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# Mobile Money, Financial Inclusion, and Unmet Opportunities: Evidence from Uganda

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**ABSTRACT** *Mobile money is an important instrument to improve the degree of financial inclusion, especially in developing countries. However, having a mobile money account does not imply that this account is actually used. In our sample, 86% of microentrepreneurs own a mobile money account, but only 49% actively use it – the resulting gap indicates unmet opportunities. We estimate that mobile money reaches up to 40% of those without prior access to (semi-)formal financial services, still leaving a substantial group behind in which women and the most disadvantaged are overrepresented. A choice experiment shows that high fees hinder mobile money usage for a substantial number of microentrepreneurs. Moreover, insufficient physical infrastructure, i.e. a small number and unfavourable spatial distribution of mobile money agents, also limits access, while a lack of financial education seems to contribute to comparatively low price sensitivity. Based on these results, we suggest policy measures that reduce the remaining barriers limiting the contribution of mobile money to financial inclusion.*

**KEYWORDS:** Financial inclusion; mobile money; microentrepreneurs; choice experiment

## 1. Introduction

Globally, about 1.7 billion adults lack financial access in its most simple form: they do not possess any kind of financial account (Demirgüç-Kunt, Klapper, Singer, Ansar, & Hess, 2020). Almost all of these adults live in developing countries with a poor bank branch infrastructure. In such an environment, the introduction of mobile money is a promising solution to provide easier and cheaper access to financial services compared to alternatives (Aron, 2018; Suri, 2017).

For example, in Uganda, mobile money began in 2009 and, within a decade, more than 80 per cent of adults had a mobile money account. Having an account with a financial institution or a mobile money provider is the standard measure of financial inclusion and, as such, Uganda looks like a case of almost complete financial inclusion. However, we challenge this view and show what policy could do to achieve financial inclusion on equal terms for all groups in society.

An obvious shortcoming of the account measure is the fact that a mobile money account is often just a by-product of having a registered mobile telephone number. The reason for this linkage is that

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the operators of mobile phone services also supply the mobile money services, so that opening a mobile money account requires little effort; moreover, mobile money is the most convenient way to purchase airtime. This does not, however, mean that the mobile money account is actively used. Even though we apply a very generous measure of using mobile money actively, there is a sizeable gap in our large sample between 86 per cent owners of a mobile money account (92 per cent own a mobile phone) and the 49 per cent who are active users.

This gap motivates two main research questions: first, who benefits from – or not – financial inclusion that mobile money enables? Second, what hinders a more active and rational use of mobile money services? These questions entail secondary issues, such that we specifically ask if easier access favours financial inclusion of individuals who are *ex ante* less well-off. We assess to what extent high mobile money fees or limited physical access constitute a barrier to its use.

To address these research questions, we conducted a large-scale survey in the Kabarole district of Western Uganda in spring 2019, implemented in cooperation with a local university. As there is no registry of microentrepreneurs, we collected information on all 108 rural trading centres in Kabarole and then drew a sample of 2,223 small business owners; these entrepreneurs from one district have qualitatively similar characteristics as microentrepreneurs in rural Western Uganda in general. The survey provides very detailed data about their financial behaviour and their use of mobile money in particular. As part of the survey, we implemented a novel choice experiment, where we measure the role of several determinants of mobile money use. As the hypothetical choice sets are randomly drawn, this approach allows for a causal analysis of the included variables on the willingness to use mobile money. We can assess whether our respondents are price sensitive, to what extent mobile money fees are a reason for non-use, and the role of financial literacy.

In general, we find that mobile money does indeed provide access to financial services for a significant share of microentrepreneurs but fails to enable full financial inclusion of the people in this area. This mirrors, to some extent, the failed experience of providing free bank accounts that could not be used due to poverty, high transaction costs, and distance to banks (Dupas, Karlan, Robinson, & Ubfal, 2018). We obtain the following five findings.

(i) We find suggestive evidence that mobile money can increase the level of financial inclusion significantly. In a rough estimation, about 40 per cent of those who are neither formally nor semi-formally banked are active mobile money users. This also implies, however, that there are still many left in financial exclusion.

(ii) Active users of mobile money differ from users of other financial services: although equally educated, they tend to be young and male. Relative to the still unbanked, active mobile money users are, on average, better-off. In particular, women and the most disadvantaged often remain financially excluded from mobile money services.

(iii) Our choice experiment proves that actual prices for mobile money services at the time of the survey are too high for about 10 to 20 per cent of the sample population. Thus, ensuring competitive financial markets should be a policy priority in Uganda and elsewhere to facilitate financial inclusion.

(iv) Beyond high fees, the use of mobile money is hindered by insufficient physical access. This includes the number and spatial distribution of mobile money agents as well as poor network coverage quality. In addition, social network effects play a role since the lack of other mobile money users in the same trading centre is linked to less usage.

(v) Finally, many survey participants with little financial literacy, lower levels of education and non-users of mobile money show a comparatively small degree of price sensitivity. This could be addressed by proper financial education, complemented by acts of consumer protection.

Research on mobile money is limited and fairly recent. Empirical studies focus primarily on the effects of mobile money use on household outcomes in the aftermath of a shock. These studies find positive impacts on consumption smoothing, risk sharing, and household welfare primarily due to increased remittance flows (Abiona & Koppensteiner, 2020; Ahmed & Cowan, 2021; Aron, 2018; Blumenstock, Eagle, & Fafchamps, 2016; Jack & Suri, 2014; Munyegera & Matsumoto, 2016; Riley, 2018; Suri, 2017). At the same time, the barriers to adopting the technology remain understudied. Few

studies focus on the role of knowledge. One exception is Kiconco, Rooks, Solano, and Matzat (2019), who find that mobile phone skills are important for initial mobile money adoption. Murendo, Wollni, De Brauw, and Mugabi (2018) find that poorer Ugandan households have fewer mobile money adopters in their social network. At the same time, they find that this social network of other adopters is positively associated with own mobile money adoption, thus possibly causing an information trap for the poor. The study by Aker, Prina, and Welch (2020) investigates the relatively low adoption in Niger in 2017. The authors show that mobile money transfer fees are too high for about half of the household sample and the small number of mobile money agents appear to be an additional limiting factor.

One new and fruitful line of research covers the impact of mobile money interventions through randomised controlled trials. Account opening assistance and fee waivers boost adoption rates among urban microentrepreneurs in Malawi (Aggarwal, Brailovskaya, & Robinson, 2020). Concerning long-term credit access, advertising mobile money payments to urban small business owners in Kenya has positive effects, seemingly driven by greater transparency towards the lender (Dalton, Pamuk, Ramrattan, Van Soest, & Uras, 2020).

The existing evidence also suggests that poor and rural households profit from using mobile money. Among the rural ultra-poor in Bangladesh, training interventions succeed in generating high adoption rates (Lee, Morduch, Ravindran, Shonchoy, & Zaman, 2021). Consequently, rural households are better insured against risks due to receiving remittances more easily. Via a random distribution of mobile money access points in rural areas of Uganda, Wieser, Bruhn, Kinzinger, Ruckteschler, and Heitmann (2019) report that for those who live far from a bank branch, offering mobile money services increases the use of mobile money, the likelihood of receiving remittances, and the probability of running non-agricultural businesses.

Business outcomes of mobile money adopters seem to be affected favourably. Providing a mobile savings account to smallholder farmers in Mozambique increases mobile savings (and fertiliser investments, as intended) as long as the account pays interest (Batista & Vicente, 2020a). In Uganda, evidence indicates that mobile money adoption among farmers increases nonfarm income due to new savings and money transfers even if remittances do not increase (Sekabira & Qaim, 2017). The authors reason that this effect is driven by the new savings and money transfer opportunities. In an urban setting, Beck, Pamuk, Ramrattan, and Uras (2018) show that mobile money adoption among formal entrepreneurs improves business growth and development through reduced risk of theft (compared to cash holdings) and more efficient transfers. Similarly, in a randomised controlled trial with female Tanzanian business owners, mobile savings account take-up positively affects side income, perceived empowerment, and subjective well-being (Bastian, Bianchi, Goldstein, & Montalvao, 2018).

Thus, there are many studies showing the positive impact of adopting mobile money but relatively few insights on potential barriers to adoption: lacking skills regarding the use of a mobile phone or a mobile money account and the general availability of mobile money services. We consider these determinants systematically, add a novel choice experiment, and derive policy lessons.

The paper is organised as follows. In the next section, we provide background information about our experimental design, sampling strategy, and data. Suggestive evidence on the financial inclusion contribution of various financial institutions (in particular of mobile money) in our sample is shown in Section 3, followed by Section 4, where we discuss how mobile money users are different from nonusers. Section 5 identifies physical barriers for the active use of mobile money. Section 6 presents the results from our choice experiment focusing on fees as an entry barrier, whilst Section 7 complements this by a heterogeneity analysis. Section 8 concludes with deriving policy measures.

## 2. Data

Uganda is an interesting case study due to its large share of rural microentrepreneurs. According to a representative survey of 3,002 adult Ugandans, 76 per cent live in rural areas, about half mainly rely on agricultural income, and only 3 per cent of Ugandans are employed in the formal sector

(FinScope, 2018). Moreover, the spread of mobile money adoption appears to realise a high level of financial inclusion.

### *2.1. Context and sampling*

To study financial behaviour of microentrepreneurs in a rural developing setting, we sample business owners in the rural Kabarole district of Western Uganda. This region in Western Uganda is neither particularly rich nor poor compared to other areas in Western and Central Uganda. We cover the whole district, except its main town, to capture the rural population, where most Ugandans live and work. The Kabarole district has an estimated population of 318,000 according to the Uganda Bureau of Statistics (Ugandan Bureau of Statistics [UBOS], 2016), with half of its population younger than 18 (Ugandan Bureau of Statistics [UBOS], 2019), which is similar to the national average of 55.1 per cent (UBOS, 2016). As there is no official registry, we mapped, in cooperation with the local *Mountains of the Moon University*, all the districts' trading centres in November 2018. Trading centres are shopping streets where microentrepreneurs are located, typically found along the main road in rural villages or small towns. It is very rare for small businesses to be located outside of such trading centres. We collected information about the location and size of all 108 trading centres in the Kabarole district and estimated 5,478 small businesses, based on the counting of active shop units. The number of small businesses per trading centre ranges from 5 to 392 (mean 51, median 35). Subsequently, from February until April 2019, we visited each trading centre once and conducted personal tablet-based interviews with sampled business owners. The share of microentrepreneurs declining participation was negligible.

Our sampling strategy is designed to interview a sufficiently large share of microentrepreneurs in each trading centre. As smaller trading centres are typically less busy, many business owners close their shops for part of the day to engage in other jobs including farming. To interview sufficient business owners from smaller centres, we approach every open business in trading centres with up to 100 businesses. This strategy results in covering 48 per cent of shops in these areas. In the 9 largest trading centres, those with more than 100 small businesses, we randomly approach every third open business (the share of opened shops in these centres is about 75 per cent). Overall, the sample encompasses 2,223 small business owners. This number represents a large fraction of all existing shops, about 41 per cent.

Clearly, in this sample, we miss those shops that were closed during our visit. As the research team stayed at least several hours in each trading centre, the sample also covers those business owners who open late or close for some hours during the day. Consequently, the closed shops must be regarded as permanently closed or tentatively less active, possibly because owners work in the field, are sick, or visiting customers, etc. In the end, our sample overrepresents active over less active microentrepreneurs and, as such, we may slightly overestimate mobile money related activities (assuming that active mobile money use is related to overall entrepreneurial activity).

Most businesses (62 per cent) are retail or wholesale stores, for instance shops selling packed food, drinks, stationary, spare parts for motorcycles, and construction materials. Around 28 per cent of microentrepreneurs run a service business, mostly hair dressing salons, restaurants, and bars. The remaining 10 per cent of businesses are manufacturing companies, mostly in furniture making or metal goods production. About half the respondents state that they have another job in addition to their business, mainly farming. It is notable that women-owned businesses have significantly lower sales, smaller profits, and fewer employees.

Regarding several characteristics, we can compare our sample to the nationally representative World Bank's Living Standards Measurement Study (LSMS). The 2018/2019 panel wave allows analysing subsamples. If we select all business owners from rural Western Uganda (i.e. 176 participants of the LSMS, see Appendix Table A1), our sample is more female, younger, and more educated than the LSMS sample. The largest difference seems to be by gender. For various reasons, including responsibilities at home, running a nearby shop is easier for women than

working at customer sites or, for example, in transportation, a predominantly male profession. This is why women are overrepresented in our sample. In particular, as this applies for women with children who need attention, these women are relatively young. As they are young, they are tentatively better educated (in line with increasing education levels over time). However, both datasets (i.e. ours and the LSMS's microentrepreneurs in rural Western Uganda) are very similar in terms of living standards and financial behaviour. Therefore, we believe that findings from our sample can be generalised for small business owners in rural areas of Western Uganda. This also largely applies to the Central region. In comparison, the Northern and Eastern regions are poorer.

Our survey is especially designed to capture financial behaviour. The enumerators are trained students from a local university, fluent in English and in Rutooro, the local language. Tablet-based interviews typically last about 45 minutes. For taking part in the survey, each participant receives a show-up fee of 3,000 Ugandan Shilling (UGX) and a game payout between 500 and 3,000 UGX, depending on choices made in a module on risk preferences, which is not included in this analysis. Total average compensation is 4,900 UGX (about \$1.40), corresponding to more than half a day's wage, as the median monthly income of the rural population in Uganda is estimated at 150,000 UGX (Ugandan Bureau of Statistics [UBOS], 2018).

## 2.2. Summary statistics

Table 1 presents an overview of the respondents' characteristics: 64 per cent of our sample is female, averaging 34 years old, and 71 per cent completed primary education. Their financial literacy competence is moderate, which is being able to answer half of the respective questions correctly. The sample has an average work experience of about 7 years, of which 4.6 are in their current business. About 65 per cent report having no employees.

The mean and median business profits over the past month are 160,000 and 100,000 UGX, respectively. Only 10 per cent report profits of more than 400,000 UGX. While 81 per cent of businesses are formally registered, they behave rather informally, with just 22 per cent keeping business records.

Regarding the availability of bank branches and mobile money, less than one in four microentrepreneurs report that their nearest bank branch is less than 10 km away. In contrast, mobile money services are easily accessible in all trading centres through local agents: 95 per cent state that they can walk to the next agent from their shop within 10 minutes and, typically, they can choose between several mobile money agents. Further, network coverage quality is just reasonable (about 7 on a scale from 0 to 10). The Appendix Table A2 provides details on financial behaviours.

In our sample, 92 per cent report having a mobile phone. This is a higher rate than the 46 per cent ownership rate identified for the rural population in Uganda (52 per cent countrywide) (FinScope, 2018, p. 10). This can be likely attributed to the small business owner's underlying characteristics: being older than the average population and running their own business. Moreover, within our sample, 86 per cent own a mobile money account. This is also significantly higher than the overall 56 per cent reported by FinScope (2018), p. 26. However, owning an account is not the same as using it actively. We define the latter via four conditions, out of which at least one must be fulfilled: current mobile savings; current mobile loans; any mobile transfers made in the past 3 months; or ever made mobile payments (traditional transfers imply person-to-person transactions while payments are directed at other businesses). Even though 86 per cent report a mobile money account in our sample, only 49 per cent overall are classified as active mobile money users. This fundamental finding implies that only 57 per cent of account owners are also active users (see Appendix Figure A1 for a depiction of the activity gap across financial institutions). Reassuringly, the Bank of Uganda (2021) also calculates for the whole country a share of 60 per cent active users (i.e. those who were active during the last three months) among all registered mobile money account holders.

**Table 1.** Descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
<b><i>Socio-economic characteristics</i></b>					
Female (share)	0.64	0.48	0	1	2,223
Age	33.86	11.66	16	96	2,215
Highest completed level of education	1.45	1.37	0	5	2,223
Number of assets	37.02	17.65	5	156	2,223
Financial literacy (correct answers out of 7 questions)	3.63	1.65	0	7	2,223
Risk tolerance (0–10 scale)	5.24	2.74	0	10	2,223
Work experience (years)	6.97	7.74	0	56	2,223
Work experience in this business (years)	4.58	5.93	0	51	2,223
<b><i>Business characteristics</i></b>					
Monthly profits (in UGX 100k)	1.62	2.21	–8	15	2,181
Number of employees	0.43	0.70	0	11	2,223
Keeps business log/record	0.22	0.42	0	1	2,223
Trading licence	0.81	0.39	0	1	2,223
<b><i>Availability of FI and network effects</i></b>					
Nearest bank branch is $\leq$ 10 km	0.24	0.43	0	1	2,223
MM agent density	3.89	3.57	0	40	2,223
Network quality (0–10 scale)	7.22	2.16	0	10	2,223
Share active MM users within TC	0.49	0.15	0	1	2,223
<b><i>Access to mobile phones and mobile money</i></b>					
Mobile phone ownership (share)	0.92	0.27	0	1	2,223
MM account ownership (share)	0.86	0.35	0	1	2,223
Nearest MM agent is $\leq$ 10 min by foot	0.93	0.26	0	1	2,223
Active MM user (share)	0.49	0.50	0	1	2,223

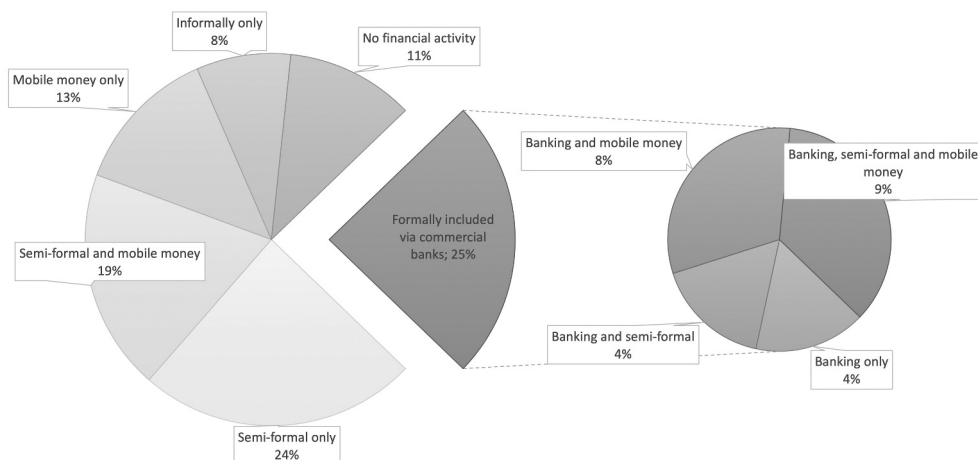
*Note:* Summary statistics are based on personal tablet-based interviews conducted in the Kabarole district in Uganda from February until April 2019. The data include information displayed above about socio-economic characteristics, business profiles, availability of financial institutions (FI), network effects, and access to mobile phones and mobile money (MM), of 2,223 small business owners in 108 local trading centres (TC). Level of completed education is an ordinal variable ranging from none or incomplete primary (0), primary (1), lower (2) and upper (3) secondary, tertiary (4) to university (5). Assets exclude livestock. Monthly profits are based on the past 4 weeks and winsorised at the 99 per cent level. Overall, only 768 respondents (35 per cent of total) know the distance to the nearest bank branch. Thus, we assume that the nearest bank branch is further than 10 km from a respondent's business if she does not know the distance. MM agent density refers to the number of MM agents within a 15-minute walking distance. Share of active MM users within the TC excludes a respondent's own observation. Active MM user indicates that respondents themselves report actual and recent MM activities on savings, transfers, loans and/or payments.

### 3. The role of various financial institutions for financial inclusion

Mobile money is widespread, but does it contribute to including more microentrepreneurs into the financial system? Mobile money services depict a new kind of financial institution, with an initial policy-relevant question being whether they contribute to reducing the share of the unbanked and, thus, increase the level of financial inclusion? While financial inclusion typically refers to formal financial institutions only, semi-formal financial institutions also provide many financial services (in particular loans) in Uganda; just as in other developing countries. Thus, we also consider both formal and semi-formal financial inclusion in the analysis to assess the *status quo* among rural Ugandan microentrepreneurs. However, the semi-formal institutions are an imperfect substitute for formal institutions, due to less services and weaker regulation (for institutional details in Uganda, see Parts 1 and 2 of Appendix Table A3).

Figure 1 informs about the observed levels of financial inclusion, considering the three dimensions: (1) formal inclusion via commercial banks; (2) semi-formal inclusion (includes SACCOs, microfinance institutions, ROSCAs and ASCAs); and (3) inclusion via active mobile money use.

Figure 1 shows that about 25 per cent of the microentrepreneurs use formal banking services. This group can be split into 4 per cent (of the total sample) who use only banks (thus neither semi-formal nor mobile money services), another 4 per cent use banks and semi-formal institutions, 8 per cent use banks



**Figure 1.** Levels of financial inclusion.

*Note:* Authors' calculations based on the full sample. The three identified levels of financial inclusion are formal inclusion via commercial banks (CBs), semi-formal inclusion (incl. SACCOs, ROSCAs, ASCAs and micro-finance institutions), and inclusion via active mobile money use. The first level of formal inclusion is presented in more detail in the pie chart on the right. The second level is presented separately as semi-formal inclusion only and semi-formal and mobile money users. The third level includes those who are included via mobile money only. These three levels of financial inclusion reach about 81% of the total sample. Informally only refers to those microentrepreneurs who only use informal financial services like: saving at home or with friends and relatives; making transfers via personal journeys, friends and relatives, or bus drivers; taking loans with moneylenders or friends and relatives. No financial activity indicates that the microentrepreneur has no savings or loans and reported no transfers in the past 3 months. This group includes people with a mobile money account who do not actively use it. However, members of this group may rely on accounts of others, such as family members.

and mobile money, and another 9 per cent use all three forms. This implies that about two-thirds of bank account users also actively use a mobile money account. Customers of semi-formal institutions are less integrated in other financial institutions: about 24 per cent (of the total sample) use semi-formal providers exclusively, another 19 per cent only in combination with mobile money (see Figure 1). Half of all semi-formal customers also use mobile money actively.

About 35 per cent of the total sample use mobile money actively, in addition to formal or semi-formal financial services. This pattern appears typical for other African countries (see Demirgüç-Kunt et al., 2020). Those using mobile money exclusively are an especially interesting group to study with respect to financial inclusion because this status indicates – following Demirgüç-Kunt et al. (2020) – the extension of financial inclusion to previously unbanked people. As depicted in Figure 1, about 13 per cent of the sample are exclusively financially included through active use of mobile money services. At the same time, about 19 per cent of the microentrepreneurs are not financially included (i.e. report informal activities only, such as saving at home, or none at all). This provides suggestive evidence that mobile money improves financial inclusion of up to 40 per cent of those without prior access to (semi-)formal financial services, calculated as 13 over the sum of 13 and 19.

Although this subsample is clearly financially included via mobile money, it would be a strong assumption that none of these small business owners have used formal or semi-formal financial services before or would not be willing to use these alternatives in the absence of mobile money. Thus, if we cautiously assume that half of this group are indeed *additionally* financially included, then the introduction of mobile money would have reduced the number of financially excluded by about 25 per cent (from formerly about 25.5 per cent to 19 per cent).

#### 4. Characteristics of mobile money users

Although it is generally found that the availability of mobile money reduces the share of the financially excluded, it is a concern for identification that financial inclusion does not occur randomly. The question arises whether there is any evidence that mobile money is able to reach new segments of the population for whom access to formal (or semi-formal) institutions may be difficult to achieve. Being poorer, less educated, female, and older is shown to generally decrease the probability of having a mobile money or bank account (e.g. Zins & Weill, 2016). Moreover, (using) mobile money is associated with lower distance to mobile agents (Munyegera & Matsumoto, 2016) and existing financial inclusion (Batista & Vicente, 2020b; Riley, 2018); with respect to paying suppliers via mobile money, it is associated with being younger, male, and rather productive entrepreneurs (Beck et al., 2018).

To analyse this issue further, we identify the explanatory variables for each level of financial inclusion by comparing groups to each other. Thus, we estimate the following model using a probit regression:

$$Pr(FI_{ik}|X) = \Phi(\beta_0 + \beta_1 \text{Socioecon.}_i + \beta_2 \text{BusinessCharacteristics}_i + \beta_3 \text{Availability}_i) \quad (1)$$

where  $FI_{ik}$  measures individual financial inclusion of type  $k$ , which differs across regressions. Probit models are estimated by the maximum likelihood method and, here, quantify the probability of whether an individual is financially included to not, conditional on the explaining variables  $X$ .  $\Phi$  is the standard normal cumulative distribution function. The explaining variables of the model are socio-demographic attributes, business characteristics, and the availability of financial services, as summarised in the first three sections of Table 1. Standard errors are clustered at the trading centre level.

We present the marginal effects of the variables from Equation 1 in columns (1) to (4) in Table 2. In a first step, we estimate the determinants of *formal* financial inclusion. We compare the group of formally included microentrepreneurs via active use of banking services to all other small business owners. The expectation from the literature is that this group is characterised by higher status in various respects, such as better education and higher wealth, etc. This is indeed what we find in our sample and show in detail in column (1) of Table 2.

In column (2) of Table 2, we compare the active users of mobile money, i.e. 49 per cent of the sample, to all others. We know that, within this group, some business owners are additionally elsewhere financially included, but some use mobile money exclusively. Thus, we expect just some similarity with the banked group from specification (1). Indeed, we find some similarity with the bank account holders: this group is also more often male, wealthier, and risk loving. They are also more profitable, keep business records, are licenced, closer to bank branches, and have better network coverage. New, and thus of particular interest, is that this group is younger than others and reports a higher share of other active users in their trading centre. If the share of active mobile money users increases by 10 percentage points, the likelihood of mobile money activity increases by 2.1 percentage points, all else equal. In addition, the results in column (2) show that the number of available mobile money agents matters for active use. Specifically, each additional mobile money agent within a 15-minute walking distance is, on average, associated with a 1 percentage point higher probability of active mobile money usage, all else equal. From the descriptive statistics, we know that, on average, 4 mobile money agents are available to business owners within this radius. In sum, there seem to be two driving forces for mobile money usage: first, being a young man (and relatedly being more risk tolerant) and, second, better availability of mobile money. The Table S1 in the Supplementary Materials provides further details.

Next, we look deeper at those who only use mobile money and do not use formal or semi-formal financial services, i.e. 13 per cent of the sample. These respondents likely contribute to improving financial inclusion. In Table 2, column (3), we compare this group to all others, finding some

**Table 2.** Correlates of financial inclusion

	(1) Formally included	(2) Active mobile money user	(3) Active mobile money user (exclusive)	(4) Active mobile money user
	Reference group: all others	Reference group: all others	Reference group: all others	Reference group: only financially excluded (informal/inactive)
<b><i>Socio-economic characteristics</i></b>				
Female	-0.04** (0.017)	-0.06*** (0.022)	-0.05** (0.021)	-0.06 (0.042)
Age	0.00 (0.001)	-0.00*** (0.001)	-0.00*** (0.001)	-0.01*** (0.002)
Highest completed level of education	0.05*** (0.006)	0.00 (0.009)	-0.00 (0.006)	0.01 (0.012)
Number of assets (std.)	0.06*** (0.008)	0.03** (0.014)	-0.02** (0.009)	0.04* (0.026)
Financial literacy (std.)	0.02* (0.014)	0.02 (0.014)	-0.02** (0.009)	0.01 (0.023)
Risk tolerance (std.)	0.02*** (0.008)	0.07*** (0.012)	0.01 (0.007)	0.05*** (0.018)
Work experience (years)	0.00*** (0.001)	0.00 (0.002)	-0.00 (0.001)	0.00 (0.003)
<b><i>Business characteristics</i></b>				
Number of employees	0.01 (0.012)	0.03* (0.017)	0.01 (0.010)	0.05* (0.031)
Monthly profits (in UGX 100k)	0.02*** (0.004)	0.02** (0.007)	-0.01 (0.004)	0.02 (0.014)
Keeps business log/ record	0.05** (0.019)	0.17*** (0.021)	0.02 (0.017)	0.22*** (0.041)
Trading licence	0.06** (0.026)	0.08*** (0.031)	0.02 (0.020)	0.09* (0.049)
<b><i>Availability of FI and network effects</i></b>				
Nearest bank branch is ≤ 10 km	0.10*** (0.019)	0.15*** (0.024)	0.03* (0.017)	0.14*** (0.043)
MM agent density	0.01** (0.003)	0.01*** (0.003)	0.00 (0.002)	0.01** (0.005)
Network quality (0–10 scale)	0.01*** (0.004)	0.02*** (0.005)	-0.00 (0.003)	0.01 (0.008)
Share active MM users within TC	0.05 (0.061)	0.21** (0.083)	0.04 (0.054)	-0.03 (0.132)
Observations	2,173	2,173	2,173	689

*Note:* Table displays marginal effects from a probit regression with binary dependent variables that differ across regressions. Columns (1) – (4) depict the different groups of financial outcomes as outcome variables. Risk preferences are based on a self-assessment about the individual willingness to take on risk, measured on a 0–10 scale and then standardised to a z-score. Robust standard errors (clustered at trading centre (TC) level) in parentheses with \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

similarity to specification (2): those belonging to this group are more likely male and younger. However, they are less wealthy, less financially literate, and the availability of mobile money does not explain their use.

In column (4), we compare exclusive mobile money users to the financially excluded microentrepreneurs. We find that the exclusive mobile money users are, on average, younger and more risk tolerant. Moreover, those belonging to the group of active mobile money users without formal or semi-formal accounts have, on average, more employees, are more likely to keep business records, and are more likely to be licenced than the financially excluded. Like the characteristics of formally included versus others, exclusive mobile money users are also wealthier than the financially excluded. New is that mobile money agent density is relevant, which clearly indicates that availability is important.

Overall, we find that mobile money users have some similarity with the banked respondents, however, tending in their characteristics more towards average microentrepreneurs. To better capture the contribution from spreading financial inclusion, we look at those who exclusively use mobile money. There are two different revelations for this group: relative to all others, this group is male and young, but less wealthy and less financially literate. However, relative to the financially excluded, this group is better-off and profits from the better availability of mobile money. As a result, we find that financial inclusion via mobile money does not occur randomly, and barriers seem to persist for the most disadvantaged.

## 5. Insufficient availability of mobile money services

In this section, we analyse the potential consequences of insufficient availability of mobile money. Indeed, we show in [Table 2](#), although not yet extensively discussed, that several availability factors may affect the use of mobile money. Summarising the results shown towards the bottom of [Table 2](#) in columns (2) to (4), coefficients are, with two exceptions, positive. Seven out of 12 coefficients are positive and statistically significant, even though they are always included jointly into the regressions. The variable of ‘nearest bank branch’ is a measure of geographical centrality because it has a positive impact on the use of mobile money. Despite this effect, the ‘MM agent density’ (which is also higher in central places) also has a positive influence on the use of mobile money (for a similar result, see [Aker et al., 2020](#)). As third availability variable, the quality of network coverage is significant in specification (2), i.e. comparing active users versus all others.

Finally, also the share of active mobile money users in the same trading centre has a significantly positive coefficient in specification (2). We argue that a higher share of adopters in the respondent’s vicinity increases the probability that the respondent is better informed about mobile money and enjoys the higher local network benefits of mobile money. This is in line with [Murendo et al. \(2018\)](#), who survey 477 Ugandans from another district and find that social network effects in terms of knowing other mobile money adopters significantly increases the likelihood of own adoption.

In sum, our results clearly indicate the relevance of the availability factor for the use of mobile money. In addition to physical access, positive network externalities around mobile money services also impact their use. While this holds for the total sample, the use of mobile money – in contrast to financially excluded microentrepreneurs – is mainly driven by centrality of the location and agent density.

## 6. High fees as a barrier against mobile money services

In this section, we explore another potential limiting factor of mobile money use, namely high fees. For small-scale transactions, fees are as high as 50 per cent of the transaction amount at the time of our survey. Therefore, we implement a novel choice experiment to analyse the microentrepreneurs’ willingness to pay (WTP) for mobile money services and compare this to the actual prices of the two

leading mobile money providers in Uganda (see Figure S1 for the pricing tables at the time of the survey).

### 6.1. Design of the choice experiment

To analyse the impact of fees for active mobile money use, we conduct a specific survey experiment. The experimental design allows for causal inference of how individual behaviour changes when certain parameters of the experiment change, as the components are randomly assigned (Charness, Gneezy, & Kuhn, 2012). To reduce biased responses, we frame the hypothetical situations in a clear and simple way, carefully train the enumerators, clarify to each respondent that there is no right or wrong answer, and pre-test the whole setting. As this approach encourages and motivates respondents to reveal their true preferences, we expect that responses reflect the true decision situation of participants. Moreover, results indicate a high degree of internal validity of responses.

We implement a discrete choice (vignette) design where each respondent is exposed to a total of 12 hypothetical situations involving mobile money transactions and asked to judge them. The choice sets in our experiment differ along four dimensions: (i) the type of mobile money service (i.e. transfer within same network, transfer to different network, cash withdrawal from the mobile money account, and payment in a store; in our analysis, we exclude the very different mobile money services of savings or loans); (ii) the transaction amount (10,000 UGX, 50,000 UGX and 150,000 UGX); (iii) the fee charged (1%, 5%, 10%, 15% and 25%, i.e. varying around the actual fees); and (iv) whether the information about the fee is given in per cent only or also in total UGX (in the main text, we exclude the hypothetical case of information in percentage only here, see Bertrand & Morse, 2011, because in Uganda information is always provided in UGX). For each question, the respondents need to decide whether they would be willing to make the mobile money transaction under the stated conditions. Our preamble, interviewer instructions, possible choice sets, and the randomisation procedure are presented in Tables S2 and S3.

Note that the hypothetical questions largely mirror real-world situations. A difference is our presentation of fees in percentage terms and total UGX, while mobile money providers in Uganda state fees only in UGX. Regarding the presentation in per cent plus UGX, participants' decisions are driven by the UGX amounts and, thus, approximate the real situation in Uganda quite well. We show this result in Table S4 where we repeat the choice experiment for 80 per cent of the sample (being collected at that time) and where we use three forms of presentation, i.e. fees given in per cent, in per cent plus UGX, and in UGX only. The WTP for UGX only is only slightly less than for per cent plus UGX, but both differ markedly from the WTP when information is presented in per cent only.

In total, 60 different situations are possible outcomes of the randomisation process. With each respondent answering an average of 4 hypothetical questions (and a maximum of 12; the difference is because we do not consider two out of six items, i.e. savings and loans, and we do not consider fee information in percentage only), we have enough observations to implement a full factorial design. The average reservation price can be identified by estimating what fees are, on average, still accepted. Due to the random assignment, the elements described above vary evenly across the sample.

### 6.2. Within-experiment determinants of the willingness to pay

We estimate the following model using a linear regression, which tests whether variation in the four different variables (introduced in the section above) is systematically related to the WTP for a mobile money service. We measure the WTP as the likelihood to accept a choice set:

$$Pr(WTP_i = 1|X) = \beta_0 + \beta_1 Type + \beta_2 Amount + \beta_3 Fee + \beta_4 AmountFee \quad (2)$$

Equation 2 shows that we consider the impact of transaction amount separately and in an interaction. In addition, we treat them as ordinal variables with three and five levels, respectively. In the following, we focus on the effects of the transaction type, the amount and level of fees, as well as their interaction.

Table 3 presents the results. Column (1) provides results for the full sample. First, relative to the most common transaction within network, the WTP for business payments is lower than for transfers; this difference largely reflects the actual fee structure. Generally, differences in WTP across transaction types are minor. Second, the WTP decreases with higher transaction amounts, which again qualitatively reflects actual transaction fees. Third, higher fees decrease the WTP and when fees are as high as 25 per cent of the transaction amount, the willingness to pay decreases by 60 per cent compared to the reference case of 1 per cent (such detailed results are shown in Table S5). Overall, these patterns are qualitatively reasonable and document clear price elasticity. Finally, the interaction term between amount and fees is negative and significant in the full specification and for transfers within the same network. In columns (2) to (5), it appears that there are no qualitative differences in the determinants of the WTP across transaction types.

### 6.3. Willingness to pay at real world fees

In the next step, we compare the stated WTP to actual fees in Uganda at the time of the survey. The share of respondents with a WTP at least as high as the actual transaction fees should be at least as

**Table 3.** Willingness to pay for mobile money – within-experiment determinants

	(1) Full	(2) Transfer within network	(3) Transfer diff. network	(4) Withdrawal	(5) Payment in a store
<b>Transaction type</b>					
Transaction type: Transfer within network	Ref.				
Transaction type: Transfer to different network	0.01 (0.013)				
Transaction type: Withdrawal	-0.00 (0.013)				
Transaction type: Payment in a store	-0.04*** (0.013)				
<b>Transaction amount and fee</b>					
Amount	-0.07*** (0.012)	-0.06*** (0.022)	-0.05** (0.024)	-0.07*** (0.025)	-0.09*** (0.023)
Fee	-0.14*** (0.009)	-0.14*** (0.015)	-0.15*** (0.016)	-0.13*** (0.016)	-0.16*** (0.016)
<b>Interaction effect</b>					
Amount*Fee	-0.01*** (0.004)	-0.02*** (0.007)	-0.01 (0.007)	-0.01* (0.007)	-0.01 (0.007)
Constant	1.16*** (0.028)	1.16*** (0.047)	1.13*** (0.053)	1.13*** (0.052)	1.18*** (0.051)
Observations	8,896	2,235	2,214	2,251	2,196
N (respondents)	2,206	1,457	1,445	1,474	1,400
R-squared	0.262	0.279	0.248	0.245	0.275

Note: Table shows results from a linear probability model. Column 1 shows the results for the full specification, columns 2–5 results by type of transaction. Vignette questions on savings and loans and those including the fee only in percentage terms have been excluded. Standard errors are clustered at the individual level and displayed in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

high as the share of active users of mobile money, i.e. about 49 per cent, assuming that cost considerations are the sole determinant of mobile money use. If more than 49 per cent report a WTP for mobile money at real world fees, this suggests that there are non-fee hindrances to using mobile money. In addition, any difference between the WTP and 100 per cent indicates the share of potential users who regard mobile money as being too expensive.

Table 4 presents the results. Indeed, the elicited WTP for all kinds of transactions is clearly higher, on average, than the actual use of mobile money services at about 49 per cent; the only exception are transfers to a different network for small amounts. As not all participants have decided about all alternatives, we only discuss shares, which are informative due to the random allocation of treatments.

For typical transactions involving 50,000 UGX, with fees reported in per centages and UGX, 65 to 79 per cent of the respondents are willing to make the transaction. While these WTP-numbers clearly indicate the further potential of mobile money with lower real-world fees, how big is this potential? For an assessment, we consider that about 10 per cent of respondents are largely financially inactive and likely not interested in mobile money services at any fee level. Thus, the short-term potential is not 100 per cent but rather 90 per cent of the sample. Accordingly, we estimate that an order of magnitude of about 10 to 20 per cent of the population (i.e. 90 per cent minus about 70 to 80 per cent, respectively) may not use mobile money because of high fees for a typical transaction amount (fees are an even higher barrier in the WTP experiment by Aker et al., 2020). For smaller transaction amounts, this share is estimated to be even higher. In particular, small transactions to different networks are particularly costly.

As only 49 per cent of our sample actively use mobile money services, the presented results indicate that large shares of respondents do not actively use mobile money for reasons unrelated to fees. Roughly, this share is between 20 and 30 per cent of our sample, given that 10 to 20 per cent are constrained by fees, 10 per cent may be not interested in the service, and 49 per cent are active users; collectively equalling 100 per cent. While some may not see any good reason to use mobile money, there are others, who we can identify, who find the limited availability of mobile money as a barrier to its use (see Section 5).

Interestingly, the level of fees declined significantly in May 2019, i.e. directly after our sample period (which ended in April 2019). According to statistics of the Bank of Uganda (2021) the share of registered or active mobile money users has clearly increased over time; moreover, a declining average transaction value indicates a more intensive use.

## 7. Willingness to pay according to participants' characteristics

In this section, we analyse the willingness to pay (WTP) experiment from above by focusing on six specific characteristics of participants. In particular, we are interested whether these characteristics

**Table 4.** Willingness to pay for mobile money at actual transaction fees

	(1)	(2)	(3)
	Transfer within network	Transfer to different network	Withdrawal
<i>Transaction amount</i>			
UGX 10,000	67%	36%	78%
UGX 50,000	79%	65%	73%
UGX 150,000	89%	72%	66%

*Note:* Table reports the share of respondents willing to make a hypothetical transaction in the choice experiment with fees (reported in total UGX and %) that would actually be charged for that transaction at the time of the interview.

are related to the level of WTP for mobile money services and to the price sensitivity regarding mobile money services.

As first characteristic, we expect a potential impact of higher financial literacy on higher WTP and higher price sensitivity (i.e. less acceptance of high fees). Note that we have measured financial literacy via standard items, similar to Lusardi and Mitchell (2014), and that this measure shows the well-known relations to better education and higher income, etc. Results from a regression on the respondent's willingness to pay, controlling for several respondent characteristics, are presented in Table 5. Interestingly, financial literacy indeed leads to a higher WTP for mobile money services and stronger sensitivity regarding increasing fees (column 1). While a fee of 5 per cent is still almost as likely accepted as a 1 per cent fee by those with higher financial literacy, fees at 10 per cent or more appear to discourage them more from making a transaction.

**Table 5.** Willingness to pay for mobile money by respondent characteristics

Dependent variable: Willingness to pay for mobile money services						
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Experiment characteristics<sup>a</sup></i>	YES	YES	YES	YES	YES	YES
<i>Respondent characteristics</i>						
Financial literacy (std.)	0.08*** (0.016)					
Number of assets (std.)		-0.02* (0.013)				
Female			-0.03 (0.025)			
Age				-0.00* (0.001)		
Active mobile money user					-0.02 (0.024)	
Highest completed level of education						0.03*** (0.008)
<i>Interaction terms<sup>b</sup></i>						
<i>Characteristic*UGX 10,000</i>	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
<i>Characteristic*UGX 50,000</i>	-0.04** (0.015)	0.02 (0.012)	-0.02 (0.024)	-0.00 (0.001)	0.07*** (0.023)	0.00 (0.008)
<i>Characteristic*UGX 150,000</i>	-0.05*** (0.016)	0.02 (0.012)	0.00 (0.025)	0.00 (0.001)	0.10*** (0.024)	-0.01 (0.009)
<i>Characteristic*1%</i>	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
<i>Characteristic*5%</i>	-0.01 (0.019)	0.02 (0.016)	0.04 (0.030)	0.00 (0.001)	0.05* (0.028)	-0.02* (0.010)
<i>Characteristic*10%</i>	-0.07*** (0.019)	0.05*** (0.015)	0.08** (0.031)	0.00 (0.001)	-0.00 (0.030)	-0.01 (0.010)
<i>Characteristic*15%</i>	-0.08*** (0.019)	0.03* (0.015)	-0.01 (0.031)	0.00 (0.001)	-0.06** (0.030)	-0.02** (0.010)
<i>Characteristic*25%</i>	-0.09*** (0.019)	0.01 (0.015)	0.06** (0.029)	-0.00 (0.001)	-0.07** (0.029)	-0.03*** (0.010)
Constant	1.00*** (0.014)	1.00*** (0.014)	1.03*** (0.021)	1.08*** (0.039)	1.02*** (0.020)	0.97*** (0.020)
Observations	8,896	8,896	8,896	8,864	8,896	8,896
R-squared	0.271	0.268	0.268	0.267	0.270	0.268

*Notes:* Table shows results from a linear probability model. Standard errors are clustered at the individual level and displayed in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . <sup>a</sup>All experiment characteristics as in Table 3 included. Vignette questions on savings and loans and those including the fee only in percentage terms have been excluded. <sup>b</sup>*Characteristic* refers to the respective respondent characteristic for which the interaction effects are calculated (col. 1: financial literacy, col. 2: wealth, col. 3: female, col. 4: age, col. 5: active mobile money use, col. 6: education).

In further regressions, we test the possible effect of five more characteristics. Column (2) shows that larger asset holdings seem to have opposite effects to those from column (1). This is a bit surprising, the size of coefficients is relatively small and not fully consistent, so that we hesitate to interpret this as a clear (wealth) effect. The result in column (3) shows no systematic gender effect, despite the gender gap in the actual use of mobile money services (Table 2). Moreover, we find that age (being older) affects the WTP to a marginal degree only and does not affect the respondent's reaction to higher transaction costs (column 4). Finally, active mobile money users respond more strongly to an increase in the (hypothetical) fees charged (column 5) and the better educated react tentatively as the financially literate but to a lesser degree (column 6). Cumulatively, this highlights the need to invest in financial education, which will contribute to a more rational use of mobile money services.

## 8. Policy conclusion

Not only are mobile money services typically less costly and more easily accessible than formal financial services, but they are also more flexible than semi-formal financial services. Thus, they have the potential to overcome existing barriers for financial inclusion. In our sample of rural microentrepreneurs, we find that 86 per cent have a mobile money account; however, only 49 per cent of respondents actually qualify as active users. Analysing this gap indicates measures that policy could take to further improve financial inclusion.

We acknowledge that mobile money use reaches a relatively large share of the sample population, given that only about 25 per cent use bank services. Moreover, we find that mobile money increases financial inclusion by up to about 13 per cent of the population and that many of the newly financially included need this financial access desperately. However, this progress can be misleading as it often hides the many and large shortcoming in financial inclusion that we uncover: the most disadvantaged are less likely adopters, insufficient availability hinders use, too high fees discourage a significant share of the population, while consumer decisions are likely affected by a lack of financial literacy.

We respond to these shortcomings by suggesting four policies that can improve financial inclusion via mobile money: (i) Further network expansion in rural areas should be supported in order to lower the barrier of insufficient availability of mobile money. (ii) The high fees should be put under pressure by improving competition among the various suppliers. (iii) Improved financial education can support the use of mobile money by making people more aware of this opportunity (also beyond the microentrepreneurs) and to ensure they understand how it works; this may lead, for example, to an increased price sensitivity. (iv) Measures should also target the three groups that use mobile money less frequently, i.e. women, older adults, and those with lower socio-economic status.

In countries like Uganda, which follow a national strategy of financial literacy, properly designing financial education can help address several problems simultaneously. It seems important to inform people about the potential of mobile money to increase demand while also making it more inclusive by facilitating access to mobile money for women and less well-off participants. Participants need education about fees, which may increase price elasticity and reduce biased decisions due to a lack of understanding. Overall, and despite some remarkable success, our analysis indicates that mobile money still has much potential to further improve financial inclusion.

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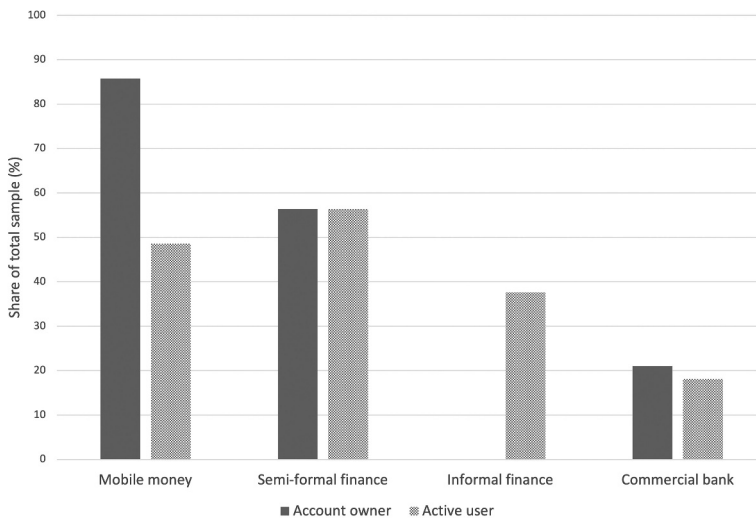
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## References

- Abiona, O., & Koppensteiner, M. F. (2020). Financial inclusion, shocks, and poverty: Evidence from the expansion of mobile money in Tanzania. Forthcoming. *Journal of Human Resources*, 1018–9796R1. <http://jhr.uwpress.org/content/early/2020/02/14/jhr.57.2.1018-9796R1.abstract>
- Aggarwal, S., Brailovskaya, V., & Robinson, J. (2020). Cashing in (and out): Experimental evidence on the effects of mobile money in Malawi. *AEA Papers and Proceedings*, 110, 599–604. doi:10.1257/pandp.20201087
- Ahmed, H., & Cowan, B. (2021). Mobile money and healthcare use: Evidence from East Africa. *World Development*, 141, 105392. doi:10.1016/j.worlddev.2021.105392
- Aker, J. C., Prina, S., & Welch, C. J. (2020). Migration, money transfers, and mobile money: Evidence from Niger. *AEA Papers and Proceedings*, 110, 589–593. doi:10.1257/pandp.20201085
- Aron, J. (2018). Mobile money and the economy: A review of the evidence. *The World Bank Research Observer*, 33(2), 135–188. doi:10.1093/wbro/lky001
- Bank of Uganda. (2021). Mobile money statistics. Data and Statistics. Retrieved from <https://www.bou.or.ug/bou/bouwebsite/PaymentSystems/dataandstat.html>
- Bastian, G., Bianchi, I., Goldstein, M., & Montalvao, J. (2018). *Short-term impacts of improved access to mobile savings, with and without business training: Experimental evidence from Tanzania* (Center for Global Development Working Paper 478). Retrieved 1 November 2020, from <https://www.cgdev.org/publication/short-term-impacts-improved-access-mobile-savings-business-training>
- Batista, C., & Vicente, P. C. (2020a). Improving access to savings through mobile money: Experimental evidence from African smallholder farmers. *World Development*, 129, 104905. doi:10.1016/j.worlddev.2020.104905
- Batista, C., & Vicente, P. C. (2020b). Adopting mobile money: Evidence from an experiment in rural Africa. *AEA Papers and Proceedings*, 110, 594–598. doi:10.1257/pandp.20201086
- Beck, T., Pamuk, H., Ramrattan, R., & Uras, B. R. (2018). Payment instruments, finance and development. *Journal of Development Economics*, 133, 162–186. doi:10.1016/j.jdeveco.2018.01.005
- Bertrand, M., & Morse, A. (2011). Information disclosure, cognitive biases, and payday borrowing. *The Journal of Finance*, 66(6), 1865–1893. doi:10.1111/j.1540-6261.2011.01698.x
- Blumenstock, J. E., Eagle, N., & Fafchamps, M. (2016). Airtime transfers and mobile communications: Evidence in the aftermath of natural disasters. *Journal of Development Economics*, 120, 157–181. doi:10.1016/j.jdeveco.2016.01.003
- Center for Financial Inclusion. (2018). Financial inclusion glossary. Center for Financial Inclusion at Accion. Retrieved 1 November 2020, from <https://www.centerforfinancialinclusion.org/financial-inclusion-glossary>
- Charness, G., Gneezy, U., & Kuhn, M. A. (2012). Experimental methods: Between-subject and within-subject design. *Journal of Economic Behavior & Organization*, 81(1), 1–8. doi:10.1016/j.jebo.2011.08.009
- Dalton, P. S., Pamuk, H., Ramrattan, R., van Soest, D., & Uras, B. (2020). *E- payment technology and business finance: A randomized control trial with mobile money* (Working Paper). Retrieved 1 December 2020, from <https://drive.google.com/file/d/1kC7PH8aiHr7nSRGtoXLOH32wrtLiAe-Y/view>

- Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S., & Hess, J. (2020). The Global Findex database 2017: Measuring financial inclusion and opportunities to expand access to and use of financial services. *The World Bank Economic Review*, 34(Supplement 1), S2–S8. doi:10.1093/wber/lhz013
- Dupas, P., Karlan, D., Robinson, J., & Ubfal, D. (2018). Banking the unbanked? Evidence from three countries. *American Economic Journal. Applied Economics*, 10(2), 257–97.
- FinScope. (2018). FinScope Uganda 2018 survey report. Financial Sector Deepening Uganda (FSDU), Kampala, Uganda. Retrieved 1 November 2020, from <http://fsduganda.or.ug/finscope-2018-survey-report/?download=1>
- Jack, W., & Suri, T. (2014). Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution. *American Economic Review*, 104(1), 183–223. doi:10.1257/aer.104.1.183
- Kiconco, R. I., Rooks, G., Solano, G., & Matzat, U. (2019). A skills perspective on the adoption and use of mobile money services in Uganda. *Information Development*, 35(5), 724–738. doi:10.1177/0266666918788908
- Lee, J. N., Morduch, J., Ravindran, S., Shonchoy, A., & Zaman, H. (2021). Poverty and migration in the digital age: Experimental evidence on mobile banking in Bangladesh. *American Economic Journal. Applied Economics*, 13(1), 38–71.
- Lusardi, A., & Mitchell, O. S. (2014). The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature*, 52(1), 5–44. doi:10.1257/jel.52.1.5
- MagnaCarta. (2019). Unravelling the web of inclusion. Oslo financial inclusion summit on 28 March 2019. Commissioned research by Mastercard. Retrieved 1 November 2020 from, <https://newsroom.mastercard.com/eu/files/2019/03/MCC1-FinInc-Report-PRweb.pdf>
- Munyegera, G. K., & Matsumoto, T. (2016). Mobile money, remittances, and household welfare: Panel evidence from rural Uganda. *World Development*, 79, 127–137. doi:10.1016/j.worlddev.2015.11.006
- Murendo, C., Wollni, M., De Brauw, A., & Mugabi, N. (2018). Social network effects on mobile money adoption in Uganda. *The Journal of Development Studies*, 54(2), 327–342. doi:10.1080/00220388.2017.1296569
- Pasti, F. (2019). 2018 State of the industry report on mobile money. London: GSMA.
- Riley, E. (2018). Mobile money and risk sharing against village shocks. *Journal of Development Economics*, 135, 43–58. doi:10.1016/j.jdeveco.2018.06.015
- Sekabira, H., & Qaim, M. (2017). Mobile money, agricultural marketing, and off-farm income in Uganda. *Agricultural Economics*, 48(5), 597–611. doi:10.1111/agec.12360
- Suri, T. (2017). Mobile money. *Annual Review of Economics*, 9(1), 497–520.
- Ugandan Bureau of Statistics. (2016). National population and housing census 2014 . Kampala, Uganda. Retrieved 1 November 2020, from <https://www.ubos.org/wp-content/uploads/publications/0320182014NationalCensusMainReport.pdf>
- Ugandan Bureau of Statistics. (2018). National labour force survey (NLFS) 2016/17 – main report. Kampala, Uganda. Retrieved 1 November 2020, from <https://www.ubos.org/wp-content/uploads/publications/102018Reportnationallabourforcesurvey201617pdf>
- Ugandan Bureau of Statistics. (2019). Northern region - Parish level profiles (Census 2014). Kampala, Uganda. Retrieved 1 November 2020, from <https://www.ubos.org/explore-statistics/20/>
- Wieser, C., Bruhn, M., Kinzinger, J., Ruckteschler, C., & Heitmann, S. (2019). The impact of mobile money on poor rural households: Experimental evidence from Uganda. Policy Research Working Paper No. WPS 8913, World Bank, Washington, DC.
- Zins, A., & Weill, L. (2016). The determinants of financial inclusion in Africa. *Review of Development Finance*, 6(1), 46–57. doi:10.1016/j.rdf.2016.05.001

## Appendix



**Figure A1.** The activity gap across financial institutions. *Note:* Authors' calculations based on the full sample. Account owners are those who report current personal accounts at the respective financial institution. Active user includes all for whom at least one of the following are reported at the respective provider: current savings; current loans; any transfers made in the past 3 months; only for mobile money services: past payments ever made. Semi-formal finance includes SACCOs, ROSCAs, ASCAs and microfinance institutions. Conversely, informal finance can include any of the following: saving at home or with friends and relatives; making transfers via personal journeys, friends, relatives, or bus drivers; taking loans with moneylenders, friends, and relatives.

**Table A1.** Comparison: own sample against LSMS data

Variable	Own sample			LSMS sample aged > 15			Diff.	Wald test p-value
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.		
Female	2,223	0.64	0.010	176	0.43	0.045	0.21	0.000
Age	2,215	33.86	0.248	176	40.73	1.344	-6.87	0.000
Illiterate	2,223	0.12	0.007	176	0.15	0.036	-0.03	0.399
Completed primary education	2,223	0.71	0.010	167	0.51	0.046	0.20	0.000
Completed secondary education	2,223	0.19	0.008	167	0.09	0.023	0.10	0.000
HH rooms for sleeping	2,223	2.37	0.032	176	2.42	0.104	-0.05	0.626
Own bank account	2,223	0.21	0.009	176	0.25	0.038	-0.04	0.320
Any loan	2,223	0.34	0.010	117	0.46	0.056	-0.12	0.033
Semi-formal savings (SACCO, ROSCA)	2,223	0.53	0.011	176	0.66	0.042	-0.13	0.003
Western Rural Region	YES	YES	YES	YES	YES	YES		
Business Owners	YES	YES	YES	YES	YES	YES		

*Note:* Table displays descriptive statistics of own sample and the business owners among the regionally representative sample of the LSMS – Uganda National Panel Survey 2018–2019, Household Questionnaire. The LSMS sample includes household weights. Business owners are identified from LSMS data via the question whether the respondent ran a business of any size for himself/herself in the last 7 days, even if it was for only one hour. Own bank account refers in LSMS data to reporting savings or a loan at a commercial bank account, and any loan refers to any loan in the past year, whereas our sample is asked about current outstanding loans, i.e. our question is more restrictive and contributes to explaining the lower share of loans.

**Table A2.** Descriptive statistics: financial behaviour

Variable	Mean	Std. Dev.	Min.	Max.	N
<i>Financial activity</i>					
Currently financially active <sup>a</sup>	0.89	0.31	0	1	2,223
Financial activities at formal bank	0.24	0.43	0	1	2,223
Financial activities at formal bank or semi-formal FI	0.68	0.47	0	1	2,223
Financial activities at formal bank, semi-formal FI or MM	0.81	0.39	0	1	2,223
<i>Informal financial activity</i>					
Any informal financial activity	0.38	0.48	0	1	2,223
Among formally included: informally active	0.31	0.46	0	1	544
Among formally or semi-formally included: informally active	0.35	0.48	0	1	1,513
Among only MM included: informally active	0.45	0.50	0	1	286
Among neither formal, semi-formal nor MM included: informally active	0.43	0.50	0	1	424
<i>Savings</i>					
Any savings	0.77	0.42	0	1	2,223
Currently savings at formal or semi-formal FI	0.67	0.47	0	1	2,223
Currently any savings held in MM	0.09	0.29	0	1	2,223
Current savings exclusively in MM	0.04	0.19	0	1	2,223
<i>Loans</i>					
Currently outstanding loan	0.34	0.47	0	1	2,223
Currently loans at formal bank or semi-formal FI	0.22	0.41	0	1	2,223
Currently any loan in MM	0.00	0.05	0	1	2,223
Current loans exclusively in MM	0.00	0.03	0	1	2,223
<i>Transfers<sup>b</sup></i>					
Any transfers	0.41	0.49	0	1	2,223
Any transfer at formal bank or semi-formal FI	0.01	0.08	0	1	2,223
Any transfers made with MM	0.28	0.45	0	1	2,223
Transfers exclusively with MM	0.25	0.43	0	1	2,223
<i>MM payments</i>					
Ever made payments using MM	0.29	0.46	0	1	2,223

Note: <sup>a</sup>Respondents are classified as financially active if they report current savings, current loans, any transfers in the past 3 months and/or ever made payments with mobile money (MM). <sup>b</sup>Respondents are asked to report money transfers made in the past 3 months to people living outside their own village.

**Table A3.** Financial inclusion and mobile money in Uganda (Part 1)

Notion	Definition	Context in Uganda	References
Financial inclusion	Access to the full range of financial services at affordable prices with sufficient convenience and dignity. The competing financial providers need to be obtainable for all groups in a society, incl. poor, rural and disabled populations.	Only one out of four adult Ugandans have an account at a formal financial institution. Financial inclusion is currently driven by semi-formal services and mobile money.	Center for Financial Inclusion (CFI, 2018), Demirgüç-Kunt, Klapper, Singer, Ansar, and Hess (2020)
Formal inclusion	Formal services are provided by financial institutions such as commercial banks. They are recognised as transparent and secure due to their legal regulation.	Often appear as more expensive, complex, and less accessible than given alternatives. Access typically requires a minimum deposit, a valid ID and residence documentation, which only a small minority of the rural population have.	FinScope (2018) and MagnaCarta (2019)

(continued)

**Table A3.** (Continued)

Notion	Definition	Context in Uganda	References
Semi-formal inclusion	Semi-formal services are provided by non-regulated, usually smaller, and less restrictive financial institutions. They are typically governed by their own members and are considered to be more accessible and reasonably priced. However, they offer fewer services.	Most Ugandans save semi-formally with SACCOs or other saving groups. In order to accumulate and borrow funds, group meeting associations such as ROSCAs and ASCAs are popular.	FinScope (2018)
SACCOs	Savings and Credit Co-operatives allow their members to regularly deposit money and earn interest. This money is redistributed to other members who wish to take out a loan and have established a steady saving history. New members need to buy a minimum share of the SACCO and thus becomes co-owners.	SACCOs have at least 30 members and can have many thousand. The national SACCO association in Uganda counts more than 1,200 SACCOs as member organisations.	<a href="https://ucscu.coop">https://ucscu.coop</a>
ROSCAs	In Rotating Savings and Credit Associations, group meetings collect savings and each time give the total amount to another, thus rotating, member.	Compared to SACCOs, ROSCAs are usually smaller and less formalised.	
ASCAs	Accumulating Savings and Credit Associations (ASCAs) lend the regularly collected savings to some members with interest, which is then fairly shared in the group.	ASCAs are usually small but require some book-keeping to manage the loan repayment.	
Informal inclusion	Informal financial services are not provided by institutions but by personal contacts, for ex. when borrowing from relatives, friends or moneylenders, or when conducting a money transfer through a bus driver.	Overall, one in three Ugandans (also) keeps cash savings at home. In rural areas, informal providers of financial services play a very important role.	FinScope (2018)

Table A3. Financial Inclusion and Mobile Money in Uganda (Part 2)

Notion	Background	Context in Uganda	References
Mobile money adoption	First offered in Kenya in 2007, mobile money services are now available in 90 countries. Today, there are more than 866 million registered accounts, processing 1.3 billion US dollars per day. The technology is most popular in developing and emerging markets, satisfying the demand for easily accessible and cheaper financial services.	Adoption increased rapidly after services were first introduced in Uganda in 2009. In 2019, 27 million registered customers collectively conducted almost 3 billion transactions in a network of about 200,000 agents. About half of the population sends and receives money using mobile money.	Bank of Uganda (2021), FinScope (2018), and Pasti (2019)

(continued)

Table A3. (Continued)

Notion	Definition	Context in Uganda	References
Mobile money providers	Large telecommunication companies offer mobile money services whilst also selling SIM cards and airtime to their customers. Thereby, mobile money sets itself apart from mobile payments in developed countries, as it is not linked to pre-existing bank accounts. Registered users can exchange cash for mobile money and make withdrawals with anybody from a vast network of licensed agents who earn commissions.	There are currently seven mobile money providers (most prominently MTN and Airtel Uganda), all of them regulated by governmental institutions.	
Prerequisites and services	Owning any kind of mobile phone, a SIM card of a mobile money provider and a national ID card for registration, are typically the only prerequisites to use mobile money services. Firstly, a mobile money account allows simple and exible safe-keeping of funds. Secondly, users can transfer mobile money instantaneously to other users in their network, users in other networks and even non-users.	Many providers have introduced additional services such as making payments for utilities via mobile money or granting short-term loans.	
Mobile money fees	Where account ownership is free of charge, transaction costs arise for all additional services. In general, mobile money services charge much lower fees for money transfers compared to alternative financial services. Fees relative to volume typically fall with increasing transaction amounts and vary by type of mobile money service.	A competitive market recently led to significant price cuts and promotional offers in Uganda.	Suri (2017)