Effects of Mobile Money Education on Mobile Money Usage: Evidence from Ghana

Emmanuel Kwablah Apiors1 · Aya Suzuki1

Accepted: 21 December 2021 / Published online: 13 April 2022
© European Association of Development Research and Training Institutes (EADI) 2022

Abstract
This study conducts a randomised control trial to offer a technical workshop and examine whether providing information about the full range of services on the mobile money platform would increase mobile money usage, by taking a case of the Ashanti Region, Ghana. We find a significant positive impact of mobile money education on the recent usage of mobile money for transactions. However, no significant evidence of the workshop was found on new mobile money account ownership, or on the share of transactions transmitted through mobile money. Furthermore, weak and volatile outcomes were observed as impacts on remittances after the interventions. We discuss potential reasons behind the weak effects found.

Keywords Mobile money education · Technology adoption · Financial literacy · Financial inclusion · Payments · Ghana · Africa

Résumé
Cette étude consiste en un essai randomisé contrôlé qui propose un atelier technique et cherche à savoir si le fait de fournir des informations à propos de la gamme complète de services offerts par la plateforme d’argent mobile permettrait d’augmenter l’utilisation de la monnaie mobile. Pour ce faire, l’étude s’appuie sur le cas de la région d’Ashanti, au Ghana. Nous constatons que l’éducation liée à l’argent mobile a un impact positif significatif sur l’utilisation d’argent mobile pour des transactions récentes. Cependant, nous n’avons trouvé aucune preuve significative que l’atelier a eu un impact sur l’ouverture de nouveaux comptes d’argent mobile, ni sur la proportion des transactions réalisées grâce à l’argent mobile. En outre, en termes d’impact, des résultats faibles et instables ont été observés en matière d’envoi de fonds après les interventions. Nous discutons des raisons potentielles pouvant éclairer la faiblesse des effets relevés.

* Emmanuel Kwablah Apiors
emmanuel.apiors@s.k.u-tokyo.ac.jp
Aya Suzuki
ayaszk@k.u-tokyo.ac.jp

1 Department of International Studies, The University of Tokyo, Kashiwa 277-0882, Japan
Introduction

Mobile money has received attention in recent years as a financial inclusion tool, particularly in Sub-Saharan Africa (Suri et al. 2012; Karlan et al. 2017). Access to mobile money increases savings and reduces vulnerability to shocks (Jack and Suri 2014); increases consumption by increasing remittance receipts (Munyegera and Matsumoto 2016; Suri and Jack 2016); increases remittances sent and received (Suri et al. 2012); and increases investment in education, micro- and small businesses, and savings (Apiors and Suzuki 2018).

However, the adoption and usage of mobile money have been uneven across the developing world; studies on the intensity of its usage have mostly been concentrated around Kenya (Suárez 2016) and neighbouring East African countries. For example, while mobile money account ownership is still low among mobile phone users in Ghana, a wide gap exists between registered mobile money accounts and active mobile money accounts (Ghana 2017), thus indicates high dormancy and low usage. According to Arun and Kamath (2015), the adoption of mobile money does not automatically lead to usage because not everyone who owns a payment product uses it for inflows. Therefore, usage needs proactive pursuance to reflect the benefits derived from it. Batista and Vicente (2020) have explored mobile money adoption patterns and impacts on welfare outcomes in rural Mozambique, focussing on the newly introduced mKesh. In a field experiment, they organised community meetings to disseminate information about mKesh, and distributed leaflets about mKesh. They found that mKesh availability resulted in mobile money services adoption, although adoption decreased over time. Particularly, mKesh adoption increased remittances received, consumption, and reduced vulnerability to hunger, but reduced agricultural investments. However, these studies have been limited to strictly rural populations and non-mobile money user samples and have not been tested on a more general sample.

Two arguments surround the low usage of financial services. First, financial services are too expensive to provide (Beck et al. 2007), especially in rural areas, and for low-income people. The second, and our primary focus is low financial literacy, a barrier which may be caused by an inadequate supply of information, or users’ inability to understand their usage. To use a mobile money platform independently, users need to have technical information regarding the usage of mobile money applications, and basic financial literacy, owing to the diverse financial products offered through mobile money services. Moreover, many mobile money kiosks (where users can receive or transfer mobile money) are located widely even across rural areas in developing countries. However, official mobile telecommunication shops, which consumers can access when they face problems or have questions, are limited to urban areas, and are not easily accessible for the majority of consumers. It is likely that consumers lack access to the information necessary to use mobile money effectively.
Evidence suggests that the significant barrier of low financial literacy on the demand side of financial services can be overcome through well-designed and targeted training. However, existing studies are limited and report mixed results (Hastings et al. 2013). Cole et al. (2011) found that financial education had moderate to no effect on the likelihood of opening an account. Fernandes et al. (2014) found that financial education explained only 0.1% of financial behaviour, and Collins (2013) observed a lack of impact of financial education on savings behaviour. However, Bruhn et al. (2016) found that monetary incentives may convince individuals to attend financial education programmes. Other studies (Mitchell and Lusardi 2011; Lusardi and Tufano 2015; Miller et al. 2015) found strong evidence that the comprehension of financial concepts and improved financial decisions are positively related, and translate into household welfare. However, most financial education studies are not specific to mobile money usage. Essentially, mobile money service users need to possess more than basic financial literacy, as practical or legal knowledge that can protect from fraud is crucial.

We examine whether providing information about the full range of services on the mobile money platform will increase user participation. For an empirical case, our study builds on the study of Batista and Vicente (2020) by examining the effects of detailed information of mobile money on both users and non-users, in the context of urban, peri-urban, and rural communities in Ghana. Specifically, considering the ubiquitous nature of mobile money agent networks nationwide, we examined how mobile money education workshop enhances mobile money account ownership, recent use of mobile money for a transaction, and the share of financial transactions conducted through mobile money.

Through a randomised control trial (RCT) experiment, we provided information about mobile money in a workshop by inviting 216 randomly selected people out of a sample of 557. Using two rounds of data collected in a panel, we examined the effects of the workshop on the financial behaviour of mobile phone users. We employed fixed effect (FE) and fixed effects instrumental variable (FEIV) estimation methods to correct for possible endogeneity of workshop participation. We found no significant treatment effect of mobile money education on mobile money account ownership. However, we observed strong positive impacts on recent transactions undertaken using mobile money after the workshop. This means that the education provided a better understanding of the benefits of using mobile money, hence, participants utilised the services, although they were not eager to open mobile money accounts.

Conversely, after the education, mixed and weakly significant outcomes were observed as impacts on the remittances sent and received. This weak significance may be explained by the awareness of a 1% transaction fee charged to every amount sent or withdrawn from a mobile wallet. Heterogeneous analyses revealed joint significance effects of location and household size on mobile money activities.

This study contributes to experimental evidence regarding the effects of mobile money education on customers’ financial transactions. The participants’ recent usage of mobile money for financial transactions increased after the workshop, indicating that limited knowledge on the use of this service was likely the reason for low usage in Ghana. While mobile money was well known among the
sample many participants were unaware of the variety of services provided with mobile money. The service industry is relatively new in Sub-Saharan Africa, and, by the nature of the industry, the development of customer services is important, for example providing necessary technical information, or easy access to service desks to solve problems that customers may have. Our findings shed some light on the need to improve the information provision to customers, in order to enhance mobile money adoption.

The remainder of this paper is structured as follows. “Study Context and Hypotheses” section explains the study context and hypotheses, “Data and RCT” section describes data and the experiment, “Estimation Strategy” section enumerates the estimation strategy, while “Main Results” section presents the main results. “Mechanism and Discussion” section discusses the results, and the conclusion is presented in “Conclusion” section.

**Study Context and Hypotheses**

**Mobile Money Trend in Ghana**

Mobile money is an electronic payment and banking concept using subscriber identification module (SIM) cards in mobile phones (The World Bank 2012), and it is aimed at bringing financial services to the unbanked (Tobbin and Kuwornu 2011). In this study, mobile money is electronic cash backed by an equivalent amount of Bank of Ghana notes and coins, stored using the SIM card in a mobile phone as an identifier (Ghana 2017). The storage of value function leads to quarterly interest payments (1.5–7%) to customers based on balances in their wallets. For user’s convenience, mobile money wallets may be linked to personal bank accounts, to provide access to a variety of financial services (GSMA 2010) designed to meet the needs of the economically vulnerable or the unbanked (Page et al. 2013).

Mobile voice call subscription (a proxy for both mobile analogue and smartphones ownership) has been on a sharp rise since 2012 (Fig. 1). As mobile phone subscription grew at an average annual rate of 9.09% of projected population between 2012 and 2016, registered mobile money accounts and active mobile money accounts grew at 13.77% and 7.0%, respectively. Note that citizens are free to own multiple—mobile phones, mobile money accounts, and bank accounts, thus the absolute figures give a clearer picture. Also, although, people in Ghana use both analogue and smart phones, the National Communication Authority is yet to provide statistics on their proportions. In 2013, there were approximately four million mobile money accounts, fewer than the approximately seven million bank accounts. However, by December 2017, the number of mobile money accounts increased to approximately 24 million, twice higher than bank accounts (National 2018). Conversely, the number of active mobile money accounts rose steadily from 2012 and plateaued at approximately the same figure as that of bank accounts countrywide by December 2017. This shows that while registered mobile money accounts increased rapidly, active mobile money accounts trailed at an unequal pace.
Information and Transaction Costs

In developed countries, telecom companies sell and subscribe consumers to mobile telephony and data altogether. In Ghana, however, mobile phones, mobile network and data subscriptions, and mobile money accounts are three independent products, offered separately by various actors. While mobile phones can easily be purchased from retail shops, mobile network and data subscriptions, and mobile money accounts are only available through mobile telecommunications companies. To own a mobile phone, one must purchase it from the free market. To access a network’s services, one must subscribe by purchasing a SIM card of a preferred network, the network operator then registers and activates the SIM. Similarly, to own a mobile money account, one must consult the respective telecom company’s centre to register and activate a SIM that is already subscribed to the same network’s telephony.

Unlike in developed countries, where consumers receive packaged information about mobile phone acquisition and usage subscription contracts, in Ghana, no specific packaged information is given to consumers when they purchase mobile phones or subscribe to telephony networks, although consumers may receive oral information about on-going subscription promotions. Concerning mobile money accounts, the basic information provided is the importance of consumers keeping their generated personal identification number (PIN) as a secret, that
the platform is used to send and receive cash. Once a consumer requests mobile account ownership, their knowledge about mobile money is assumed. To access further information, consumers are directed to telecom companies’ general complaint helplines, or to one of the few customer complaints centres in the cities and big towns.

Consumers’ awareness and knowledge about mobile money is generally low, as they lack opportunities to obtain the necessary information. The main form of dissemination campaign done to promote mobile money is a short 30–60 s radio and television advertisements (Online Appendix A) on the remittance function, but in-depth knowledge about the related products offered by the mobile money platform is low. The adverts duration did not change overtime, but the content for each company changed based on new products available to consumers, for example, connecting to bank accounts, withdrawing money using automated teller machines (ATMs), receiving international remittance, and interoperability. About 78% of our baseline sample had advert as their source of first time information about mobile money. Only 5% received their first information from operator text message, 10% from mobile money vendors and 7% from other sources. Although the short adverts and codes direct prospective consumers to the nearest mobile money vendor for further information, these vendors are usually busy performing only sending and receiving transactions for users. For instance, our baseline survey shows that many people lack detailed knowledge about the full range of products, apart from sending and receiving money, although there are more products and services to enable consumers to be financially included, other than remittances. At baseline, 68.4% of all mobile money account holders did so with the reason of either receiving or sending remittances. Only 11% and 9% had reasons for saving and investment, and facilitation of day-to-day living, respectively, while the remaining 11.6% stated other non-specified reasons for owning mobile money accounts. Seventy-five percent (75%) of non-mobile money account holders at baseline indicated reasons such as not knowing much about the product and not expecting to receive money from anyone or do not see the need. The remaining 25% stated personal reasons for not owning mobile money accounts. Inadequate information centres in consumer neighbourhoods fuelled the lack of access to information.

Users pay a two-way transaction cost of 1%. When users transfers funds from their mobile wallet, they pay 1% of the amount transferred. When a receiver goes to cash the amount received at a vendor, 1% of the amount withdrawn is paid. When an account holder sends money to a non-account holder, either the sender or receiver pays a 3% transaction charge.

**Hypotheses**

Given the above situations, we examine whether providing more information on mobile money usage promotes people’s use of mobile money ex post. In particular, we investigate the impacts of our intervention on mobile money account
ownership, recent transaction, and share of various transactions relative to total financial transactions made. Specific hypotheses are as follows.

**Hypothesis 1 (H1)** Mobile money education contributes to increased mobile money account ownership.

**Hypothesis 2 (H2)** Mobile money education contributes to increased usage of mobile money for a recent transaction.

**Hypothesis 3 (H3)** Mobile money education contributes to an increase in the share of payments, remittances, and savings conducted through mobile money.

Mobile money accounts are not necessary when users want to receive or send money through mobile money platforms, but they are necessary to save on the platform. Thus, H1 will show whether providing information can deepen the peoples’ use of mobile money. While H2 will show us the general impacts on the use of mobile money, H3 will show which type of transaction is affected by information dissemination and by how much, relative to the total amount of transactions conducted including the amount transacted by traditional channels.

**Data and RCT**

**Data**

The analyses combined data from two surveys. We conducted the baseline survey in September 2016 and February 2017, and randomised the sample into treatment and control groups. The intervention was implemented through a workshop in March 2017. A follow-up survey was conducted 6 months after the intervention (Fig. 2). The sample composed individuals, rather than households. We used stratified random sampling approach to select respondents. First, all ten regions of Ghana were considered, based on the 2010 Population and Housing Census. We selected the Ashanti Region because it’s most populous and represented rural, urban, and peri-urban communities. One district each was selected from urban [Kumasi Metropolis (100% urban)], peri-urban [Obuasi Municipality (61% urban)], and rural [Amansie West District (96% rural)].
In each district, we stratified communities using population and level of commercial activities. Using financial institutions, nature and scale of commercial activities (Online Appendix B) we selected two communities, one of high commercial activity and another which is low, from which respondents were randomly sampled. While we acknowledge that it is ideal to have a list of residents and pick respondents randomly from the list, such lists are not available. Thus we had our enumerators enter the communities and talk to people randomly within a radius of 3 km from the station. To examine the impact of the intervention on both users and non-users, mobile money user status was used to stratify the sample within communities. To obtain user or non-user categories, randomly approached prospective participants were asked whether or not they were users. A mobile money user was any adult who had ever used mobile money to conduct a transaction, at least once, before the baseline survey. A non-user was any adult who had never used mobile money to do any transaction before the baseline survey.

The prospective participants were informed about the study, and as with most surveys, participation in our interview was voluntary. Non-participation rate was 10%. The target sample comprised adults who were at least 18 years and owned a mobile phone. Precaution was taken to ensure that gender was balanced among the participants surveyed.

A mobile money account holder described an adult who had registered a personal phone number as a wallet to conduct any self-initiated mobile money transaction. Note that one does not need to hold a mobile money account to be a user. However, certain features on the platform are only available for mobile money account holders, such as savings on and the purchase of government investment bonds (TBILL4ALL).

The informal sector employs about 80% of the labour force, therefore participants were mainly informal sector workers engaged in retail and other self-employments. In total, 557 participants were enrolled in the baseline survey, 388 users and 169 non-users. Table 1 shows the number of respondents surveyed per location. The endline survey was completed by 81% of the baseline sample (Table 2).

---

1 Enumerator’s characteristics may affect what kind of person s/he chooses to approach for a survey or from whom s/he receives a consent to interview. If there is such a tendency, it may create bias in our sample. To prevent such bias, our enumerators were not recruited locally but from another city (i.e. no social connection that may lead to bias). Enumerators were selected from a pool of applicants and were trained for five days to learn about the research and the protocols and ethics in conducting surveys. They all had first degrees and previous experience of working for similar projects. The researchers were also present in the field during the survey to supervise them and maintain consistency in the quality of their work. We also checked whether the respondents’ characteristics differ importantly depending on enumerators and found that the difference was minimum.

2 We checked the non-response rate at the end of each survey day and there was no systematic difference across days, enumerators, nor locations. The survey team visited these communities as a team, so each location was surveyed by all the enumerators to minimise bias across locations.
Randomisation

From each six communities, 36 respondents were randomly selected and invited to attend the education workshop. Of these 36 respondents, half were mobile money users, and the other half, non-users. In total, 216 randomly selected respondents formed the treatment group, and the rest (341) formed a control group. Table 3 indicates the number of observations randomised into the treatment group (invited and participated) versus the control group.

Approximately half of the invitees attended the workshop (Table 3). The low take-up rate was partly due to respondents being sceptical about the workshop and information relating to mobile money. During the intervention, frequent incidences of fraud were reported by mobile money users. Nevertheless, the take-up rate was very similar between the user and non-user groups.

To avoid non-invited respondents at the workshop, during the baseline survey, all respondents were informed that only randomly selected respondents would be invited for the workshop, that the non-selected would receive the information after the study. Randomly selected participants were informed through a phone call—1 month, 1 week, a day before the workshop, and on the day of the workshop; they were asked to keep their selection a secret, and not to invite anyone when coming to the workshop. Therefore, although it was anticipated that some non-invitees might show up at the workshop, especially in the rural areas, no non-invitees attended the workshops.

| Table 1 | Study participants by location. Source Authors’ survey |
|---------|------------------------------------------------------|
| Location | User (1) | Non-user (2) | Total (3) |
| Urban    | 130      | 60          | 190       |
| Peri-urban | 120      | 60          | 180       |
| Rural    | 138      | 49          | 187       |
| Total    | 388      | 169         | 557       |

| Table 2 | Participants per survey round. Source Authors’ survey |
|---------|------------------------------------------------------|
| Survey rounds | Survey sample (1) | Attrition (2) |
| Baseline    | 557               | –             |
| Endline     | 456               | 18.1%         |

| Table 3 | Randomisation and take-up (treated). Source Authors’ field experiment |
|---------|-----------------------------------------------------------------------|
| Treated | User (1) | Non-user (2) | Total (3) |
| Invited (participated) | 108 (55) | 108 (51) | 216 (106) |
| Controlled  | 280     | 61         | 341       |
| Total      |         |            | 557       |
The RCT was conducted in collaboration with telecom companies that offer mobile money products in Ghana; AIRTEL, MTN, and VODAFONE. This study liaised with officials of these companies to design an education programme about the unique product offerings each company has on its platform. Apart from the packaging, SIM cards, and short codes, the core product (electronic cash) is the same. Therefore, it has been possible since 2018 to transfer the store of value (core product) from one company’s SIM to another. The three companies promoted the same product and the different packages (telecom specific) it comes in (Fig. 3). Photos 1 and 2 display the outline of the content taught by officials from MTN and VODAFONE, respectively. The participants were educated on AIRTEL Money, MTN Mobile Money, and VODAFONE Cash. Each company had representatives in each community. Each representative was supervised by the same regional heads and the research team, during the delivery of the prepared content at each location.

A two-hour workshop was organised in each of the six communities. The content taught participants about electronic cash. It informed about product kinds available on the mobile money platform; how to use the products regularly, how participants can access the products on personal phones, and how to maintain vigilance to prevent fraud. The telecom officials answered questions raised by attendees, mobile money accounts were opened only for new customers who were willing to do so after they had understood how it worked and participants were allowed to practice the codes and processes on their mobile phones using their own money. Fraud incidences and the various forms it takes on the platform were discussed. Officials
taught customers how to prevent fraud and explained the transaction charges associated with services on the mobile money platform.

Participants evaluated the effectiveness of the workshop, after. Overall, the workshop was effective; 60% of participants reported that the workshop content ‘was just right’, 30% reported that ‘it was easy’, and 8% said ‘it was too easy to understand’. However, 2% reported that ‘it was difficult to understand’. Fifty-six percent of the participants said that ‘it is beneficial’, and 44% said, ‘It will be helpful’. The telecom officials evaluated the workshop and said “it was an eye-opener”, “it gave us insight into customers’ awareness of mobile money”.

**Estimation Strategy**

**Treatment Effects**

The analyses of workshop impacts on the use of mobile money for daily activities, focussed on mobile money account ownership, payments sent and received, remittances sent and received, savings, and the share of these transactions through mobile money.

In a simple form, the aim is to estimate the coefficient, $\beta_3$ in the following equation based, on the panel data:
\[ Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{time}_i + \beta_3 \text{Treat}_i \times \text{time}_i + \beta_4 \mathbf{X}_{it}' + \gamma_i + \delta_t + \epsilon_{it}, \]  

where \( Y_{it} \) is the outcome variable of interest for participant \( i \) at month \( t \); \( \text{Treat}_i \) is a dummy variable, equal to 1 if the person is “treated” and 0 otherwise; \( \text{time}_i \) indicates the follow-up survey period; \( \mathbf{X}_{it}' \) is a set of socioeconomic characteristics; \( \gamma_i \) is an individual fixed effect; \( \delta_t \) is a time fixed effect; and \( \epsilon_{it} \) is an error term.

We examine both the “intention-to-treat (ITT)” effects and the “treatment-effect-on-the-treated (TOT)” effects. ITT shows the causal impact of offering the treatment (being “invited”) on participants’ financial behaviours and is used often by policymakers as it offers the average effects of being invited. TOT shows the causal impact of the actual exposure to treatment on participants’ financial behaviour and is useful to the evaluator (Ravallion 2007; Glennerster and Takavarasha 2013). Random invitation status was used as the \( \text{Treat}_i \) variable in estimating ITT, whereas actual participation status to the workshop was used as the \( \text{Treat}_i \) variable for TOT. Both models were run by FE and FEIV estimations.

To estimate TOT, it is necessary to consider the potential endogeneity of \( \text{Treat}_i \). Especially, workshop attendance was very low among the treatment group, indicating that invitees to the workshop may have self-selected themselves to attend.
The effects of any unobserved systematic differences between the participants and non-participants among the invited will be captured in the error terms. This would violate one of the necessary assumptions for ordinary least squares (OLS), which states that the covariance between independent variables and an error term should be zero. To correct for any such endogeneity, the random invitation to the workshop (equal to 1 if randomised into a treatment group, and 0 otherwise) was used to instrument the actual participation status to estimate the FEIV. While we report the FE and FEIV results, the random effect, pooled OLS, and ANCOVA specifications were also estimated. The results were not very different.

**Heterogeneous Effects**

To examine whether specific characteristics of respondents affect the impacts of the workshop, the heterogeneous impacts focussed on differences due to gender, bank account ownership, household size, rural and urban dummies.

Gender may affect people’s financial decisions. Females are more likely to participate in mobile money compared to males (Apiors and Suzuki 2018). Hence, how gender and workshop information jointly affected usage may be useful for policy. Bank accounts can either complement or compete with mobile money accounts ownership. Intuitively, individuals with larger household sizes are likely to have higher household expenses; hence are more likely to transmit higher amounts through mobile money. Rural communities may pose a challenge for cost-effective distribution of financial access (Beck et al. 2007). A user’s location may either promote or inhibit mobile money adoption and usage.

**Attrition Analyses**

Attrition within the sample was low (18.1%) (Table 2), however, we examined whether this attrition posed validity issues to the analyses (Glennerster and Taka-varasha 2013). We investigate whether attrition systematically affected the outcome variables of interest, using the baseline sample in Eq. (2):

\[
Y = \alpha_0 + \beta_1 T + \beta_2 \text{Attrit} + \beta_3 T \times \text{Attrit} + \epsilon,
\]

where \(Y\) is a primary outcome variable at the baseline, \(T\) is an indicator for the treatment group, and \(\text{Attrit}\) is an indicator for attrition. \(\beta_3 - \beta_2\) was shown to be statistically insignificant for each baseline variable using an F-test.
Table 4  Socioeconomic variables’ summary at baseline. Source Authors’ survey

| Variables                              | Treatment (N=216) | Control (N=341) | p value of difference (3) |
|----------------------------------------|-------------------|-----------------|--------------------------|
|                                        | (1)               | (2)             |                          |
| Age (years)                            | 32.296 (12.15)    | 32.935 (12.42)  | 0.551                    |
| Education (years)                      | 8.47 (4.5)        | 9.32 (3.86)     | 0.017*                   |
| Gender (1 = male)                      | 0.51 (0.5)        | 0.52 (0.5)      | 0.79                     |
| Married (1 = yes)                      | 0.43 (0.49)       | 0.43 (0.49)     | 0.94                     |
| Household size                         | 3.56 (2.2)        | 3.36 (2.19)     | 0.299                    |
| Non-household dependents               | 0.44 (0.64)       | 0.47 (0.65)     | 0.548                    |
| Employment status                      | 0.87 (0.33)       | 0.85 (0.35)     | 0.51                     |

Major sources of first information about mobile money

Television                              | 0.29 (0.45)       | 0.30 (0.46)     | 0.73                     |
Radio                                   | 0.24 (0.44)       | 0.26 (0.43)     | 0.64                     |
Friends                                 | 0.19 (0.40)       | 0.22 (0.41)     | 0.45                     |
Vendor                                  | 0.09 (0.29)       | 0.10 (0.30)     | 0.75                     |

Standard deviations in parentheses *p < 0.1

Main Results

Socioeconomic Characteristic of Respondents

Table 4 shows the t-test results at baseline, indicating how treatment and control groups compared before the intervention. The treatment group comprises the invitees. In column (3), the treatment and control groups did not vary significantly in most of the socioeconomic variables, except for the years of education, suggesting that the randomisation was relatively successful. The average years of education was 8.5 years for the treatment group, a little lower than 9.3 years for the control group.

First, we examine participant’s financial activities, using bank account ownership, awareness, and the use of mobile money features. At baseline, 54% of the sample owned bank accounts, of which 70% deposited and withdrew at least once a month. Approximately 73% of no bank account holders attributed it to low income. All respondents were aware of mobile money. However, only 63.4% had ever used mobile money to receive cash, and 61% had ever used mobile money to send cash.
Table 5  Financial activities’ summary at baseline. *Source* Authors’ survey

| Variables                                      | Treatment ($N=216$) | Control ($N=341$) | $p$ value of difference |
|------------------------------------------------|---------------------|-------------------|-------------------------|
| Ownership of Bank Account                      | 0.54 (0.5)          | 0.56 (0.49)       | 0.157                   |
| Ownership of Mobile Money Account              | 0.287 (0.45)        | 0.436 (0.49)      | 0.0004**                |
| Mobile Money Sent (All transactions, last 12 months(GH¢)) | 72.96 (328.44)      | 469.91 (3562.98)  | 0.103                   |
| Mobile Money Received (all transactions last 12 months(GH¢)) | 201.04 (1294.83)    | 300.05 (2795.54)  | 0.625                   |
| Payments Sent (last 30 days(GH¢))              | 1410.09 (1619.14)   | 1846.75 (2957.36) | 0.047*                  |
| Payments Sent (last 12 months(GH¢))            | 14,276.53 (57,632.24)| 12,006.28 (17,544.98) | 0.497                  |
| Respondents’ Income (last 12 months(GH¢))      | 9002.5 (16,912.68)  | 7729.9 (10,901.81)| 0.28                    |
| Respondents Income (last 30 days(GH¢))         | 689.34 (2,409.87)   | 639.96 (1505.33)  | 0.766                   |
| Remittance and Gifts Sent (last 12 months(GH¢)) | 227.56 (462.51)     | 251.24 (488.05)   | 0.56                    |
| Remittance and Gifts Received (last 12 months(GH¢)) | 190.87 (409.24)     | 318.01 (589.53)   | 0.0057**                |
| Investment in Micro-Enterprise, Land, and Buildings (GH¢) | 5499.07 (55,096.62) | 1997.47 (6099.78) | 0.245                   |
| Total savings (GH¢)                            | 892.26 (2865.2)     | 1363.86 (9023.07) | 0.456                   |
| Total Financial Assets (GH¢)                   | 1376.11 (2834.22)   | 1438.78 (4213.55) | 0.847                   |
| Household Total Physical Assets (GH¢)          | 1,122,518 (15,000,000) | 668,523 (5,026,467) | 0.605                   |
In 2016, the basic minimum wage in the Ghanaian formal sector was GH₵8.00, GH₵40.00, and GH₵160.00 for daily, weekly, and monthly minimum incomes, respectively.

Standard deviations in parentheses

**p < 0.05, *p < 0.1

Notes

Except “Mobile Money Sent” and “Mobile Money Received”, all other variables indicate the amount transacted disregarding the methods (Mobile Money, bank, or cash)

Table 5 (continued)

| Variables | Treatment (N=216) | Control (N=341) | p value of difference |
|-----------|-------------------|-----------------|----------------------|
| Consumption (last 12 months in (GH₵)) | 4912.45 (5646.4) | 5088.2 (7234.26) | 0.761 |

Notes

Except “Mobile Money Sent” and “Mobile Money Received”, all other variables indicate the amount transacted disregarding the methods (Mobile Money, bank, or cash)

In 2016, the basic minimum wage in the Ghanaian formal sector was GH₵8.00, GH₵40.00, and GH₵160.00 for daily, weekly, and monthly minimum incomes, respectively.

Standard deviations in parentheses

**p < 0.05, *p < 0.1
Only 22.5%, 7%, 5%, and 0% had ever used mobile money to save, take or repay a loan, pay utility bills, and purchase treasury bills, respectively. Thirty-seven percent of the sample had mobile money accounts, of which 90%, 7%, 6%, and 5% were with MTN, AIRTEL, TIGO, and VODAFONE, respectively. Some participants had multiple accounts with multiple service providers.

Table 5 shows how financial activities compared between the treatment and control groups. Although the time between the intervention and the survey was 6 months, we used outcomes that cover the last 12 months as some of the expenditures may be annual rather than half-year base and payment timing may be different across respondents. Thus restricting the time may result in biassed answers. Besides mobile money account ownership, payments sent in the last 30 days and remittances and gifts received in the last 12 months, all other variables did not differ significantly between the treatment and control groups. This suggests that the randomisation worked moderately well regarding the outcome behaviours. The treatment group had a lower mobile money account ownership when compared to the control group. This was significant at the 1% level.

Payments sent is the total value of cash-outs made for goods and services received. At baseline, the treatment group made an average payments of GH¢1410.09 in the last 30 days and GH¢14,276.53 in the last 12 months. However, the control group made average payments of GH¢1846.75 in the last 30 days and GH¢12,006.28 in the last 12 months. Of these payments, the treatment group sent an average of GH¢72.96 through mobile while the control group sent GH¢469.91. The treatment group received average payments of GH¢204.04 through mobile money, while the control group received GH¢300.05.

Remittances sent in the last 30 days did not vary significantly; however, remittances received in the last 12 months were lower for the treatment group’s customers (GH¢190.87) compared to those in the control group (GH¢318.01).

Impact on Account Ownership and Usage

Figure 3 indicates how mobile money account ownership increased across the first 6 months after the intervention, for both treatment and control groups. At baseline, only 30% of the workshop attendees own mobile money accounts. However, after the intervention, 60% of the workshop attendees became new mobile money account holders. Among the control group, mobile money account ownership increased from 35% at baseline to 65% after the intervention.

Table 6 presents estimations of ITT and TOT of mobile money education on participants’ likelihood of opening new mobile money accounts. The results (Table 6, column (1)) show no significant ITT effect of mobile money education on new account ownership. Similarly, no significant TOT impact is seen on account ownership, although a positive sign is observed (column (3)). Thus, the first hypothesis “mobile money education contributes to mobile money account ownership” is not supported. The coefficients of the Endline are positive and significant across models, indicating that, after the workshop, the number of people who opened mobile money accounts increased, both for the treated and control groups.
The “recent usage” refers to the incidence of using mobile money to transact at least one financial activity at least once in the last 30 days. Column 1 (Table 7) shows that workshop invitees increased their probability of using mobile money for a recent activity after the workshop, and this was statistically significant at 1%. Further, a strong positive TOT impact of workshop participation was observed on
the recent use of mobile money for transactions. The coefficient of the Endline was negative and significant, implying that, generally, respondents decreased their usage of mobile money at Endline. However, the treatment of inviting participants to the workshop compensated for the decline in the probability of use by $-0.728 + 0.513$.

In both columns (2) and (3), the coefficients of Participate × Endline are positive and statistically significant at 1%. The FEIV results show that, at the Endline, the probability of usage was generally lower than at the baseline (the negative coefficient at the Endline). However, the coefficient of Participate × Endline compensates for this lower usage, suggesting that the workshop participants increased the probability of recent use by 143% ($-1.103 + 2.537$). At the 1% significance level, workshop participation increased the recent usage of mobile money for a transaction by 143% within 6 months after the intervention. These results support the second hypothesis: “mobile money education contributes to increased usage of mobile money for a recent transaction”.

**Impact on Financial Transaction**

To examine the third hypothesis, the ITT and TOT of mobile money education on (1) payments (sent and received; Table 8), (2) remittances (sent and received; Table 9), and (3) savings for the last 12 months were examined. Note that for each outcome, the first three columns use the log of total amounts transacted, disregarding the transaction methods, i.e. including transfers through banks, as the dependent variables. The last three columns examined the share of these transactions conducted through mobile money to test Hypothesis 3.

Tables 8 and 9 are presented in the same format, for easy comprehension. Columns (1), (4), (7), and (10) show the ITT, estimated using random invitation status as the treatment. Columns (2), (5), (8), and (11) estimate the FE by using the participation status as the treatment, whereas columns (3), (6), (9), and (12) use FEIV estimation, by using participation status as a treatment and instrumenting it with random invitation status, to correct for endogeneity.

The ITT results indicate no significant effect of invitation to the workshop on the payments sent, nor on the share of payments sent through mobile money (Table 8, Panel A). Generally, the payments sent among the sample did not change; however, the share of payments sent through mobile money increased above the baseline values.

Similarly, no significant treatment effect of mobile money education was observed on the payments received, or on the share of payments received through mobile money (Table 8, Panel B). The general sample decreased their total amount of payments relative to the baseline values. However, both the treatment and control groups increased their shares of payments received through mobile money.

Concerning remittances sent, while no significant ITT impact was observed on the remittances sent, the FE model shows a positive TOT that faded after instrumentation (Table 9, Panel A). There were no significant TOT effects on the share of remittances sent through mobile money; however, the general sample increased both the remittances sent and the share of remittances sent through mobile money.
Likewise, models of remittances received show similar results (Table 9, Panel B). The FE model marked a 10% significance of TOT for the remittances received; however, the significance fades after instrumentation, and no significant TOT is seen on the share of remittances received through mobile money. Conversely, relative to baseline values, both the treatment and controlled group samples had received more remittances and increased their share of remittances received through mobile money during the Endline survey.

Table 8  Impact on payments

|                      | ITT FE | TOT FE | FEIV | ITT FE | TOT FE | FEIV |
|----------------------|--------|--------|------|--------|--------|------|
| **Panel A**          |        |        |      |        |        |      |
| Log payments sent    |        |        |      |        |        |      |
| Invite x Endline     | 0.004  | (0.10) |      | 0.003  | (0.01) |      |
| Participate x Endline| 0.12   | 0.02   | (0.13) (0.51) | 0.01 | 0.01 | (0.02) (0.06) |
| Endline              | −0.027 | −0.052 | −0.03 | 0.024*** | 0.028*** | 0.022 |
| (0.063)              | (0.055) | (0.124) | (0.008) (0.008) | (0.016) |
| Observations         | 912    | 912    | 912  | 912    | 912    | 912  |
| $R^2$ [Overall]      | 0.058  | 0.060  | 0.180 | 0.037  | 0.039  | 0.005 |
| Number of PID (N)    | 456    | 456    | 456  | 456    | 456    | 456  |

|                      | ITT FE | TOT FE | FEIV | ITT FE | TOT FE | FEIV |
|----------------------|--------|--------|------|--------|--------|------|
| **Panel B**          |        |        |      |        |        |      |
| Log payments received|        |        |      |        |        |      |
| Invite x Endline     | 0.20   | (0.24) |      | −0.06  | (0.08) |      |
| Participate x Endline| 0.40   | 1.01   | (0.26) (1.27) | 0.10 | −0.33 | (0.13) (0.53) |
| Endline              | −0.468*** | −0.482*** | −0.618** | 0.188** | 0.140*** | 0.239* |
| (0.171)              | (0.143) | (0.311) | (0.088) (0.062) | (0.131) |
| Observations         | 911    | 911    | 911  | 878    | 878    | 878  |
| $R^2$ [Overall]      | 0.09   | 0.092  | 0.123 | 0.028  | 0.029  | 0.004 |
| Number of PID (N)    | 456    | 456    | 456  | 456    | 456    | 456  |

“Participate” is instrumented with random invitation status in FEIV models
All models include log of financial assets, log of physical assets, and constant
Robust standard errors in parentheses ***p < 0.01, **p < 0.05, *p < 0.1
Regarding savings, ITT results showed no significant impact. The effects on the log of savings and share of savings both showed no significant impact; however, the general study sample increased the amount of savings relative to the baseline value at the Endline; but, this was not necessarily achieved through mobile money.
Results of Heterogeneous Effects

Table 10 shows the results of heterogeneous effects on the outcome variables. Bank account ownership and gender showed no significant joint effect on the outcome variables. A negative significant joint effect was observed between workshop participation and urban dwellers on the share of payments sent through mobile money (column (1)). This suggests that the effect of the workshop attendance on the share of payments sent through mobile money was 10.4% less for urban dwellers than for rural dwellers. Concerning the share of savings conducted through mobile money, a significant negative effect was observed when household size interacted with workshop participation. Column 4 (Table 10) shows that larger households experienced a 50.4% less impact on the share of savings through mobile money, and this is significant at 5%. Workshop attendance had positive effects on the share of savings conducted through mobile money, but this effect was greater for smaller households.
Table 11: Attrition across main outcome variables

| Variables          | Payments               | Remittances              | Savings               |
|--------------------|------------------------|--------------------------|-----------------------|
|                    | Sent (1)               | Received (2)             | Sent (5)              | Received (6)         | (9)         |
|                    | (3)                   | (4)                      | (7)                  | (8)                   | (10)        |
| Participate        | −0.108                 | −0.376                   | −197.2***             | −1117                 | −74.24***   | −359.7***  | 60.93      | −2654      |
|                    | (0.123)                | (0.538)                  | (67.74)               | (1207)                | (13.27)     | (87.71)    | (162.5)    | (3661)     |
| Attrition          | 0.003                  | 0.078                    | 320.9                 | −727.2                | 23.48       | 28.65      | −26.07     | −137.3*    | −429.7     | −1011      |
| attrition x        | −0.213                 | −2.858                   | −219.3                | 5664                   | −35.09      | 488.6      | 23.34      | 777.2      | −731.6     | −419.2     |
|                    | (0.400)                | (2.846)                  | (421.4)               | (6384)                 | (23.12)     | (464.0)    | (26.57)    | (859.8)    | (697.9)    | (19,370)   |
| Constant           | 8.855***               | 8.921***                 | 224.2***              | 579.2*                 | 24.80***    | 2.180      | 76.97***   | 148.8***   | 1283**     | 1936**     |
|                    | (0.057)                | (0.141)                  | (63.25)               | (317.3)                | (8.516)     | (23.06)    | (21.42)    | (42.73)    | (511.8)    | (962.7)    |
| F                  | 0.24                   | 0.93                     | 0.44                  | 0.88                   | 1.88        | 0.86       | 0.87       | 0.99       | 0.07       | 0.00       |
| Prob > F           | 0.622                  | 0.335                    | 0.508                 | 0.349                  | 0.171       | 0.354      | 0.352      | 0.320      | 0.796      | 0.977      |
| Observations       | 557                    | 557                      | 557                   | 557                    | 557         | 557        | 557        | 557        | 557        |            |
| $R^2$              | 0.003                  | 0.005                    | 0.006                 | 0.009                  | 0.001       |            |            |            |

For IV models, “Participate” was instrumented with random invitation status.
Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$
Attrition Results

The OLS and IV estimates (Table 11) show that none of the coefficients on Attrition x Participate were statistically significant for the primary outcome variables. This means that attrition in this study was independent of potential outcomes, and did not cause bias in the RCT or estimation results (Gerber and Green 2012).

Mechanism and Discussion

Overall, the results of recent usage of mobile money for transactions are consistent with the suggestions that well-designed targeted training may increase financial literacy (Behrman et al. 2012; Drexler et al. 2014). The treatment group’s response to the education provided, shown through an increase in the usage for transactions, highlights the importance of knowledge acquired during the workshop. Therefore, how did the intervention catalyse recent incidences of using mobile money for transactions? Possibly, the education improved trainees’ understanding of mobile money and its benefits. As participants improved their knowledge of mobile money, their confidence and trust increased, thereby increasing usage.

The puzzle is participants’ reluctance to open new mobile money accounts, which would enable them to take advantage of the more useful features of the platform, for example, savings which may improve their livelihood (Klapper et al. 2016). Although workshop attendees opened new mobile money accounts, they did so at a similar rate to the control group. Contrary to expectations, this finding aligns with literature that suggests little to no impact of financial education on account opening (Cole et al. 2011).

Though a spillover of information about mobile money to the control group could be one reason for this observation, the widespread occurrence of any spillover is likely slim, because of the strict design and implementation protocols followed.

Alternatively, field data suggest that the reasons respondents stated for not having a mobile money accounts were consistent with the main reason why people may want to own accounts. For instance, ‘not expecting to receive money from anyone’ was a major reason stated for not owning mobile money accounts. Moreover, this reflects the goals stated by respondents who opened new mobile accounts; 82.9% of the existing users at baseline had the goal of using their mobile money account to ‘receive’ cash. Likewise, 85% of the non-users who became new account holders after the intervention stated to ‘receive’ cash as their main goal. These suggest cash receipt expectations remain a significant driver of mobile money account ownership. Qualitatively, evidence confirms this, as 80% of workshop attendees became new account holders after the intervention with the primary goal of receiving cash. This reason closely aligns with our data and the situation on the ground.

Concerning financial activities, the swing between weak significance to no treatment effect on financial activities through mobile money implies that, although mobile money education could have had a positive outlook for financial activities through mobile money, this effect was weak and volatile. These findings align with
other financial education studies, which observed weak unstable impacts (Collins 2013; Fernandes et al. 2014).

We found that workshop increased the recent use of mobile money among users (Table 7), but it did not have significant impacts on the transacted amounts or share of transaction through mobile money (Tables 8, 9). Several reasons may account for the volatile or no treatment effect observed. First, probably the one-time two-hours training was inadequate. Second, our Endline survey was too early to capture the sufficient effects on the full transaction of the past 12 months. We did find that recent use (within 30 days) increased for the workshop participants, but this behavioural change was not enough to observe the effect of the workshop on the financial transactions of a longer term. A longer time frame might be necessary to observe the change. Third, every payment transaction on a mobile money account attracts a 1% charge. Consequently, as knowledge on mobile money improved, consumers became more aware of the 1% transaction charges when payment is sent or received through mobile money. Such charges are non-existing for cash payment, bank account deposits, and withdrawals at banks or ATMs. When customers make smaller units of transactions, the charge is less noticeable; however, it becomes substantial when the transaction amounts increase. Therefore, the charges may act as a disincentive to transmit more substantial amounts of payments through mobile money. To confirm this assertion, during the lockdown periods of COVID-19, the 1% charge was waved for all transactions of GH¢ 100 and below, and this contributed to a 4.3% increase in active mobile money accounts, new activations, and higher person-to-person transactions on MTN.

The heterogeneous effect results provide more insights into interaction terms that explain changes that may occur. Relative to rural dwellers, urban workshop participants decreased their share of payments sent through mobile money by 10.4%. Furthermore, larger householders who attended the workshop decreased their share of savings held in mobile money by 50.4%.

**Conclusion**

We examined the impact of mobile money education on individuals’ mobile money participation. Through an RCT and two survey rounds in a panel, we estimated the treatment effect of mobile money education on mobile money usage.

Overall, the intervention promoted the recent usage of mobile money for transactions among workshop participants. However, weak significant treatment effects were found on the remittances sent and received by attendees. These weak effects faded after instrumentation with the randomisation variable. Concerning the share of financial activities conducted through mobile money, although a positive outlook was observed, no significant treatment effect was observed. Examining the qualitative data, these weak to no treatment effects can likely be attributed to either possible spillover effects between the treated and control groups (as mobile money participation increased for both groups in general over time) or to the 1% transaction
charge incurred on every transaction on mobile money, which became more evident to the workshop participants.

Heterogeneous impact analyses revealed significant joint effects of the workshop and location, and household size on the share of financial activities transmitted through mobile money. Urban dwellers experienced lesser impact from the workshop regarding payments sent through mobile money, and larger households decreased their savings held via mobile money.

Policies directed towards educating people about financial products on mobile money platforms will constitute reasonable attempts to improve participation through the incidence of current use, with moderate impacts on users sending and receiving remittances. It will encourage people to use mobile money products with understanding, thereby maximising their potential benefits from mobile money usage, while promoting financial literacy and sustainable development goals.

Concerning further work, this study was conducted in only one region of Ghana, hence limited by ample sample size for strong statistical power. However, the results are robust, and may be used as a starting point for a more extensive study to observe the short- and long-term impacts of mobile money education.

**Supplementary Information** The online version contains supplementary material available at https://doi.org/10.1057/s41287-022-00529-x.

**Acknowledgements** We appreciate the generosity of KDDI foundation for the grant for this study. Thank you KDDI. We thank Settor Amediku and Stephen Sasu-Yeboah of Bank of Ghana; Berthold Gadagbui and George Ofosu Boateng of Ecobank; Adu Danso, Confidence Amegashitsi, Yaw Antwi-Boasiako, and Kwame Amoako Agyeman of VODAFONE Cash; Alexander Oti Boateng and Isaac Kwadwo Bediako of AIRTEL Money; Eli, Hini, Gabriel Agana, Steven Asare, Charity Darko, Richmond Darfar, Anthony Kweinin, Aboagye Mizhack, and Deladem of MTN Mobile Money; Bernard Frimpong and Alexander Alordeppey and the survey team for their support during fieldwork.

**Declarations**

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

**References**

Apiors, E.K., and A. Suzuki. 2018. Mobile money, individuals’ payments, remittances, and investments: Evidence from the Ashanti Region, Ghana. *Sustainability* 10 (5): 1409. https://doi.org/10.3390/su10051409.

Arun, T., and R. Kamath. 2015. Financial inclusion: Policies and practices. *IIMB Management Review* 27(4): 267–287. https://doi.org/10.1016/J.IIMB.2015.09.004.

Bank of Ghana. 2017. Impact of mobile money on the payment system in Ghana: an econometric analysis. https://www.bog.gov.gh/privatecontent/Public_Notices/ImpactofMobileMoneyonthePaymentSystemsinGhana.pdf.

Batista, C., and P.C. Vicente. 2020. Is mobile money changing rural Africa? Evidence from a field experiment. NOVAFRICA Working Paper, 1805(August), pp. 1–62. www.gsma.com. Accessed 31 Dec 2020.

Beck, T., A. Demirgüç-Kunt, and R. Levine. 2007. Finance, inequality and the poor. *Journal of Economic Growth* 12 (1): 27–49. https://doi.org/10.1007/s10887-007-9010-6.

Behrman, J.R., O.S. Mitchell, C.K. Soo, and D. Bravo. 2012. How financial literacy affects household wealth accumulation. *American Economic Review*. https://doi.org/10.1257/aer.102.3.300.
Bruhn, M., L.S. Leao, A. Legovini, R. Marchetti, and B. Zia. 2016. The impact of high school financial education: Evidence from a large-scale evaluation in Brazil. American Economic Journal: Applied Economics 8 (4): 256–295. https://doi.org/10.1257/app.20150149.

Cole, S., T. Sampson, and B. Zia. 2011. Prices or knowledge? What drives demand for financial services in emerging markets? The Journal of Finance 66 (6): 1933–1967.

Collins, J.M. 2013. The impacts of mandatory financial education: Evidence from a randomized field study. Journal of Economic Behavior and Organization 95: 146–158. https://doi.org/10.1016/j.jebo.2012.08.011.

Drexler, A., G. Fischer, and A. Schoar. 2014. Keeping it simple: Financial literacy and rules of thumb. American Economic Journal: Applied Economics 6 (2): 1–31. https://doi.org/10.1257/app.6.2.1.

Fernandes, D., J.G. Lynch, and R.G. Netemeyer. 2014. Financial literacy, financial education, and downstream financial behaviors. Management Science 60 (8): 1861–1883. https://doi.org/10.1287/mnsc.2013.1849.

Gerber, A., and D. Green. 2012. Field experiments: Design, analysis, and interpretation. New York: W.W. Norton.

Ghana, B. of. 2017. Payment systems Department Bank of Ghana payment systems oversight Annual report. https://www.bog.gov.gh/privatecontent/PaymentSystems/PaymentSystemsAnnualReport2017.pdf. Accessed 5 July 2018.

Glennener, R., and K. Takavarasha. 2013. Running randomized evaluations: A practical guide. Princeton: Princeton University Press. https://doi.org/10.2307/j.ctt4cqd52.

GSMA. 2010. Mobile money definitions. https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/06/mobilemoneydefinitionsnomarks56.pdf. Accessed 5 March 2019.

Hastings, J.S., B.C. Madrian, and W.L. Skimmyhorn. 2013. Financial literacy, financial education, and economic outcomes. Annual Review of Economics. https://doi.org/10.1146/annurev-economics-082312-125807.

Jack, W., and T. Suri. 2014. Risk sharing and transactions costs: Evidence from Kenya’s mobile money revolution. American Economic Review 104 (1): 183–223. https://doi.org/10.1257/aer.104.1.183.

Karlan, D.S., P. Dupas, J. Robinson, and D. Ubfal. 2017. Banking the unbanked? Evidence from three countries. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2815092.

Klapper, L., M. El-Zoghbi, and J. Hess. 2016. Achieving the sustainable development goals—the role of financial inclusion, p. 20. www.cgap.org. Accessed 19 Feb 2018.

Lusardi, A., and P. Tufano. 2015. Debt literacy, financial experiences, and overindebtedness. Journal of Pension Economics and Finance 14 (4): 332–368. https://doi.org/10.1017/S1474747215000232.

Miller, M., J. Reichelstein, C. Silas, and B. Zia. 2015. Can you help someone become financially capable? A meta-analysis of the literature. World Bank Research Observer 30 (2): 220–246. https://doi.org/10.1093/wbro/lkv009.

Mitchell, O.S., and A. Lusardi. 2011. Financial literacy and planning: Implications for retirement well-being. Financial Literacy: Implications for Retirement Security and the Financial Marketplace. https://doi.org/10.1093/acprof:oso/9780199668190.003.0002.

Munyegera, G.K., and T. Matsumoto. 2016. Mobile Money, remittances, and household welfare: Panel evidence from rural Uganda. World Development 79 (25101002): 127–137. https://doi.org/10.1016/j.worlddev.2015.11.006.

National, C.A. 2018. MNOs voice subscription trends. https://www.nca.org.gh/assets/Uploads/Voice-Oct-Dec-2018.pdf. Accessed 27 Feb 2019.

Page, M., M. Molina, G. Jones, and D. Makarov. 2013. The Mobile Economy 2013, p. 100. https://www.gsma.com/newsroom/wp-content/uploads/2013/12/GSMA-Mobile-Economy-2013.pdf. Accessed 24 Feb 2018.

Payment System Statistics 1. Ghana Interbank Settlement (RTGS). 2010. https://www.bog.gov.gh/privatecontent/PaymentSystems/PaymentSystemStatistics-December2018.pdf. Accessed 30 Jan 2019.

Ravallion, M. 2007. Chapter 59 evaluating anti-poverty programs. Handbook of Development Economics 4: 3787–3846. https://doi.org/10.1016/S1573-4471(07)04059-4.

Suárez, S.L. 2016. Poor people’s money: The politics of mobile money in Mexico and Kenya. Telecommunications Policy 40 (10–11): 945–955. https://doi.org/10.1016/j.telpol.2016.03.001.

Suri, T., and W. Jack. 2016. The long-run poverty and gender impacts of mobile money. Science 354 (6317): 1288–1292. https://doi.org/10.1126/science.aah5309.

Suri, T., W. Jack, and T.M. Stoker. 2012. Documenting the birth of a financial economy, Proceedings of the National Academy of Sciences 109 (26): 10257–10262. https://doi.org/10.1073/pnas.1115843109.
The World Bank. 2012. Maximizing Mobile: The World Bank. Information and Communications for Development 2012. https://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/IC4D-2012-Report.pdf. Accessed 6 March 2019.

Tobbin, P., and J.K. Kuwornu. 2011. Adoption of mobile Money Transfer Technology: Structural equation modeling approach. European Journal of Business and Management 3 (7): 59–78.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.