Combining Financial-Literacy Training and SMS Reminders to Influence Mobile Money Use and Financial Inclusion among VSLAs: Experimental Evidence from Malawi

Abstract

Mobile money is increasingly promoted to improve financial outcomes and livelihoods of individuals in low-income countries. However, its adoption among the poor remains low. We exploit a randomized experiment that exposed Village Savings and Loan Associations (VSLAs) members in Malawi to a financial literacy and mobile money training program, complemented by text message (SMS) reminders. Using field-survey data and administrative records from the main telecommunication operators in the country, we find that our intervention significantly improved a mobile money knowledge index, a mobile money usage index, and a financial inclusion index among treated individuals, by 5, 3, and 4 percentage points, respectively. We also find evidence of heterogenous treatment effects for mobile money usage and knowledge as a function of pre-treatment trust in mobile money and the degree of economic development of the individuals' district of residence. This is among the first studies to provide rigorous field-based evidence on how financial training supported by SMS reminders can influence mobile money behaviour in Africa. This study also provides a novel approach to study the effects of such an intervention among members of VSLAs.

Key words

Mobile Money; Village Savings and Loan Associations; Financial Literacy; Randomised Experiment; Malawi

1 Introduction

There is increasing recognition of the direct consequences of financial development and inclusion on poverty reduction and economic performance (Ksoll et al., 2016; Otchere, Senbet & Simbanegavi, 2017; Ozili, 2018; Zins & Weill, 2016). However, according to the 2017 Global Financial Index, 1.7 billion adults around the globe are still unbanked, lacking access to a financial institution or to a mobile-money account (Demirgüç-Kunt et. al., 2018). The Global Financial Index also states that most of these individuals are concentrated in least-developed countries (LDCs). Financial development and inclusion, therefore, remain incomplete tasks in LDCs (Allen et al., 2014; Otchere, Senbet & Simbanegavi, 2017).

Mobile money is one of the most promising financial platforms for improving access to financial services in LDCs (Breza et al., 2020; Abiona & Koppensteiner, 2018; Demombynes & Thegeya, 2012; Fanta et al., 2016; Jack & Suri, 2014; Mbiti & Weil, 2013; Ntwiga, 2016; Otchere, Senbet & Simbanegavi, 2017). However, the positive effects of mobile money in LDCs have so far mostly been concentrated among high- and middle-income users (Fanta et al., 2016; Zins & Weill, 2016; Ozili, 2018). The limited adoption and use of mobile money among low-income individuals are related to several factors, among which the most important appear to be perceived insecurity, lack of trust, difficulty in using financial technology, and low levels of financial literacy (Oliveira et al., 2016; Ozili, 2018). In this sense, carefully designed, context based, financial education interventions could bridge the financial-inclusion gap and increase the adoption and use of digital finance services among the poor (Abebe, Tekle & Mano, 2018; Cohen, Hopkins & Lee, 2008; Xu & Zia, 2012).

In the last years, the rapid dissemination of savings groups such as Village Savings and Loans Associations (VSLAs), has reshaped the landscape of opportunities for financial inclusion in LDCs (Meyer, 2015; Ouma, Odongo & Were, 2017). VSLAs have transformed the financial sector in several African countries, and there is ample evidence in the literature pointing to its positive impacts among women and other society members historically excluded from the formal financial markets (Meyer, 2015; Ouma, Odongo & Were, 2017; Karlan et al., 2017). Developed in the early 1990s in Mali by CARE, VSLAs are a model of savings-led microfinance (Karlan et al., 2017).[1] The functioning and features of VSLAs, as well as their accessibility, make them attractive to low-income individuals who cannot afford bank fees and other costs related to formal

[1] Members make money contributions or take loans at regular meetings that all members are expected to attend. The minimum contribution is determined by group members based on income level. This could be a restriction on participation; however, we did not assess this issue in our paper because we studied a sample of individuals who were already members of a VSLA. assess this issue in our paper because we studied a sample of individuals who were already members of a VSLA. Money is normally saved in a cash box that is kept by the group treasurer. Members can contribute more than the minimum agreed amount, and loans earn interest (Karlan et al., 2017). The group shares accumulated interest and savings at the end of the saving cycle. The share received by individual members depends upon their savings and interest earned, which provides incentives for members to save and participate actively. Though this also puts pressure on members to borrow because financial rewards largely accrue to active participants (Le Polain, Sterck & Nyssens, 2018).

financial services. As such, VSLAs can also provide a unique context to introduce and disseminate mobile money platforms.

VSLAs provide financially excluded segments of poor societies with financial services which are ordinarily absent. Since participation in VSLAs is voluntary, VSLA members can be identified as a segment of the financially excluded who effectively demand financial services. Despite the conceptual gaps associated with VSLA objectives and practice (le Polain et al., 2018), the empirical evidence suggests that VSLAs improve members financial behaviour, which results in higher savings and access to credit (Ksoll et al., 2015), and that participation in VSLAs also improve business outcomes (Karlan et al., 2017). Cognizant of the fact that VSLA members effectively demand financial services but face supply constraints, we hypothesize that promoting mobile money use into VSLAs daily operations can act as bridge between participation in informal financial services (i.e., VSLAs) and access to the formal financial sector (mobile money). In other words, introducing mobile money among VSLAs may accelerate financial inclusion.

Given this context, we partnered with a local non-governmental organization (Emmanuel International) to implement a Randomized Control Trial in Malawi in order to study the role of financial-literacy training, reinforced by SMS reminders, on mobile-money knowledge and use, among VSLA members. Our results show that, approximately three to four months after our intervention, treated VSLA members are more likely to report a higher knowledge and use of mobile money services, as well as a higher level of access to formal financial services. Our results also provide evidence of heterogeneous intervention treatment effects related to pre-treatment trust in mobile money and the degree of economic development of the intervention area. We also exploit administrative data provided by the two main telecommunication companies in the country to estimate the effect of our intervention on the volume of individual mobile money transactions. While the estimated effect has the expected positive sign, it is not statistically significant. This may be related to the fact that individuals also rely on local agents to perform mobile-money transactions and that such behaviour is not captured in the administrative data. Indeed, 15% of our survey respondents report receiving money through mobile money but have no matched cell phone for the transaction, implying that an agent may have been used. Alternatively, the failure to reject the null in this latter case may be related to the reduced sample of individuals for which administrative data is available.

The evidence on the role of financial-literacy training on subsequent financial behaviour is vast but mixed, and limited studies deal properly with self-selection into training (Drexler, Fischer & Schoar, 2014; Mandell & Klein 2009; Sayinzoga, Bulte & Lensink, 2014). Recent development literature suggests that text-message reminders are increasingly used to influence behaviour in several contexts, such as promoting agricultural practices (Cole & Fernando, 2012; Larochelle et al., 2017; Murray et al., 2015), and influencing health-seeking behaviours (Gurman, Rubin & Roess, 2012). Some studies have also used text-message

reminders to influence financial behaviour and mobile-money use (Abebe, Tekle & Mano, 2018). Among farmers in Tanzania, there is experimental evidence suggesting that interactive text-message and behavioural-economics principles improve savings and borrowing on a mobile savings and credit product (M-PAWA) (Dyer, Mazer & Ravichandar, 2017). Along similar lines, an Ethiopian experiment shows that financial training combined with text-message reminders increases financial literacy and savings among micro-entrepreneurs (Abebe, Tekle & Mano, 2018). Others, like Cole, Sampson, and Zia (2011), combine financial training with price subsidies and find an increased demand for bank accounts.

As mentioned before, mobile money and VSLAs can be complements in the process of financial inclusion for the poor in Africa, in particular, and in other LDCs in general. The introduction of mobile money to individuals in savings groups offers several potential benefits to individual members, to the group, and to the economy more generally. For example, the use of mobile-money platforms in VSLAs (known as digital VSLAs or electronic VSLAs) can reduce risks and uncertainties such as cash theft, which has been reported as one of the risks of savings groups (Le Polain, Sterck & Nyssens, 2018). Digital VSLAs can also enable absent members to deposit or take loans from the group. Moreover, opening a mobile-money account can be the first step towards sustained access to formal financial services (Breza, et al., 2020). Recent reports indicate that savings groups in Kenya and Uganda have started using mobile-money saving accounts (Meyer, 2015) and that pockets of this practice can also be found in Malawi. To the best of our knowledge, however, there are no studies related to the promotion and dissemination of such practices or to their impact on the financial behaviour of VSLA members. In this study we aim to fill this gap, by providing empirical evidence on a promotion strategy to encourage the digitalization of VSLAs. In this regard our paper is among the first to provide rigorous, field-based evidence on how financial training supported by text-message reminders can influence mobile-money transactions and related financial behaviour in the short term. It is also among the very first to study the effects of such an intervention among members of VSLAs. This is particularly relevant in the Malawian and African contexts, as financially excluded individuals are increasingly being served by such savings groups.

The rest of the paper is organized as follows. Section 2 presents the intervention, the experimental design, and discusses how data was collected and analysed. Section 3 develops our empirical analysis. We start Section 3 by assessing the balance in pre-treatment characteristics among treatment and control groups, and then proceed to estimate the impact of our intervention using the follow-up survey data. In Section 3 we also test alternative specifications, explore heterogenous treatment effects, and assess the intervention effects using the administrative data obtained from the telecommunications firms operating in the area. Finally, Section 4 concludes.

2 Experimental Design

2.1 The Intervention

Our study took place in Malawi, in southern Africa, where, by 2017, only 34% of adults owned a bank account (Demirgüç-Kunt, et al., 2018) and just 21% had activated a mobile-money account (United Nations Capital Development Fund, 2018). By 2015, there were 610,596 individuals affiliated to one of the 37,461 VSLAs operating across the twenty-eight districts in this country (Ministry of Finance, Economic Planning and Development, 2015), which amounted to 7% of the adult population at the time. In terms of the policy environment, the main goals of the Malawi Financial Sector Development Strategy for 2016-2020 (Government of Malawi, 2017) and the related Payment Systems Act of 2015 focus on expanding the reach of digital payments (mobile money inclusive), increasing savings through savings groups (VSLAs), and improving financial literacy. This context represents a unique opportunity for the promotion of mobile money through VSLAs.

The experiment was implemented among VSLA members in the Mangochi and Machinga Districts in southern Malawi (Figure 1). The two districts are geographically adjacent and given that the dominant ethnic groups are the same, they also share common cultural traits. However, Mangochi is more urbanized and has a higher level of economic development than Machinga, as a result of the tourism and fishing industries that have developed around Lake Malawi. Additionally, poverty is higher in Machinga (66%) than in Mangochi (52%) (National Statistical Office & ICF International, 2017). We chose the Mangochi and Machinga Districts for our study because our partner NGO, Emmanuel International, have active VSLAs in these two districts. Emmanuel International promotes different types of VSLAs in the two districts. In Mangochi, VSLAs are promoted among both men and women with the aim of increasing the commercialization of fishing activities; while VSLAs in Machinga primarily target women, with the aim of promoting female empowerment (although men may also participate). Unlike previous studies (Karlan et al., 2017; Ksoll et al., 2016), whose interventions involved the establishment of VSLAs from scratch, we use VSLAs that were active prior to the study to assess the impact of adding mobile-money promotion to their activities.

The intervention aimed to improve financial literacy and knowledge of mobile-money use and related benefits. It involved face-to-face training sessions followed by weekly reminder text-messages. The reminder texts were expected to reinforce knowledge of training materials and encourage take up of mobile-money services. The intervention contents (training and reminder text-messages) were promoted as a package, following previous experimental evidence (Abebe, Tekle & Mano, 2018; Dyer, Mazer & Ravichandar, 2017) showing that training alone does not lead to significant financial outcomes, but is more effective when combined with reminders.

Training was implemented in two stages. First, the research team (researchers and research assistants) were trained by the two main telecommunications operators in Malawi (Airtel Malawi (Airtel) and Telekom Networks Malawi (TNM)) on how VSLAs and their members could use mobile money for transactions. Simultaneously, the Reserve Bank of Malawi trained the research team on financial literacy. This first stage of training took place on December 3-4, 2018. After the first stage, the research team trained VSLA members in the treatment group only (342 participants). The second stage took place from December 9-17, 2018. Each training session was facilitated by four members of the research team. In addition to face-to-face training sessions, individuals in the treatment group received reminder text-messages twice weekly for two months starting on January 21, 2019. The training materials were translated into the local language, Chichewa, and delivered in sessions that lasted about four hours.

We must highlight that the timing of our intervention overlapped with the lean season in Malawi, the period between pre-planting and harvest. The lean season is typically associated with reduced food stocks and reduced circulation of money in businesses as funds are diverted into the purchase of farm inputs and other agriculture-related investments (Anderson et al., 2017; Chirwa, Dorward & Vigneri, 2012). VSLAs in rural areas often end their cycle by sharing savings and interests just before planting time in order to channel funds to farming activities (Ksoll et al., 2016). Thus, the level of VSLA transactions may have been at their lowest point during our intervention[2].

2.2 Experimental Design and Data

We implemented a cluster randomized trial in which the experimental units were the VSLAs supported by our NGO partner. Our experimental design contains forty-two clusters, twenty-one assigned to the treatment group and twenty-one assigned to the control group, allowing us to achieve a reasonable level of statistical power.[3] The selection of VSLAs into the study was done at the Group Village Head (GVH) level A GVH is a traditional administrative jurisdiction under a chief and often consists of six to ten villages. The number of VSLAs in each GVH ranges from one to thirteen, with an average of seven. There is an important degree of interaction among VSLAs within the same GVH, because they attend the same social gatherings and public services. Therefore, to minimize contamination, we randomly selected a single VSLA from each of the GVHs. This selection strategy places participating VSLAs relatively far apart (geographically) and minimizes the chances of interaction among members of different participating VSLAs. All members of the sampled VSLAs who

[2] We had to implement the intervention in this manner because of the timing of the grant that supported the experiment.
[3] Statistical power was calculated with a p-value set at 0.05, the base value of mobile money used to receive money at 11%, and an impact size of 10%. The number of clusters equaled forty-two with a 95% CI of the impact between 8% and 24% and an average cluster size of thirteen. We used Optimal Design to determine statistical power and we found that the design gave us a statistical power of 81%.

consented to participate were included in the study[4].

In this study we mainly exploit survey (self-reported) data, but also have access to administrative data. Survey data[5] was collected before (November 4-23, 2018) and after the intervention (March 29-April 18, 2019). In both cases, participants answered questions on mobile-money knowledge and use as well as related financial behaviour. Survey data was collected by administering questionnaires[6] to VSLA members in face-to-face interviews by trained research assistants. Emmanuel International assisted the research team with field-related logistics, such as locating VSLAs and making appointments, which facilitated research assistants' access to the communities.

In the baseline survey, we collected data from 640 VSLA members, 342 in the treatment group and 298 in the control group. In the end-line survey, we were able to reach 87% of individuals in the baseline sample (554 individuals in total: 291 from the treatment group and 263 from the control group). The observed decline in sample size represents a 13% attrition rate, which is considered to be relatively high for a four-month observation period[7] (Ksoll et al., 2016). Attrition in our study was affected by adverse weather conditions that led to heavy flooding in some parts of the study area in March and April 2018 (Government of Malawi, 2018).

Attrition is a problematic issue in randomized control trials (RCTs). First, the treatment may be related to attrition, which can destroy the comparability of treatment and control groups (Gertler et al., 2016) and henceforth the internal validity of the study. To assess whether attrition was related to our treatment, we follow Thomas et al. (2012) and estimate a simple regression of the attrition variable on the treatment status. The results from this regression indicate that there is no significant relationship between the two variables ($p=0.931$), suggesting that the treatment did not influence attrition. Secondly, attrition may affect external validity, as it may affect the original composition of the study sample. To assess the effect of attrition on external validity, we follow Miller & Wright (1995) and estimate a logit model whose dependent variable takes the value of 1 if the individual participated in the follow-up survey and 0 otherwise, and in which respondent characteristics are used as control variables.[8] All control variables in the estimation are statistically insignificant, suggesting that attrition is likely random in our contexts and that the remaining sample is comparable to the original one.

Administrative data provided by Airtel and TNM on subscribers' mobile-money-account usage is also

[4] Written consents were obtained from all individuals who participated in the study before the treatments were assigned.

5 Survey CTO was used to collect data.

[6] The survey protocol and tools were approved by the Malawi National Committee on Research in Humanities and Social Sciences (NCRHS), and respondents consented to participate in the project.

[7] Most of the cases were lost because some respondents were not available on the survey day. Others presented identification information different from what had been provided at baseline and therefore could not be matched.

[8] Independent variables included educational level, marital status, farmer dummy, and district of residence. The same independent variables were used in subsequent models

used for estimation purposes. Confidentiality and non-disclosure agreements were signed with the telecommunication companies before the data was accessed. The data was provided for the mobile phone numbers owned by study participants as well as for the mobile phone numbers of individuals (such as friends or relatives) who did not participate in the study but whose phones are accessible by some of the study participants (as reported in our baseline and follow-up surveys). Evidence shows that sharing of mobile phones is common in certain areas in Africa and hence it was important to include this type of phone access in our study (James & Versteeg, 2007; Wesolowski et al., 2012). Although there are 276 mobile phone numbers[9] reported in our surveys; according to TNM and Airtel, the records showed that only 101 were active during April and May 2019.

2.3 Balance in Pre-treatment Characteristics

As mentioned before, attrition in our study is not related to treatment status or other participant characteristics, which alleviates our concerns related to internal and external validity. We therefore use the remaining follow-up sample of 554 observations to assess the balance in observables between treatment and control groups. In Table 1 we present the baseline characteristics for the treatment group, control group, and the entire sample. We include cluster robust p-values for statistical tests of observable raw mean differences between treated and control units in the sample[10].

{Table 1 here}

As we can observe in Table 1, treatment and control groups are, on average, similar in their pre-treatment demographic and socioeconomic characteristics. Of the nineteen variables in Table 1, a statistically significant difference exists in only two cases (divorced status and farmer dummy), and the difference in point estimates is relatively small. Moreover, these two variables appear as non-statistically significant in a multiple regression for the treatment status on all the control variables reported in Table 1[11]

In terms of overall sample pre-treatment characteristics, respondents are, on average, 39 years old and the majority (93%) are women. The predominance of women is in line with our study context, because women's participation in VSLAs has generally been higher than men's in several African settings (Aggarwal, Goodell & Selleck, 2015; Cassidy & Fafchamps, 2015; Garikipati, 2012). In some cases, men participated in

[9] Of this total, 155 (56%) were phones owned by respondents, while 121 (44%) were the phones of relatives or friends to which respondents had access.

[10] Balance test was also conducted after the baseline survey and we found that the treatment and control groups were balanced. Results can be provided upon request.

[11] Results of this regression can be provided on request

VSLAs through a backdoor by sending women partners to save and obtain loans on their behalf (Garikipati, 2012). Table 1 also indicates that about 76% of the individuals in our study are married and that the average household includes six members. The education level is relatively low, with an average educational indicator of 2.14, which corresponds to junior primary education (typically one to four years of primary education). Most individuals in our sample are self-employed, predominantly in areas such as small businesses/hawking (39%), agriculture (29%), and fisheries (4%).

Our data also shows that ownership of mobile phones in our baseline is close 32%, which is close to the 34% national level of ownership reported by the National Statistical Office and the Malawi Communications Regulatory Authority (National Statistical Office and Malawi Communications Regulatory Authority, 2015). Also, there are not statistically significant differences in ownership of mobile phone among treated and control individuals. Of the 68% of individuals who do not own a mobile phone, 56% have access to a relative's or friend's phone, representing 38% of the total sample. This implies that about 70% of our sample has some form of access to a mobile phone. The results in Table 2 also show that about 16% of individuals in the baseline have mobile-money accounts.

In order to measure individuals' knowledge of mobile money services, usage of mobile money services, as well as to assess their degree of financial inclusion, we asked VSLAs members a series of related questions, for which individuals have to provide "Yes" or "No" answers. For example, in the knowledge category, individuals were asked if they knew that mobile money could be used to receive money; send money, save money, pay bills, buy airphone time, transfer phone credit and obtain a loan. Similar questions were asked in the usage category, but in this case, we asked for previous use rather than previous knowledge. These answers are used to generate binary indicators (0-1) for each question within each category. Using these binary indicators, for each of the categories we study: mobile money knowledge, mobile money usage and financial inclusion, we construct an average index, which simply measures individual's average knowledge for each of the categories. The index of knowledge of mobile money is calculated as the average number of mobile money services known by the respondents[12], while the index of usage of mobile money is calculated as the average number of mobile money services used by the respondent. The index of financial inclusion is calculated as the number of financial services the respondent reported to have access to[13]. As we work with average indices

[12] The following list of services was used to ask the knowledge and usage questions: receiving money, transferring money, paying bills, buying airtime, transferring credit, saving money and getting a loan through mobile money.

[13] We used the following financial inclusion indicators ownership of a bank account, holding savings with a bank, and saving with microcredit group.

constructed from binary responses, all indices values are within the 0 to 1 range[14]. Table 2 presents the pre-treatment status regarding the main outcome indices and their components for the treatment and control groups. In general, treated and control units are similar in their baseline outcome indicators as presented by insignificant mean differences.

{Table 2 here}

The average mobile money knowledge index value at baseline was 0.84, while the mobile money usage index value was lower, and equal to 0.67. The two indices show that on average, an individual knew or used less than one mobile money service. This reflects very a low level of knowledge and usage of mobile money, as the maximum number of services they were asked was 7. The knowledge and usage levels were not uniformly distributed across different services, although they were generally low in almost all of them. While 22% of individuals indicated knowing that mobile money could be used to receive money, only 4% knew that mobile money could be used to pay bills. The baseline information also shows that only 1% of VSLA members have ever used mobile money to perform VSLA transactions. This proportion is the same for control and treatment VSLAs. Table 2 also indicates that about 25% of the respondents have used mobile money to receive money and that only 2% have used it to pay bills. These statistics are consistent with national estimates, which show that cash-in/out and airtime purchases are the most popular mobile financial transactions, while payment of bills is rarely adopted (Reserve Bank of Malawi, 2019).

For the case of the financial inclusion, results in Table 2 show that the corresponding average index is 0.21 which is also relatively low if we take into account that the maximum possible value is 1. For both treatment and control groups, levels of formal financial inclusion were very low at baseline, and only 3% of the sample owned a bank account. In terms of the institutions where the study participants save money, we find that 8%, 5%, and 2% of them used mobile money, microcredit groups, and a commercial bank, respectively.

2.3 Empirical Strategy

Following Abebe, Tekle, and Mano (2018), Dupas et al. (2018), and McKenzie (2012), we estimate analysis of covariance (ANCOVA) regression models to measure the impact of our intervention. This involves regressing the outcome variable on the treatment status dummy variable and the baseline value of the outcome

[14] Within each dimension/category, the average indexes were estimated using the following formula:
$number\ of\ positive\ answers / total\ number\ of\ elements\ within\ the\ category$

variable[15]. Our ANCOVA regression model is thus specified as follows:

$$Y_{ijf} = \varsigma + \vartheta Y_{ijb} + \beta Z_j + \Omega' X_{ij} + \eta_{ij} \quad (1)$$

where Y_{ijf} denotes the outcome indicators for individual *i* in VSLA *j* at follow-up (f). As mentioned before, we study three outcome indices: mobile money knowledge index, mobile money usage index, and financial inclusion index. Y_{ijb} denotes the value of the outcome indicator for individual i in VSLA *j* at baseline (b) and Z_j is the dummy variable that captures treatment assignment (taking the value 1 if VSLA *j* was assigned to the treatment group and zero otherwise). The parameter β in equation (1) measures the intention to treat (ITT) effect of the intervention. To assess the robustness of the estimates, in some specifications we add individual level baseline regressors to equation (1). These regressors, which are represented by the vector X_{ij}, include pre-treatment educational level, marital status, farmer dummy, access to mobile phone, and district of residence[16]. The standard errors in all regressions are clustered at the VSLA level (our randomization unit).[17]

3 Results

3.1 Impact of the Intervention

In Table 3 we present the ANCOVA regression results which estimate the intention to treat (ITT) effects of our intervention on mobile money knowledge, mobile money usage and financial inclusion. In table 4, we include as controls in our ANCOVA regressions a set of individual characteristics (age, sex, and education level), a dummy variable that indicates district of residence (1 for Mangochi), and a dummy variable to identify those who have access to a mobile phone (either his/her own or a relative's phone). We have also estimated the treatment effects on each of the individual indicators that were used to compute the average outcome indices. These are presented in Appendix 1.

As we can observe, the treatment effects estimated in Tables 3 and 4 are similar in size and statistical significance. The findings show that our intervention had positive and significant effects on all three indices: mobile money knowledge, mobile money usage, and financial inclusion. Financial literacy training plus remainder messages increased the mobile money knowledge index by 0.05 (significant at the 10% level), the

[15] As discussed in McKenzie (2012), ANCOVA regression yields important gains in power over differences-in-differences (DID) estimation, which is a common analytical tool used in impact evaluations.

[16] Farmer dummy was equal to 1 if the respondent's main source of income was agriculture and zero otherwise; education level was a dummy equal to 1 if the respondent received some education and zero otherwise; marital status was a dummy equal to 1 if the respondent was married and zero otherwise; district of residence was a dummy variable equal to 1 if the residence was in the Machinga District and zero otherwise.

[17] The empirical analyses were implemented using the Stata 16 software.

mobile money usage index by 0.03 (significant at the 10% level), and the financial inclusion index by 0.04 (significant at the 1% level). The results imply that the intervention increased average mobile money knowledge by 5 percentage points, average mobile money usage by 3 percentage points, and average access to services related to financial inclusion by 4 percentage points. This evidence confirms previous experimental findings, which show that financial-literacy training increases financial-literacy rates in African contexts (Sayinzoga, Bulte, and Lensink 2014). Our results therefore highlight the importance of financial literacy trainings in fostering financial inclusion, which has been shown to reduce poverty and bring economic development (Ksoll et al., 2016; Zins & Weill, 2016; Ozili, 2018).

{Table 3 here}

{Table 4 here}

The estimation of the control variables coefficients that have been used in the regressions corresponding to Table 4, also present some important evidence on the drivers of mobile money knowledge, mobile money usage, and financial inclusion. For example, our findings show that the education variable has a positive and significant effect on all indicators. This is in line with related literature showing that more educated individuals have higher levels of mobile money knowledge, mobile money usage, and financial inclusion. Individuals who reported that their main occupation was housework, were found to have lower levels for all the three indices holding all other things constant. This means that compared to other respondents that had occupations that are associated with cash income earnings, individuals who do not earn cash have lower levels of mobile money knowledge and usage, as well as financial inclusion. This result shows that low access to cash income reduces the chances to use mobile money services, as well as other financial services.

Another interesting result is that individuals residing within the Mangochi district have higher levels of financial inclusion than the respondents from Machinga. As mentioned earlier in this study, Mangochi is more developed than Machinga, and therefore the results suggest that higher levels of financial inclusion are more likely to be observed in developed regions than in less developed ones.

We also find that individuals with access to a mobile phone (either their own or someone else's) have higher levels of mobile money knowledge, mobile money usage and financial inclusion. As such, this particular finding suggests that some of the low utilisation levels of mobile money services observed in developing countries may be explained by low access to mobile phones. Access to a mobile phone may also have an influence on the treatment effects of our intervention, that is, individuals who have access to a mobile phone may be more likely to improve their knowledge and, in particular, their usage of mobile money services. In the

next section we explore heterogeneous effects of our intervention as a function of mobile phone access, as we all as a function of other factors that have been pointed out in the literature as influencing the success of similar interventions, such as education, baseline levels of trust and financial literacy.

3.2 Heterogeneous Treatment Effects

The results in the previous sections estimate the average treatment effects of our intervention. It is, however, relevant to also explore how these effects are influenced by pre-treatment factors that can be expected to play a key role in the context of financial-related interventions. Following similar studies in the literature, we explore heterogeneous effects related to education, trust,[18] financial literacy, and district of residence. We assess the presence of heterogeneous effects by estimating an interaction term between our treatment variable and a variable that corresponds to each of the factors mentioned before. As the effects of our intervention can also be influenced by access to a mobile phone at baseline, in particular the effects on mobile money usage, we also explore heterogenous treatment effects with respect to this specific factor.

To measure trust in digital payments, respondents were asked whether they agree or disagree with the statement: *"I trust a cash payment more than a digital payment using a cell phone."* The responses were given in a five-level Likert scale, where 1 indicated strong agreement and 5, strong disagreement. We considered Scales 4 and 5 to represent trust in mobile money payments and, in such cases, the trust indicator takes the value of 1 (0 otherwise). To measure financial literacy, respondents were asked five questions consistent with Cole, Sampson, and Zia (2011) and Lusardi (2008). The questions relate to economic concepts like savings or inflation, competencies like calculating interest earned, and knowledge of risk diversification. Respondents who correctly answered at least three questions correctly are considered financially literate and, in this case, the related indicator takes the value of 1; otherwise, they are considered financially illiterate, and the indicator takes the value of zero.

Table 5 presents the heterogeneous effects related to access to mobile phone, pre-treatment level of education level of the respondent, pre-treatment trust in mobile money, pre-treatment level of financial literacy, and district of residence.

{Table 5 here}

Our findings show that there is no evidence of heterogeneous treatment effects associated with access

[18] Various authors have suggested that financial literacy coupled with trust in digital finance is important to create awareness and understanding for effective demand and use of financial services (Cohen, Hopkins & Lee, 2008; Malady, 2016; Ozili, 2018).

to a mobile phone. This result may be related to the fact that in our study context, even users that do not have a mobile phone in the area, can also access mobile phone services through agents and kiosks who provide this service for a given fee in the main village markets. There is also no evidence of heterogenous effects related to the level of education or the baseline level of financial literacy. We however find some evidence of heterogeneous effects related to pre-treatment trust in mobile money and district of residence. In particular, we find that the treatment effect of the intervention on mobile money usage was higher among individuals with higher levels of trust on mobile money at baseline. In this sense, increasing public perception about the security in the use of mobile money may benefit interventions like the one in this study[19]. Moreover, the findings show that the treatment effects on mobile money knowledge are lower in Mangochi than in Machinga. More specifically, the intervention increased mobile money knowledge by 17 percentage points in Mangochi relative to the Machinga district. It should be noted that Mangochi is relatively more developed than Machinga. As such, these results suggest that in relatively less developed areas, the impacts on mobile money knowledge are higher than those of relatively more developed areas. In the relatively more developed regions, the intervention may have lower impacts because the levels of mobile money knowledge and use are expected to be already higher than that of relatively less developed areas. For example, the proportion of individuals who reported knowing that mobile money could be used to receive money in Machinga before the intervention was 18% compared to 33% in Mangochi. After the intervention, the proportion in Machinga rose to 32% while the proportion in Mangochi marginally rose to about 37%. In other words, the two districts converged in terms of knowledge levels. We do not find statistically significant heterogeneous treatment effects for mobile money usage and financial inclusion.

3.3 Administrative Data Analysis

We also had access to administrative data on mobile-money account use for phones owned by our respondents or by relatives/friends to which the respondents reported having access to. Out of the 276 mobile phone numbers reported in our data, only 101 had an active mobile-money account during the follow-up months of April and May 2019 (half in the treatment and half in the control groups). This could be attributed to decline in economic activities that is associated with the lean season. In Table 7, we report estimates of the effect of our treatment on total mobile-money amount transacted only for those who reported owning or having access to a mobile phone at baseline. In all our estimations, respondents without active mobile-money accounts are imputed the value of zero as the amount transacted. We find positive but statistically insignificant treatment effects when we consider all individuals in this subsample as well as when we consider solely individuals who

[19] This can be achieved for example in the form of curbing fraud in mobile money interventions

own the phone number. When we only consider individuals who do not own a phone but have access to a relative's or friend's one, the estimated coefficient is negative but not statistically significant.

In Table 8 we look for heterogeneous treatment effects related to trust, education, financial literacy, farmer dummy, and district of residence. We do not find statistically significant evidence of differential treatment effects related to any of the above-mentioned variables in the administrative data.

{Table 7 here}

{Table 8 here}

The absence of statistically significant effects in the administrative data may be related to two factors. First, individuals in the area can also access mobile-money services through agents or kiosks located in the main villages, and the administrative data does not capture transactions that occurred at that level. In fact, 30% of the cases that reported to have received money through mobile money did not have access to their or a relative's phone, suggesting the use of an agent or kiosk to receive the money. A significant number of individuals also reported having used mobile money to perform other transactions despite their lack of access to mobile-money accounts. Second, our administrative data analysis is based on only 276 individuals who reported access to a mobile phone at baseline, of which only 101 had an active mobile-money account during the relevant follow-up period, which greatly reduces our statistical power.

4 Conclusions

Using experimental data from two rural districts in Malawi, we study the effects of mobile money and financial literacy training reinforced by SMS reminders on mobile money knowledge, mobile money use, and financial inclusion among VSLA members. To the best of our knowledge, this is among the first studies that explores the adoption of mobile money among VSLA members in Africa. It is also among the first to combine financial literacy training with a behavioural component via SMS reminders.

Treated respondents in our intervention increased their self-reported knowledge and usage of mobile money services relative to individuals in the control group. Moreover, the intervention also increased the level of financial inclusion among the treated individuals. These results are robust to the inclusion of potential confounders such as education and employment status. Interestingly, the size of the treatment effects on mobile money usage was larger for individuals with higher baseline trust in mobile money transactions than among those who had lower trust at baseline. We also showed that the treatment effects on knowledge of mobile money was higher among treated individuals residing in the relatively less developed region (Machinga

district) than among those in the relatively more developed are (Mangochi district).

The average effect sizes in our study are generally small though significant, and several factors could explain this. In particular, the timing of the experiment coincided with the lean period, when food stocks run out, business activities decrease, and VSLA cycles come to an end, as households in rural areas channel funds toward the next farming season. In addition, the four-month duration of the intervention may have been relatively short to allow for a wider diffusion of mobile-money knowledge. Up-take may also have been constrained by user fees on mobile-money transactions. Future studies, therefore, should try to rule out the potential effects of the lean season and user fees, allow for a longer intervention period and use administrative data with a broader community reach (rather than just the intervention sample). Notwithstanding these limitations, our findings suggest that the expansion of digital payments and savings promotions may be achievable through financial-literacy interventions reinforced by behavioural elements that focus on members of a VSLA. A digital finance inclusion program that combined training and reminder text-message would be effective especially in locations with prior low knowledge and use of financial innovations. Government support for such interventions may be also critical, particularly trough campaigns that promote trust in mobile money banking.

References

Abebe, G., Tekle, B., and Mano, Y. (2018). Changing Saving and Investment Behaviour: The Impact of Financial Literacy Training and Reminders on Micro-Businesses. *Journal of African Economies*, *27*(5), 587-611.

Abiona, O. and Koppensteiner, M.F. (2018). Financial Inclusion, Shocks and Poverty: Evidence from the Expansion of Mobile Money in Tanzania. *International Business Review, 24*(1), 55-65. Available at http://dx.doi.org/10.1016/j.ibusrev.2014.05.008.

Aggarwal, R., Goodell, J. W., and Selleck, L. J. (2015). Lending to Women in Microfinance: Role of Social Trust. *International Business Review*, 24(1), 55-65. Available at http://dx.doi.org/10.1016/j.ibusrev.2014.05.008.

Allen, F., Carletti, E., Cull, R., and Qian, J. "QJ" (2014). African Financial Development and Financial Inclusion Gaps. *Journal of African Economies, 23*(5), 614-642.

Anderson, C. Leigh, Reynolds, T., Merfeld, J. D., and Biscaye, P. (2017). Relating Seasonal Hunger and Prevention and Coping Strategies: A Panel Analysis of Malawian Farm Households. *Journal of Development Studies, 54*(10), 1737-55. Available at https://doi.org/10.1080/00220388.2017.1371296.

Bongomin, G. O, Ntayi, J. M., Munene, J. C., and Malinga, C. A. (2018). Mobile Money and Financial Inclusion in Sub-Saharan Africa: The Moderating Role of Social Networks. *Journal of African Business, 19*(3), 361-384. Available at https://doi.org/10.1080/15228916.2017.1416214.

Breza, E., Kanz, M., and Klapper, L. F. (2020). Learning to Navigate a New Financial Technology: Evidence from Payroll Accounts (No. w28249). *National Bureau of Economic Research*.

Cassidy, R. and Fafchamps, M. (2015). Can Community-Based Microfinance Groups Match Savers with Borrowers? Evidence from Rural Malawi. CSAE Working Paper WPS/2015-13. Oxford, UK: Centre for the Study of African Economies.

Chirwa, E. W., Dorward, A., and Vigneri, M. (2012). Seasonality and Poverty: Evidence from Malawi in Seasonality. In S. Devereux, R. Sabates-Wheeler, and R. Longurst, Eds, *Seasonality, Rural Livelihoods and Development.* New York: Earthscan.

Cohen, M., Hopkins, D., and Lee, J. (2008). Financial Education: A Bridge between Branchless Banking and Low-Income Clients, Microfinance Opportunities. Working Paper No. 4. Global Financial Education Program. Washington, DC: Microfinance Opportunities. Available at http://www.microfinancegateway.org/sites/default/files/mfg-en-paper-financial-education-a-bridge-between-branchless-banking-and-low-income-clients-aug-2008.pdf.

Cole, S., Sampson, T., and Zia, B. (2011). Prices or Knowledge? What Drives the Demand for Financial Services in Developing Countries? Harvard Business School Working Paper No. 09-117 LXVI (6), 1933-1967.

Cole, S.A., and Fernando, A.N. (2012). The Value of Advice: Evidence from Mobile Phone-Based Agricultural

Extension. HBS Working Paper No. 13-047. Boston, MA: Harvard Business School. Available at http://nrs.harvard.edu/urn-3:HUL.InstRepos:10007889.

Demirgüç-Kunt, A. L. K., Singer, D., Saniya, A., and Hess, J. (2018). *The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution.* Washington, DC: World Bank Group. Available at http://documents.worldbank.org/curated/en/332881525873182837/The-Global-Findex-Database-2017-Measuring-Financial-Inclusion-and-the-Fintech-Revolution.

Demombynes, Gabriel and Thegeya, Aaron (2012). Kenya's Mobile Revolution and the Promise of Mobile Savings. Policy Research Working Paper No. 5988. Washington, DC: The World Bank. Available at http://documents.worldbank.org/curated/en/docsearch/document-type/620265.

Drexler, A., Fischer, G., and Schoar, A. (2014). Keeping It Simple: Financial Literacy and Rules of Thumb. *American Economic Journal: Applied Economics, 6*(2), 1-31. Available at http://dx.doi.org/10.1257/app.6.2.1.

Dupas, P., Karlan, D. S., Robinson, J., and Ubfal, D. (2018). Banking the Unbanked? Evidence from Three Countries. *American Economic Journal: Applied Economics, 10*(2), 257-297.

Dyer, J., Mazer, R., and Ravichandar, N. (2017). *Increasing Digital Savings and Borrowing Activity with Interactive SMS: Evidence from an Experiment with M-PAWA Savings and Loan Mobile Money Product in Tanzania,* Washington, DC: Consultative Group to Assist the Poor (CGAP). Available at https://www.findevgateway.org/library/increasing-digital-savings-and-borrowing-activity-interactive-sms.

Fanta, A. B., Mutsonziwa, K., Goosen, R., Emanuel, M., and Kettles, N. (2016). The Role of Mobile Money in Financial Inclusion in the SADC Region: Evidence Using FinScope Surveys. FinMark Trust Policy Research Paper No. 3. Johannesburg, South Africa: FinMark Trust. Available at https://www.finmark.org.za/wp-content/uploads/2016/12/mobile-money-and-financial-inclusion-in-sadc.pdf.

Garikipati, Supriya (2012). Microcredit and Women's Empowerment: Through the Lens of Time-Use Data from Rural India. *Development and Change, 43*(3), 719-750.

Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B., and Vermeersch, C. M. J. (2016). *Impact Evaluation in Practice*, Second Ed. Washington, DC: Inter-American Development Bank and World Bank. Available from https://openknowledge.worldbank.org/handle/10986/25030.

Government of Malawi (2017). National Financial Inclusion Strategy 2016-2020. Lilongwe, Malawi: Ministry of Finance and Economic Planning and Development.

Government of Malawi (2018). The Malawi Vulnerability Assessment Committee (MVAC) Bulletin No. 15/18 Volume 1: Food Security Forecast for the 2018/2019 Consumption Year. Lilongwe, Malawi. Available at https://reliefweb.int/report/malawi/malawi-vulnerability-assessment-committee-mvac-bulletin-no-

1518-volume-1-food-security.

Gurman, T. A., Rubin, S. E., and Roess, A. A. (2012). Effectiveness of Health Behavior Change Communication Interventions in Developing Countries: A Systematic Review of the Literature. *Journal of Health Communication, 17* (SUPPL. 1), 82-104.

Jack, W., and Suri, T. (2014). Risk Sharing and Transactions Costs: Evidence from Kenya's Mobile Money Revolution. *American Economic Review, 104*(1), 183-223.

James, J., and Versteeg, M. (2007). Mobile Phones in Africa: How Much Do We Really Know? *Social Indicators Research, 84*(1), 117-126.

Karlan, D., Savonitto, B., Thuysbaert, B., and Udry, C. (2017). Impact of Savings Groups on the Lives of the Poor. *Proceedings of the National Academy of Sciences, 114*(12), 3079-3084.

Ksoll, C., Lilleør, H. B., Lønborg, J. H., and Rasmussen, O. D. (2016). Impact of VSL: Evidence from a Cluster Randomized Trial. *Journal of Development Economics*, *120*, 70-85. Available at http://dx.doi.org/10.1016/j.jdeveco.2015.12.003.

Larochelle, C., Alwang, J., Travis, E., Barrera, V. H., and Andrade, J. M. D. (2017). Did You Really Get the Message ? Using Text Reminders to Stimulate Adoption of Agricultural Technologies. *Journal of Development Studies, 55*(4), 548-564. Available at https://doi.org/10.1080/00220388.2017.1393522.

Le Polain, Maïté, Sterck, Olivier, and Nyssens, Marthe (2018). Interest Rates in Savings Groups: Thrift or Threat? *World Development*, *101,* 162-172.

Lusardi, A. (2008). Financial Literacy: An Essential Tool for Informed Consumer Choice? NBER Working Paper No. W14084. Cambridge, MA: National Bureau for Economic Research. Available at https://www.nber.org/papers/w14084.

Mandell, Lewis, and Klein, Linda Schmid (2009). The Impact of Financial Literacy Education on Subsequent Financial Behavior. *Journal of Financial Counselling and Planning, 20*(1), 15-24. Available at http://ssrn.com/abstract=2224231%0A15.

Mbiti, Isaac, and Weil, David N. (2013). The Home Economics of E-Money: Velocity, Cash Management, and Discount Rates of M-Pesa Users. *American Economic Review, 103*(3), 369-374.

McKenzie, David (2012). Beyond Baseline and Follow-up: The Case for More T in Experiments. *Journal of Development Economics, 99*(2), 210-221. Available from http://dx.doi.org/10.1016/j.jdeveco.2012.01.002.

Meyer, Richard L. 2015. Financing Agriculture and Rural Areas in Sub-Saharan Africa the Way Forward. IIED Working Paper. London: International Institute for Environment and Development (IIED). Available at https://pubs.iied.org/14652IIED.

Miller, Richard B. and Wright, David W. (1995). Detecting and Correcting Attrition Bias in Longitudinal Family

Research. *Journal of Marriage and the Family, 57*(4), 921-929. Available at http://www.jstor.org/stable/353412.

Ministry of Finance, Economic Planning and Development. (2015). Village Savings and Loans Program Mapping Report (No. 1). Lilongwe, Malawi: Government of Malawi.

Murray, K. W., Woodruff, K., Moon, C., and Finney, C. (2015). Using Text Messaging to Improve Attendance and Completion in a Parent Training Program. *Child and Family Studies, 24*(10), 3107-3116.

Musinguzi, L.K. (2016). The Role of Social Networks in Savings Groups: Insights from Village Savings and Loan Associations in Luwero, Uganda. *Community Development Journal*, *51*(4), 499-516.

National Statistical Office and ICF International (2017). *Malawi Demographic and Health Survey 2015-2016*. Zomba, Malawi and Rockville, MD: NSO and ICF International. Available at https://dhsprogram.com/pubs/pdf/FR319/FR319.pdf.

National Statistical Office and Malawi Communications Regulatory Authority (2015, June). Survey on Access and Use of ICT Services in Malawi-2014. Available at http://www.macra.org.mw/wp-content/uploads/2014/09/Survey_on-_Access_and_Use_of_ICT_Services_2014_Report.pdf.

Ntwiga, D.B. (2016). Financial Inclusion and Cream Skimming in Kenya's Financial Sector. *International Journal of Research in Finance and Marketing, 6*(1), 41-47.

Oliveira, T., Thomas, M., Baptista, G., and Campos, F. (2016). Mobile Payment: Understanding the Determinants of Customer Adoption and Intention to Recommend the Technology. *Computers in Human Behavior, 61*, 404-414.

Otchere, I., Senbet, L.., and Simbanegavi, W. (2017). Financial Sector Development in Africa: An Overview. *Review of Development Finance, 7*, 1-5.

Ouma, A. S., Odongo, T. M., and Were, M. (2017). Mobile Financial Services and Financial Inclusion: Is It a Boon for Savings Mobilization? *Review of Development Finance, 7*(1), 29-35. Available at http://dx.doi.org/10.1016/j.rdf.2017.01.001.

Ozili, P.K. (2018). Impact of Digital Finance on Financial Inclusion and Stability. *Borsa Istanbul Review, 18*(4), 329-340. Available at https://doi.org/10.1016/j.bir.2017.12.003.

Reserve Bank of Malawi (2019). Quarterly National Payment Systems Report. Lilongwe, Malawi. Available at https://www.rbm.mw/PaymentSystems.

Sayinzoga, A., Bulte, E. H., and Lensink, R. (2014). Financial Literacy and Financial Behaviour: Experimental Evidence from Rural Rwanda. *The Economic Journal, 126*(594), 1571-1599.

Thomas, D., Firman, W., Frankenberg, E., Sikoki, B., Strauss, J., Sumantri, C., and Suriastini, W. (2012). Cutting the Costs of Attrition: Results from the Indonesia Family Life Survey. *Journal of Development Economics, 98*(1), 108-23. Available at http://dx.doi.org/10.1016/j.jdeveco.2010.08.015.

United Nations Capital Development Fund (UNCDF) (2018, February). The MM4P Story of Digital Financial Services in Malawi: The Journey of MM4P in the Warm Heart of Africa. New York. New York: UN Capital Development Fund. Available from https://mw.one.un.org/malawi-stands-out-in-the-2017-global-findex.

Wesolowski, A., Eagle, N., Noor, A. M., Snow, R. W., and Buckee, C. O. (2012). Heterogeneous Mobile Phone Ownership and Usage Patterns in Kenya. *PloSOne 7*(4), 1-6.

Xu, L., and Zia, B. (2012). Financial Literacy around the World: An Overview of the Evidence with Practical Suggestions for the Way Forward. Policy Research Working Paper No. 6107. Washington, DC: The World Bank.

Zins, A., and Weill, L. (2016). The Determinants of Financial Inclusion in Africa. *Journal of Advanced Research,* 6(1), 46-57. Available at http://dx.doi.org/10.1016/j.rdf.2016.05.001.

Table 1: Demographic and Socioeconomic Characteristics of the Sample

Variable	Control (n=263)	Treatment (n=291)	Mean Test		Whole sample (n=554)	
	Mean	Mean	Difference	P-value	Mean	Std. Dev.
Age	39.407	38.010	1.397	0.445	38.673	14.858
Household size	5.624	5.763	-0.139	0.559	5.697	2.041
Sex (Male=1)	0.106	0.041	0.065	0.189	0.072	0.259
Education level	2.144	2.134	0.010	0.935	2.139	0.992
Housework	0.049	0.107	-0.057**	0.013	0.080	0.271
Wage employment	0.076	0.079	-0.003	0.907	0.078	0.268
Casual work	0.118	0.079	0.039	0.208	0.098	0.297
Agricultural work	0.327	0.266	0.061	0.219	0.295	0.456
Self employed	0.380	0.403	-0.023	0.721	0.392	0.489
Fisheries work	0.038	0.045	-0.007	0.783	0.042	0.200
Remittances	0.008	0.017	-0.010	0.271	0.013	0.112
Other employment	0.004	0.003	0.000	0.945	0.004	0.060
Monogamous	0.536	0.536	0.000	0.999	0.536	0.499
Polygamous	0.202	0.230	-0.029	0.535	0.217	0.412
Divorced	0.110	0.065	0.045*	0.076	0.087	0.282
Separated	0.061	0.062	-0.001	0.966	0.061	0.240
Widowed	0.068	0.086	-0.017	0.587	0.078	0.268
Never Married	0.023	0.021	0.002	0.870	0.022	0.146
Mangochi Dummy	0.274	0.199	0.074	0.562	0.235	0.424

Notes: Mean and standard deviation of baseline characteristics of the sample as well as mean separated by treatment status. We have also included difference in mean values between treatment and control group.
Variable definitions; Sex is the sex of respondent (male = 1), Education level is the highest education level for the respondent measured as an ordinal indicator. Housework, wage employment, casual work, self-employed, fisheries work, remittances, and other employment reflect major occupation (=1 if the respondent had this as major occupation). Monogamous, polygamous, divorced, separated, widowed, and never married were dummy variables for marital status, and Mangochi was a dummy variable for residential district.
The relevant column here is p-value because it shows whether estimated difference was significant. In a joint-balance test, we regressed treatment variables on all the baseline characteristics and found that the model had a significant F-statistic at 5%. Robustness checks used some of these regressors in the ANCOVA regressions. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Comparison of Baseline Characteristics of Outcome Indicators

Variable	Control		Treatment		Mean Test		Whole Sample	
	Obs	Mean	Obs	Mean	Difference	P-Value	Obs	Mean
Own Phone	263	0.32	291	0.33	-0.01	0.920	554	0.32
Access to Relative's Phone	263	0.40	291	0.36	-0.04	0.89	554	0.38
Mobile Money Account	263	0.17	291	0.15	0.02	0.679	554	0.16
Mobile Money Knowledge								
MM knowledge index	263	0.95	291	0.80	0.15	0.441	554	0.87
Receiving money	263	0.23	291	0.21	0.02	0.672	554	0.22
Sending money	263	0.14	291	0.13	0.02	0.645	554	0.14
Paying Bills	263	0.05	291	0.03	0.02	0.413	554	0.04
Buying phone credit	263	0.12	291	0.10	0.02	0.531	554	0.11
Transferring phone credit	263	0.14	291	0.11	0.03	0.373	554	0.13
Saving money	263	0.10	291	0.10	0.00	0.924	554	0.10
Obtain a loan	263	0.16	291	0.12	0.04	0.321	554	0.14
Mobile Money Usage								
MM usage index	263	0.76	291	0.58	0.18	0.205	554	0.67
Receiving money	263	0.29	291	0.22	0.07	0.127	554	0.25
Sending money	263	0.13	291	0.10	0.03	0.525	554	0.11
Paying Bills	263	0.02	291	0.01	0.01	0.435	554	0.02
Buying phone credit	263	0.11	291	0.08	0.04	0.224	554	0.10
Transferring phone credit	263	0.10	291	0.10	0.00	0.918	554	0.10
Saving money	263	0.10	291	0.07	0.03	0.387	554	0.09
Obtain a loan	263	0.11	291	0.10	0.01	0.627	554	0.10
MM usage by VSLA	263	0.01	291	0.01	0.00	0.623	554	0.01
Financial inclusion								
Financial inclusion index	263	0.21	291	0.16	0.04	0.389	554	0.19
Own bank account	263	0.03	291	0.03	0.00	0.973	554	0.03
Save with bank	263	0.03	291	0.02	0.01	0.448	554	0.02
Save with MM	263	0.10	291	0.06	0.04	0.134	554	0.08
Save with savings group	263	0.05	291	0.06	-0.01	0.656	554	0.05

Notes: Baseline mobile-money access and use status by treatment and control groups. P-values indicate level of significance of difference between the two groups. MM = Mobile Money

Table 3: Estimated intention to treat (ITT) effects of financial literacy and mobile money training on mobile money knowledge, use, and financial inclusion

	MM Knowledge		MM Usage		Financial inclusion	
Treatment	0.050*	(0.029)	0.028*	(0.016)	0.041***	(0.014)
Lagged MM knowledge	0.470***	(0.054)				
Lagged MM usage			0.383***	(0.045)		
Lagged financial inclusion					0.505***	(0.099)
Constant	0.084***	(0.018)	0.020**	(0.008)	0.021**	(0.008)
Adj R-squared	0.16		0.22		0.18	
F	37.93		37.29		19.16	
N	554		554		554	

Clustered standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Estimated intention to treat (ITT) effects of financial literacy and mobile money training on mobile money knowledge, use, and financial inclusion (additional controls)

	MM Knowledge		MM Usage		Financial inclusion	
Treatment	0.046*	(0.026)	0.028*	(0.014)	0.045***	(0.012)
Lagged MM knowledge	0.326***	(0.051)				
Lagged MM usage			0.301***	(0.052)		
Lagged financial inclusion					0.411***	(0.088)
Age	-0.002**	(0.001)	0.000	(0.000)	0.000	(0.000)
Sex of respondent	0.054	(0.047)	0.032	(0.034)	0.009	(0.026)
Education	0.064***	(0.012)	0.028***	(0.008)	0.024***	(0.006)
Divorced dummy	-0.023	(0.021)	0.002	(0.016)	-0.023	(0.015)
Housework dummy	-0.065*	(0.033)	-0.022	(0.013)	-0.046***	(0.015)
Mangochi dummy	-0.041	(0.033)	-0.006	(0.019)	0.040**	(0.019)
Phone access	0.090***	(0.027)	0.030**	(0.013)	0.021*	(0.012)
Constant	-0.005	(0.038)	-0.052**	(0.022)	-0.062**	(0.023)
Adj R-squared	0.26		0.27		0.23	
F	21.39		15.85		12.05	
N	554		554		554	

Clustered standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Heterogenous treatment effects

	Knowledge		Usage		Financial behaviour	
Panel A: Heterogeneous effects of access to mobile phone						
Treatment	0.062	(0.041)	0.031*	(0.016)	0.046***	(0.017)
L.Phone access	0.087**	(0.035)	0.036**	(0.016)	0.038***	(0.011)
L.Phone access#treatment	-0.027	(0.056)	-0.009	(0.030)	-0.010	(0.022)
Constant	0.044**	(0.017)	0.004	(0.006)	0.002	(0.007)
Adj R-squared	0.17		0.22		0.19	
F	24.72		20.80		19.05	
N	554		554		554	
Panel B: Heterogenous effects of education						
Treatment	0.082**	(0.032)	0.030*	(0.017)	0.046**	(0.018)
L.education	0.106***	(0.020)	0.024*	(0.013)	0.046***	(0.014)
L.Education#treatment	-0.041	(0.037)	-0.002	(0.017)	-0.003	(0.021)
Constant	0.011	(0.014)	0.004	(0.011)	-0.011	(0.010)
Adj R-squared	0.17		0.22		0.19	
F	28.44		24.52		18.86	
N	554		554		554	
Panel C: Heterogeneous effects of base level of Trust on Mobile Money						
Treatment	0.036	(0.037)	0.005	(0.020)	0.033*	(0.020)
L.MM trust	-0.016	(0.038)	-0.027*	(0.015)	0.002	(0.016)
L.MM trust#treatment	0.029	(0.046)	0.049**	(0.023)	0.018	(0.030)
Constant	0.092***	(0.026)	0.033**	(0.013)	0.020	(0.013)
Adjusted R-squared	0.15		0.22		0.18	
F	20.95		24.34		10.54	
N	554		554		554	
Panel D: Heterogeneous effects of base level of financial literacy						
Treatment	0.064*	(0.036)	0.025	(0.019)	0.035*	(0.019)
L.FL	0.024	(0.031)	-0.009	(0.015)	-0.001	(0.015)
L.FL#Treatment	-0.024	(0.045)	0.004	(0.021)	0.012	(0.022)
Constant	0.071***	(0.026)	0.025*	(0.013)	0.021*	(0.012)
Adjusted R-squared	0.15		0.21		0.18	
F	19.32		18.50		9.68	
N	554		554		554	
Panel E: Heterogeneous effects of district of residence (Mangochi==1)						
Treatment	0.089***	(0.031)	0.042**	(0.018)	0.047***	(0.014)
Mangochi	0.089*	(0.046)	0.041	(0.027)	0.060***	(0.018)
Mangochi#Treatment	-0.166***	(0.055)	-0.057	(0.034)	-0.007	(0.032)
Constant	0.062***	(0.016)	0.010*	(0.006)	0.007	(0.007)
Adjusted R-squared	0.17		0.22		0.20	
F	28.50		23.01		23.15	
N	554		554		554	

Clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

MM stands for mobile money, FL stands for financial literacy. Lagged values of outcome variables have not been included because of space

Table 6: Simple Regression of Treatment Effects on Logarithm of Volume of Mobile-Money Transactions

	Access to mobile phone		
	Own phone	Relative phone	Any phone
Treatment	0.130	-0.055	0.041
	(0.852)	(0.531)	(0.581)
Constant	1.544***	0.655*	1.158***
	(0.495)	(0.322)	(0.308)
Adj. R^2	-0.006	-0.008	-0.004
N	156	121	277

Notes: Treatment effects on the volume of Malawi Kwacha mobile-money transactions for the whole sample and subsamples by district and ownership of cell phone with activated mobile-money account.
Clustered standard errors in parentheses
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 7: Multiple Regression of Treatment Effects on Logarithm of Volume of Mobile-Money Transactions

	(1)	(2)	(3)	(4)	(5)
Treatment	0.110	0.469	-0.454	0.407	-0.391
	(0.584)	(0.692)	(0.524)	(0.539)	(0.632)
Trust_MM	0.608				
	(0.670)				
Treatment*trust	-0.206				
	(0.896)				
Some_edu		0.736			
		(0.462)			
Treatment*edu		-0.563			
		(0.534)			
Financial_literacy			0.160		
			(0.526)		
Treatment*FL			0.731		
			(0.761)		
Mangochi				2.073**	
				(0.793)	
Treatment*MH				-0.804	
				(1.661)	
_cons	0.833**	0.605	1.054***	0.499**	1.481***
	(0.338)	(0.389)	(0.346)	(0.212)	(0.477)
Adj. R^2	-0.005	-0.006	-0.002	0.042	-0.002
N	277	277	277	277	277

Notes: Treatment effects on the volume of Malawi Kwacha mobile-money transactions. All models controlled for treatment and its interaction with heterogeneous variables of interest. Model 1 presents treatment effects that account for trust, (2) for education; (3) for financial literacy; (4) for Mangochi District and (5) for employment in agriculture.
Clustered standard errors in parentheses.
*p< 0.10, **p< 0.05, ***p< 0.01.

Appendix 1: Treatment Effects of the Intervention on Individual Indicators

Table A1: Treatment Effects on Knowledge of Mobile Money Related Services

	Receiving money	Sending Money	Paying bills	Saving money	Obtaining loan	Average knowledge
Treatment	0.032	0.044	0.045**	0.059	0.043	0.050*
	(0.052)	(0.048)	(0.021)	(0.036)	(0.031)	(0.029)
_cons	0.228***	0.129***	0.035**	0.099***	0.084***	0.084***
	(0.040)	(0.028)	(0.012)	(0.020)	(0.024)	(0.018)
Adj. R^2	0.112	0.085	0.052	0.144	0.023	0.156
N	554	554	554	554	554	554

Notes: ANCOVA regression coefficients of treatment effect on knowledge of mobile-money uses for the whole sample. All models controlled for lagged variables.
Standard errors reported in brackets were clustered at the village level. $^{*}p< 0.10$, $^{**}p< 0.05$, $^{***}p< 0.01$.

Table A2: Treatment Effects on Mobile-Money Use

	Receive Money	Send money	Pay Bills	Save Money	Obtain loan	VSLA transaction	Own MM account	Average Use
Treatment	0.098**	0.011	0.005	0.046*	-0.001	0.067	0.028	0.032*
	(0.038)	(0.028)	(0.008)	(0.027)	(0.012)	(0.043)	(0.043)	(0.019)
_cons	0.112***	0.025*	0.005	0.019	0.017*	0.018*	0.138***	0.023***
	(0.024)	(0.013)	(0.005)	(0.012)	(0.009)	(0.010)	(0.030)	(0.010)
Adj. R^2	0.132	0.138	0.119	0.135	0.009	0.021	0.198	0.216
N	554	554	554	554	554	554	554	554

Notes: ANCOVA regression coefficients of treatment effect on mobile-money use. All models controlled for lagged variables. MM account = Mobile-money account.
Standard errors were clustered at the village level and are shown in brackets. $^{*}p< 0.10$, $^{**}p< 0.05$, $^{***}p< 0.01$.

Table A3: Treatment Effects on Financial Behavior

	Non VSLA credit	Own bank Account	Save with bank	Save with VSLA	Save with MM	Save with microcredit group	Average number
Treatment	-0.023	0.021	0.026**	-0.007	0.062*	0.059**	0.018*
	(0.028)	(0.014)	(0.013)	(0.004)	(0.033)	(0.026)	(0.010)
_cons	0.100***	0.015*	0.008	1.001***	0.041***	0.042**	0.136***
	(0.020)	(0.008)	(0.007)	(0.001)	(0.015)	(0.016)	(0.014)
Adj. R^2	0.026	0.121	0.113	-0.000	0.197	0.026	0.123
N	554	554	554	554	554	554	554

Notes: ANCOVA regression coefficients of treatment effect on financial behavior for the whole sample. All models controlled for lagged variables. MM account = mobile-money account.
Standard errors were clustered at the village level and are shown in brackets. $^{*}p< 0.10$, $^{**}p< 0.05$, $^{***}p< 0.01$.