		(0.004)				
Control of corruption, c, t		−0.134				
		(0.064)				
Total number of mobile money providers, c, t-1			0.022	0.022		
			(0.008)	(0.010)		
NM/M, log, c, t-1			0.303	0.335		
			(0.064)	(0.100)		
Inflation, consumer prices (annual %), c, t-1			0.001	0.000		
			(0.001)	(0.003)		
dY, c, t-1			0.103	0.320		
			(0.118)	(0.142)		
Treasury bills, percent per annum, c, t-1				0.004		
				(0.004)		
Risk premium on lending, c, t-1				−0.002		
				(0.003)		
Control of corruption, c, t-1				−0.222		
				(0.076)		
Total number of mobile money providers, c, t-2					0.025	0.031
					(0.012)	(0.014)
NM/M, log, c, t-2					0.240	0.273
					(0.069)	(0.107)
Inflation, consumer prices (annual %), c, t-2					0.002	0.000
					(0.000)	(0.003)
dY, c, t-2					0.043	0.255
					(0.094)	(0.123)
Treasury bills, percent per annum, c, t-2						0.006
						(0.004)
Risk premium on lending, c, t-2						−0.001
						(0.003)
Control of corruption, c, t-2						−0.134
						(0.070)
Observations	1,017	376	1,005	398	920	363
R-squared	0.942	0.963	0.940	0.956	0.942	0.955
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses, clustered at the country level.

Newey-West standard errors were very similar to those with the Rogers standard error. Re-estimating the model in Table 3, Column (2), we obtained a coefficient on mobile money providers of 0.0241 and a standard error of 0.0097. We chose to report the Rogers standard errors as they have been found to be unbiased in the presence of a firm effect (e.g., the observations of a firm in different years are correlated), (here country effect), while the Newey-West standard errors modified for panel data tend to have a small bias (see Petersen, 2005).

Hypothesis 3 asked whether the effects of mobile money on the volume of transactions and growth in the economy as a whole are sensitive to the channel through which mobile money is provided; banks or telecoms. To test this, we extend the model to include separately the total number of mobile money services launched by telecom groups and banking groups at time t and t-1.[16] Thus in Table 4 we report results from estimations of models similar to those reported in Table 3, but with the entry of mobile money providers now separated into entry by telcos in Columns (1) and (3) and entry by banks in Columns (2) and (4), respectively.[17] We consider the specification with no lag [Columns (1) and (2)] and one lag [Columns (3) and (4)].

The regressions are very similar to those reported in Table 3 in terms of the magnitude and size of the coefficients on the control variables, but there are differences regarding the coefficients on the separate impacts of telco and bank mobile money entry on the velocity of money. We find a positive and significant effect for banking groups, with p-values of 0.00 in both Model 2 and Model 4. However, we do not identify any significant relationship between the scale of mobile money provision by telecoms and the velocity of money: the coefficient has p-values of 0.94 in Model 1 and 0.93 in Model 3. This suggests that the positive effect of the larger provision of mobile money services on the volume of transactions in an economy is stronger for services launched by banking groups than those by telecom companies, providing support for Hypothesis 3. We conclude that the impact of mobile money on the macroeconomy is greater for banks than for telcos.

5. Conclusions

5.1 Interpreting the findings

Mobile money is an example of a disruptive innovation in the financial services sector in developing economies with opportunities for rapid business growth across a variety of potential suppliers as well as for broader market and economic development. To gain a clearer understanding of the phenomena, we have explored in depth the factors determining the channels of mobile money provision in different institutional contexts, as well as the impact of mobile money provision by banks and telcos on the broader economy.

Mobile money has so far been an innovation of primary relevance to developing rather than developed economies, relying on the large penetration of cheaper technology (basic mobile phones or cheap smartphones) to facilitate new market transactions that did not previously occur because of high transaction costs. However, there remains a great deal of heterogeneity in its pace and scale of adoption, notably concerning the channels by which mobile money services are delivered. This led us to explore whether the form of entry of mobile money providers is conditioned by the institutional characteristics of the host economies. We find that the critical elements of local context leading telecom companies to offer mobile money are different to those for banks, in some cases being diametrically opposed. Thus, the control of corruption was found to be a significant determinant of banks' provision of mobile money. Converting the coefficients from Table 2b, Models (2) and (3), into relative-risk ratios, we find that a one-unit increase in the control of corruption, given entry, *increases* the "relative risk" of banks offering relative to not offering a mobile money service by a factor of 4.01. In contrast, control of corruption *decreases* this relative risk for telecom companies by a factor of 0.66.

Why do we observe these differences in the impact of contextual factors? Consider first the telecom groups. We argued above that their capabilities and assets made it easier for them than for banks to enter institutionally weak environments, where the frictional transaction costs hindering the emergence of financial markets are greater. Thus, we find that for telecoms, a one-point increase in their most important driver, the legal rights index, decreases the

16 We also tested for t-2 in the restricted model [cf., Models (1), (3), and (5) of Table 6]. The results were qualitatively similar. We do not report them here for the sake of brevity.

17 We also estimated the short model including only NM/M, inflation and dY as controls. The results were qualitatively similar so we preferred to report the model with additional controls, even if it implies a reduced sample size.

Table 4. Differential impact of mobile money via telecoms and banks on velocity of money

	Money velocity (GNI/M3), c, t			
Variables	(Model 1)	(Model 2)	(Model 3)	(Model 4)
Total number of mobile money services launched by Telecoms, c, t	0.002			
	(0.025)			
Total number of mobile money services launched by Banks, c, t		0.064		
		(0.018)		
NM/M, log, c, t	0.551	0.584		
	(0.159)	(0.156)		
Inflation, consumer prices (annual %), c, t	−0.004	−0.003		
	(0.003)	(0.003)		
dY, c, t	0.512	0.543		
	(0.090)	(0.111)		
Treasury bills, percent per annum, c, t	0.006	0.006		
	(0.004)	(0.004)		
Risk premium on lending, c, t	−0.001	−0.000		
	(0.004)	(0.004)		
Control of Corruption, c, t	−0.151	−0.142		
	(0.071)	(0.064)		
Total number of mobile money services launched by Telecoms, c, t-1			−0.002	
			(0.025)	
Total number of mobile money services launched by Banks, c, t-1				0.062
				(0.015)
NM/M, log, c, t-1			0.330	0.358
			(0.106)	(0.102)
Inflation, consumer prices (annual %), c, t-1			0.000	0.001
			(0.003)	(0.003)
dY, c, t-1			0.282	0.314
			(0.134)	(0.143)
Treasury bills, percent per annum, c, t-1			0.005	0.005
			(0.004)	(0.003)
Risk premium on lending, c, t-1			−0.002	−0.001
			(0.003)	(0.003)
Control of corruption, c, t-1			−0.238	−0.227
			(0.085)	(0.074)
Observations	376	376	398	398
R-squared	0.961	0.963	0.954	0.956
Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses, clustered at the country level.

relative risk of offering a mobile money service (given entry) by 0.69. As the institutional environments improve, the likelihood that telecoms choose to offer mobile money services decreases. Likewise, a one-point increase in the credit information index will decrease the likelihood by 0.77. The relative risk ratios of legal rights and credit information are, respectively, 0.97 and 1.26 for banks, but the coefficient is not significant. For telecom companies, mobile money provision allows them to exploit their greater strategic flexibility to operate in weaker institutional environments and therefore to reach potential clients who are poorer and more likely to be excluded from financial service markets.

Our analysis of the impact of mobile money is one of the first to identify positive significant spillover effects from mobile money to the broader economy. Thus, we found that the velocity of money is positively related to the number of providers of mobile money, in a model that controlled for all the standard explanatory factors. This finding was significant in a contemporaneous specification and for up to two lags, and is robust across alternative measures of money velocity. The impact of mobile money on the economy as a whole in our empirical study is found to be large;

an additional mobile money service launched in an economy is associated with a 2.2% to 3.1% increase in money velocity, depending on the specification. Assuming no change in the stock of money as a consequence, a plausible assumption because monetary policy is rarely set with reference to technological developments in the financial sector, mobile money will be having a large expansionary effect on GDP. To our knowledge, this is the first time such an effect has been shown.

Given our previous finding about the contextual drivers of mobile money channels, we wanted also to explore whether banking and telecom groups differ in terms of their broader economic effects. We found that the impact of mobile money provision on the velocity of money is driven by banks, but not by telecoms. We interpret this to be a consequence of the fact that telecoms cannot intermediate by making further loans to borrowers based on the mobile money deposits that they have accepted. In contrast, banks can use mobile money deposits to create additional money, thereby altering the velocity of money.[18]

Thus, the same characteristics that allow telcos to enter riskier and institutionally more challenging contexts also imply that their impact on the broader economy through financial intermediation is more limited. We saw that the effects of telco based mobile money provision on GDP are not significant. In contrast, the impact of banks-led mobile money services is positive and significant because their mobile money model builds and extends traditional banking into new mobile channels.

5.2 Limitations

Even though we constructed a novel, longitudinal dataset, our empirical efforts suffer from limitations stemming from the availability of data. The GSMA only provides information on the mobile money services that are currently available. In other words, we do not know which providers have exited the sector, merged or been acquired. This means that our estimations suffer from survivors' bias; the determinants of product launch that we modeled may reflect the behavior of larger, survivor, companies, but not necessarily that of the firms that have exited the market. Moreover, our results for the income velocity of money may be overstated because our measure of the number of mobile money providers in each year for each country was based on the mobile money providers that still existed in 2015. Further to that, we would have ideally directly captured the extent of mobile money activity and diffusion by using data on the number of transactions or number of active mobile money users, instead of data on the number of mobile money providers in each country in each year. Unfortunately, such data on transactions or mobile money accounts are not available on a consistent basis across years and countries.

In addition, we suffer from data limitations at the company level, especially concerning measures of productivity or revenues such as the number of subscribers for each organization, the volume or value of mobile money transactions and service costs for each organization. As a result, we have not been able to examine directly firms' performance in the mobile money sphere. Such information is difficult to come by, especially on a comparable basis, both across countries and across companies, in particular because different providers belong to different industrial sectors. Given the lack of published data both by the companies and by the regulator, firm surveys seem to be at this stage the way forward to gather such data.

5.3 Policy implications

We have identified in the spread of mobile money across developing countries, a feedback loop between the institutional environment; the sector in which the firm is based and the broader economic effects generated. The environment determines to a certain extent which organization will dominate the provision of mobile money when there are competing organizational forms. This then determines which products are available within this given service. The range of products available may also ultimately re-shapes the economic context, via their impact on the mode and frequency of transactions. Little previous attention has been paid to how firm capabilities and sectoral technological differences can influence firms' ability to exploit technological innovations in contexts with missing institutions.

We have found that neither banks nor telcos provide an unambiguously superior business model for the introduction of mobile money in developing countries. Rather, the advantages of each depends upon the institutional context

18 To the extent that they are required to deposit customers' funds in a bank however, the value stored as e-money will lead to money creation if this bank then provides loans to borrowers with the deposits they have accepted (di Castri 2013).

of the host economy. Because they are largely cross-selling within their existing network of agents, telcos can reach more cheaply a large market of financially excluded individuals and firms and if the mobile network has already been built, they need to sink less into the creation of a new supporting infrastructure. Moreover, they typically face less prudential regulation than banks and, because their offerings are largely restricted to transactions products, they bear fewer risks from a given volume of business. Hence, they are better positioned to navigate the complexities of countries in which missing institutions are more pronounced.

The balance of advantage and disadvantage in opening a mobile money system is rather different for banks. They usually need to build up a new structure of agents in order to reach the financially excluded, often in locations with which they are not familiar. They also face greater levels of regulation of their business activities. Thus, the transactions costs of entry into mobile money in developing countries remain higher for them than for telcos. Hence, they may be unwilling or unable to operate profitably in some contexts in which missing markets are highly prevalent because the returns for them do not exceed the transactions costs. This may contrast with telcos, which may be able to operate in these higher transactions cost locations. Thus, policy makers seeking rapid development of mobile money in challenging institutional environments might focus on telcos.

However, we have also found that mobile money systems based on telcos may have less impact on the process of economic development than those based on banks. Our comparison of the capabilities and technologies of firms in each sector explains why. Telcos may reduce the transactions costs for individuals and firms to do business, but they typically do not offer a wide range of products and their activities usually do not stimulate a money multiplier. Hence, their impact is real and spreads quickly but is more limited. For policy-makers in areas where banks are able and willing to extend their activities to mobile money, for example where institutions are of better quality, encouraging banks to do so may be a good long-term strategy to follow. In areas that are institutionally more challenging, telcos offer the more promising route, but governments need to consider in the longer term how to extend the benefits for the economy as a whole. One way might be by further encouraging partnerships between banks and telcos in the provision of additional mobile money products, such as micro-loan (cf., MShwari in Kenya).

This analysis also has implications for policy-makers because of the role of regulations in shaping the way that the provision of banking services, including MP, evolves. In the particular context of finance for the unbanked, if local incentives are not strong enough for banks to develop and launch these products and telcos are excluded, mobile money may not get off the ground. In such cases, enabling regulations for alternative organizations, such as telecom groups, may be a better strategy for policy-makers.

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Appendix

Table A.1. Variables definition

Variable name	Variable definition	Source
Distance	Geographic distance, in logs, between the most populated cities in kilometers (thousands)	GeoDist database made available by Mayer and Zignago (2011)
Common language	Dummy variable which takes the value of 1 if home and host countries have the same official language and 0 otherwise	CEPII
GDP per capita	GDP per capita of the host economy in 2007	World Economic Outlook, IMF
Population	Population of the host country in 2007, introduced in 100,000s, and using logarithms to ensure normality	World Bank, World Development Indicators
Population density	Density of population, people per sq. km of land area	World Bank, World Development Indicators
Polity index	Measure of the market-supporting character of the political regime and ranges between −10 (total autocracy) and 10 (total democracy)	Polity IV database
Financial freedom	Indicator of financial freedom, measuring banking efficiency as well as independence from government control and interference in the financial sector, and ranging from 0 (repressive) to 100 (negligible government intervention).	Heritage Foundation
Freedom from corruption	Freedom from corruption, which ranges from 0 to 100	Heritage Foundation
Personal remittances	Personal remittances received in the host country (as a percentage of GDP)	World Bank, World Development Indicators
Strength of legal rights index	Strength of legal rights index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The index ranges from 0 to 12, with higher scores indicating that these laws are better designed to expand access to credit.	World Bank, World Development Indicators
Depth of credit information index	Depth of credit information index measures rules affecting the scope, accessibility, and quality of credit information available through public or private credit registries. The index ranges from 0 to 8, with higher values indicating the availability of more credit information, from either a public registry or a private bureau, to facilitate lending decisions.	World Bank, World Development Indicators
Control of Corruption	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately −2.5 to 2.5	World Bank, World Development Indicators
Size of the shadow economy	Measures productive economic activities that would normally be included in the national accounts but which remain underground due to tax or regulatory burdens	Schneider (2012)
Enabling mobile money regulatory approach	Dummy which indicates to what extent telecoms are allowed to operate in the mobile money space (enabling = 1)	GSMA
tot number of mobile money services provided by foreign banks	Total number of mobile money services provided by foreign banks	GSMA

(continued)

Table A.1. Continued

Variable name	Variable definition	Source
tot number of mobile money services provided by domestic banks	Total number of mobile money services provided by domestic banks	GSMA
tot number of mobile money services provided by foreign telecoms	Total number of mobile money services provided by foreign telecoms	GSMA
tot number of mobile money services provided by domestic telecoms	Total number of mobile money services provided by domestic telecoms	GSMA
Money Velocity (GNI/M3), c, t	Velocity, in country c at time t, is calculated as the log of the ratio of Gross National Income to Broad Money (GNI/M3)	International Monetary Fund, International Financial Statistics
Total number of mobile money providers, c, t	Total number of mobile money providers in country c at time t	GSMA
Total number of mobile money services launched by Telecoms, c, t	Total number of mobile money services launched by Telecoms in country c at time t	GSMA
Total number of mobile money services launched by Banks, c, t	Total number of mobile money services launched by Banks in country c at time t	GSMA
NM/M, log, c, t	Logarithm of [(money + quasi money)/money]	International Monetary Fund, International Financial Statistics
Inflation, consumer prices (annual %), c, t	Inflation rate, average consumer prices, annual percent change	International Monetary Fund, International Financial Statistics
dY, c, t	Logarithmic rate of change of nominal income, dY	World Bank National Accounts data
Treasury Bills, percent per annum, c, t	Treasury bills, percent per annum	International Monetary Fund, International Financial Statistics
Risk premium on lending, c, t	Risk premium on lending, calculated as the interest rate charged by banks on loans to private sector customers minus the "risk free" Treasury bill interest rate at which short-term government securities are issued or traded in the market	International Monetary Fund, International Financial Statistics