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A National Information Campaign Encouraging Financial Technology Use in Ghana

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A National Information Campaign

Encouraging Financial Technology Use in Ghana

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Abstract

We utilise high-frequency "interactive voice response (IVR)" messages to encourage adoption of mobile banking technology in Ghana. We randomise 15,000 bank clients equally to receive messages on a) mobile banking encouragement (MB-IVR); b) savings encouragement (Savings-IVR); or c) control (no messages). Analysis using administrative records shows significant impacts of MB-IVR, tripling mobile banking use from 2.4% in the control group, with persisting effects measured at five-month post-intervention period. We see improvements in financial behaviour: The MB-IVR groups are 8% more likely to repay loans on-time, and 11% less likely to travel to the bank. There is no impact of Savings-IVR.

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1 Introduction

Lack of information has been highlighted as one of the key barriers to adopting new technologies (Foster and Rosenzweig, 2010). Theories in technology adoption suggest that bridging this information gap – changing agents' priors on the return to a behavioural shift – can translate information into action. However, it is unclear to what extent providing information can alone encourage technology uptake, as adoption often requires a strong tacit (or know-how) knowledge component, either through own use or through observing peers (Foster and Rosenzweig, 1995; Conley and Udry, 2010; Janvry et al., 2017; Munshi, 2004; Carter et al., 2014).

We explore this topic by experimentally encouraging the use of a new digital financial service, mobile banking, in Ghana. Mobile banking services are a technology building upon widely beneficial mobile money services (Jack and Suri, 2014; Lee et al., 2021; Riley, 2018) providing access to a bank account directly from a user's mobile phone, substantially reducing the transaction costs of banking by removing the need to travel. Mobile banking works on the USSD system that does not require an internet connection or smartphone, making this technology particularly beneficial to low-income and rural households. The service we examine here is very low cost, at only 1 Cedi ($0.16) fixed cost per transaction.

How can we induce learning about mobile banking at scale? To tackle this challenge, we developed a series of "Interactive Voice Response (IVR)" messages which we utilised in a randomised national informational campaign delivered over ten weeks. IVR is a pre-recorded voice calling service, making it helpful in providing information to low literacy populations. Our Mobile Banking IVR messages consisted of information on the benefits of mobile banking and practical knowledge on how to carry out different types of mobile banking transactions. They also contained information aiming to promote healthy financial behaviours such as saving for emergencies and making timely loan repayments. These messages were directly dialled as voice calls to user's phones, who, if they answered the call, would hear pre-recorded messages read by voice actors.

We conducted this study in collaboration with Opportunity International Savings and Loans Limited (OISL), a leading microfinance institute and bank in Ghana that targets the poor and under-banked population as their clients. All the clients in our study already had a bank account with OISL. Hence, the sample represents a population that, while technically banked, has high average transaction costs of accessing the bank account due to the large distances between clients and the bank branches.[1]

Utilising administrative records from the bank, we randomised 15,000 OISL microfinance clients across Ghana equally to i) receive IVR messages highlighting the benefits of mobile banking use and induce learning about the technology (Mobile Banking IVR); ii) encourage good financial behaviour (Savings IVR), and iii) a pure control group who receive no messages (status-quo). The Mobile Banking IVR group also received SMS texts reminding them of the information given during the voice messages and providing detailed instructions on performing digital transactions. To isolate the information impact of mobile banking IVR separately from encouraging good financial behaviour and contact with the bank, we purposefully included the Savings IVR, which provided weekly IVR messages promoting financial discipline and savings without the knowledge portion related to mobile banking (similarly to a placebo design). Hence, our design allows us to measure the impact of information about a new technology separately from general saving encouragement, saving salience, and bank communication.

We use a combination of admin data, call records from the IVR service provider and a short phone survey to examine impacts during and five months after the intervention ends. We had high compliance rates with the intervention, with 90% of those assigned to IVR messages listening to at least one message. Employing admin data from our partner bank, we find that the Mobile Banking IVR intervention significantly impacted the likelihood of using mobile banking services. Our intervention increased technology use for the Mobile Banking IVR group by six percentage points, compared with a base of only 2.4% in the control

[1]Clients report 24 Cedis average cost of travel to the bank, with a trip taking 50 minutes each way.

group. Treated clients had total mobile banking transaction values three times as large as the control group and conducted almost twice as many transactions. Treatment effects were large during the intervention period, with bigger impact magnitudes for later months. Impacts also continued to persist five months after the intervention ended, with the Mobile Banking IVR group remaining twice as likely as the control group to use the technology. In the mobile banking data, we see that the value of total deposits and withdrawals are net-zero on average. Consistent with this, we do not see any change in the overall saving balance held with the bank by the Mobile Banking IVR group.

However, in the admin data, we notice that Mobile Banking IVR clients are 8% more likely to make timely loan repayments, suggesting general improvement in financial management. Mobile Banking IVR clients also report being 11% less likely to have travelled to the bank in the month before the survey. The increase in mobile banking transactions, combined with no change in bank savings, supports the idea that clients are substituting physical bank trips with digital ones.[2] Given that the cost of a mobile banking transaction is only 1 Cedi, whereas the average cost of travel to the bank is 24 Cedis, this suggests a large benefit to the users. Detailed cost-effective analysis entails a benefit-to-cost ratio of 1.49 over the eight months period (during and immediately after the intervention). Additionally, by reducing late loan repayments, the mobile banking platform benefits the bank even without a net increase in deposit balance.

Interestingly, the Savings IVR did not show any discernible effect, suggesting encouraging good financial behaviour by itself is not effective without a tool to enable savings and timely loan repayments. We do not see evidence of strong heterogeneity in our estimates by gender, age, location, prior saving balance of the respondent, or whether the client had a loan, suggesting the impacts apply broadly to different clients.

This study makes two important contributions. First our study contributes to the

[2]We do not have data on the total number of bank transactions only on mobile banking transactions, and hence cannot rule out the possibility that clients are using mobile banking to make more deposits and withdrawals overall, such that the net balance effect is zero.

growing literature on low-cost interventions to encourage technology adoption. Most technology-adoption literature utilises face-to-face or peer-based information transmission to increase technology use, which is often expensive and time-consuming (Lee et al., 2021; Batista and Vicente, 2020; Dalton, 2020; Bandiera and Rasul, 2006; Duflo et al., 2008). Studies sending information by text messages have found mixed impacts, with text messages not consistently changing behaviour (Berlinski et al., 2021; Bahety et al., 2021). In contrast, our study demonstrates the efficacy of a rapidly scalable intervention using high-frequency IVR messages,[3] which can be utilised to reach even illiterate populations without access to the internet or smartphones, and, crucially, could lead to behavioural change (Cole and Fernando, 2021; Van Campenhout et al., 2021).

Second, our study speaks to the literature on the value of adopting digital financial services and whether they benefit consumers. We see that the use of mobile banking is driven by clients who previously carried out physical transactions reporting fewer trips to the bank. Since mobile banking costs are significantly lower than the costs of travelling to the bank, adopting this technology will benefit customers by shifting from physical to digital transactions. This finding that digital financial services can benefit clients currently conducting physical transactions, builds on the literature highlighting transaction costs as a limiter for bank account usage, especially for the unbanked clients (De Mel et al., 2018; Schaner, 2015; Dupas et al., 2018; Prina, 2015).

2 Setting

2.1 Mobile banking

Mobile banking enables bank deposit and withdraw services using the existing mobile money infrastructure. It requires both bank and mobile money accounts to be linked together. The mobile banking platform that we consider here, Opportunity Mobile, works over the USSD

[3]The cost of IVR message is comparable with SMS: \$0.02 per text versus \$0.03 per minute of airtime.

system on the cellular network, so smartphone or internet data is not needed. In order to deposit cash into a bank account, one can use any mobile money agent to deposit cash into a mobile money wallet. The mobile banking platform can then be used to deposit money from the mobile money account to the bank account, paying a fixed cost of only 1 Cedi ($0.16). To withdraw money from the bank account, one can also use the mobile banking platform to transfer the amount into mobile money account, after which one can withdraw it from an agent as cash or send it to someone.

2.2 COVID-19 in Ghana

The intervention took place from August-November 2020, during the COVID-19 pandemic. However, at that time, COVID-19 cases were low in Ghana, averaging only a few hundred a day. The strict lockdown restriction in Ghana was relaxed in June 2020, though rules on mandatory mask wearing in public spaces and restrictions on large gatherings remained. At that time, the government recommended reduced travel outside immediate work and home locations. The banks limit microfinance group meeting frequency and discouraged clients from physically visiting bank branches. Therefore, this is an interesting time to examine a technology that can help reduce social interactions and travel while giving people access to their finances. While willingness to adopt such technology may also be higher during the COVID-19 pandemic, it is likely to have persisted since.

3 Intervention and Study Design

3.1 Interventions

Our intervention arms are Mobile Banking IVR, a Savings IVR and a pure control group. The Mobile Banking IVR group received a series of ten IVR messages highlighting various benefits and features of mobile banking and practical information about how to access and use the service, alongside encouragement to save. The Mobile Banking IVR group also

received detailed SMS texts to remind of the information given during the voice messages and provide detailed instructions on how to perform a certain type of transaction.

The Savings IVR group received a series of ten IVR messages highlighting the importance of saving, reminders to save and general encouragement from OISL. The Savings IVR intervention was designed to provide all the contents of the IVR treatment intervention excluding the portion related to mobile banking. As such, it allows us to measure any impacts from general encouragement to save and interaction with OISL increasing the salience of saving, thus acting similarly to a placebo intervention. The pure control group did not receive any IVR messages.

The voice messages were designed by the research team and professionally recorded by voice actors in two local languages and in English.[4] Messages were sent between 2 pm and 7 pm on the designated day, with Mobile Banking IVR and Savings IVR recipients randomised into batches of 500 to receive the call in one-hour intervals to ensure a balance of call times.If the call was not answered, a second call went out three days later. Clients could repeat the IVR message if they called back the number themselves. Details of the ten message themes by treatment group are given in Appendix Table A1. One benefit of IVR is the ability to send voice messages for technology adoption to a rural population with high illiteracy.

3.2 Sample and Randomisation

The study population was existing clients of Opportunity International Saving and Loan (OISL) in Ghana. OISL is a rural bank with a mission to serve low-income customers who are excluded from mainstream banking. They have over 500,000 clients and are nationally representative across Ghana (Figure A1). OISL provide loans (group lending microfinance and individual lending) as well as savings accounts to rural clients.

Data for the sample selection and randomisation came from OISL administrative data of

[4]The messages were sent in the primary language for clients at that branch. At the end of every message, clients had an option to change language, to read in their preferred language. 80% of the messages were in Akan (Twi), 12% in English, and 8% in Ga.

June 2020. The sample was selected from the universe of OISL clients based on the following criteria:

1. Client had a current account with OISL
2. Client was already registered for Mobile Banking.[5]
3. Client had not completed a Mobile Banking transaction in the last month.
4. Client had made at least one banking transaction of any kind during 2020 i.e., within the past 6 months.
5. Client did not have more than 10,000 Cedis ($1,700) in their saving account.[6]

This left a sample of 36,000 clients meeting these criteria across 30 branches. Out of this group, 15,000 individuals were randomly selected for the study sample.

Clients were individually assigned to treatments using a stratified randomisation. The stratification is based on two variables: whether a client had a loan and whether the client was based in Accra. This was done as 99% of the loan clients were microfinance clients, who were poorer than other clients and more likely to be female, while Accra has better access to financial services in general.

4 Data

The main source of data for this study is the administrative records from our banking partner OISL. These are composed of three types of data sources: mobile banking transactions,

[5]OISL had begun registering all new clients automatically for mobile banking in 2018. Additionally, when clients went into the branch for any service, such as a loan, they were registered for mobile banking. Hence most new or active clients were registered with mobile banking. At the time of the study, 20% of 500,000 OISL clients were registered for mobile banking, of which approximately 5,000 (5%) were actively using it. We included this restriction so that clients wouldn't need to travel to the bank branch to initiate registration process for mobile banking, which would not have been ethical to encourage while social distancing measures were in place.

[6]This was the 99th percentile of saving balances and was done to exclude very wealthy clients, whose behaviour might differ from the average.

saving account balances, and loan records. Mobile banking transactions include all deposits and withdrawal transactions in a given month using the OISL Mobile Banking platform. Saving account balance refers to the end-of-month saving balance in all OISL-held accounts. Finally, loan records are the end-of-month loan status and include the outstanding amount, repayments, and details of any late payments for all loan clients. OISL also provided basic demographic data, including gender, age, and the associated branch's location. Administrative data were obtained for the month proceeding the randomisation (June 2020), for every month during the study (August - November 2020), and at five months after (April 2021). Administrative data is available for every client in the sample, and as such, there is no attrition in these measures.[7]

To complement this detailed and high frequency admin data, we carried out an endline IVR surveys where we asked 11 questions which clients could respond by using their phone keypad. These questions covered saving behaviour, bank visits, use and knowledge of Mobile Banking. Since these questions were asked as a part of the IVR survey, they are only available for the Mobile Banking IVR and Savings IVR groups, not for the control group.

Response rates for the IVR survey were low, as has previously been documented with this form of survey (Suri and Dorval, 2018), with only 15% of the sample answering at least one IVR question and responses dropping off extremely quickly, such that only 1% answered the 10th question. However, as shown in Appendix Table A5, attrition is balanced across the Mobile Banking IVR and Savings IVR arms for 10 of the questions and only significant at the 10% level for the first question. Looking at predictors of attrition (Table A6) using variables available in the administrative data, we see that women and older clients are less likely to answer and loan clients are more likely to answer most questions. Given the low R^2, we cannot explain most of what drives answering the IVR survey. Overall, while there is a strong selection on characteristics in terms of who answered the questions, there is no selection by treatment arms, so we can interpret any differences in answers to these questions

[7]It is possible though that clients switched bank account providers, and we would not be able to see any transactions with another bank

as due to the intervention.

We also have data from the IVR provider, detailing the date, time and length of listening to every IVR message. This rich data allows us to calculate accurate compliance figures for the Savings IVR and Mobile Banking IVR interventions based on how much of each message was listened to.

4.1 Outcome variables

We pre-specified our analysis plan with four primary upstream outcomes of mobile banking use at the extensive and intensive margins as well as knowledge, and four downstream outcomes of savings and loan behaviour. All monetary values were winsorised at the top 1%.

Our primary upstream outcomes are an indicator for having made any transactions with Mobile Banking, the sum of the value of all the transactions made using Mobile Banking and the number of Mobile Banking transactions made in a given month.[8]

Our primary downstream outcomes include each client's saving account balance with OISL in Cedis, an indicator for late loan repayment (among OISL loan clients only), an indicator for reporting having savings over 50 Cedis, and an indicator for visiting their bank's branch less than once per month. Out of these variables, the first two are part of OISL's administrative data and the last two were part of the endline IVR survey.

4.2 Baseline balance and summary statistics

Baseline balance on demographic and loan variables are shown in Table 1. Column 1 shows each variable's mean, and column 4 shows the p-value of the test that the coefficients for the Savings IVR and Mobile Banking IVR dummies are equal. The final row of the table has a p-value from the F-test of whether the variables jointly explain the Mobile Banking IVR or Savings IVR. The null hypothesis cannot be rejected in both cases, confirming that the

[8]We also pre-specified a measure of knowledge of mobile banking that was included in the IVR survey. However, only a few people (100) answered the knowledge questions, hence we do not focus on this outcome.

groups were balanced on observable characteristics.

This table also provides basic summary statistics. Half of our sample was female with a mean age of 40 years old, the average savings balance with the bank was about 300 Cedis ($50), though 50% of the sample had less than 11 Cedis ($1.83) saved. Nearly half of the clients come from the wider Accra area. Just under one-third of clients had a loan, with an average disbursement amount of 1760 Cedis ($300). Loan clients have lower savings than non-loan clients, with only 36 Cedis ($5.83) saved on average. Since the loan clients are all microfinance clients, this fits with the idea that credit clients are poorer than non-loan clients.

4.3 Compliance: Listening to the messages

IVR messages were sent to all clients as planned, however, to have any impact, the messages need to be listened to. Aided with rich data from our IVR partner, Viamo, we can observe whether the call was picked up and exactly how long the call was listened. Hence we know precisely which content of each message was listened to by the study participants.[9]

We defined compliance in our pre-analysis plan (PAP) as having listened to the "main pitch" of the IVR message. The main pitch covered the key points of the message. The main pitch was followed by detailed information about how to perform specific transactions using mobile banking (for the Mobile Banking IVR messages), followed by general safety information about COVID-19, and a concluding statement. In our PAP, we defined compliers as those who listened to the main pitch of at least 3 messages.

Message compliance was very high with nearly 90% of the Savings IVR and Mobile Banking IVR groups listening to at least one message. On average the Savings IVR group listening to 4.4 messages while the Mobile Banking IVR group listening to 3.7 messages (Table 2).[10] Using our definition of a complier as someone who listened to 3 main pitches,

[9]While it is possible people answered the call and then just let it run without listening to it, we consider this behaviour unlikely, particularly for multiple messages.

[10]Due to the way we designed the Mobile Banking IVR messages to always include the Savings IVR content

we see that 71% of the Savings IVR group complied and 61% of the Mobile Banking IVR group complied with their intervention. In terms of information interventions, this is a high rate of compliance with the intervention.(Berlinski et al., 2021; Van Campenhout et al., 2021; Bahety et al., 2021)

Table A2 shows the proportion of each treatment arm who listened to each week's message. Compliance was highest for the first message, with 61-67% listening. Compliance drops off after the first week, but soon stabilises at around 30-40% of clients listening to the message each week. The fact we do not see compliance dropping down to zero over time suggests that clients found the messages useful and continued picking up and listening to the calls.

Looking at predictors of compliance, treated clients are less likely to comply than Savings IVR (Table A3) by between 3 and 10 percentage points, likely due to the length of the messages. Most of the variables we have available in the baseline also predict compliance (Table A4): Women are less likely to listen to 3 or 5 messages, but no different for any or 7 messages. Older clients, loan clients, clients from Accra and those with a higher savings balance are much more likely to listen. The R-squared on all the regressions is extremely small, so the variables we have available are not able to explain why a client listened to certain number of messages.

5 Empirical Strategy

As stated in the pre-analysis plan, to estimate the effect of the IVR treatments, we estimated the following intention-to-treat (ITT) ANCOVA equation using a pooled regression for all

plus the additional mobile banking content, the Mobile Banking IVR messages were always longer than the Savings IVR messages, with the average duration of Savings and Mobile Banking IVR messages being 94 and 140 seconds, respectively. This is why compliance is mechanically lower for the Mobile Banking IVR messages, as people were less likely to listen to longer calls.

the primary outcome variables of interest constructed from the administrative data:

$$\begin{aligned} Y_{ist} =& \beta_1 \text{MB-IVR}_{is} + \beta_2 \text{Savings-IVR}_{is} \\ &+ \beta_0 Y_i^0 + \mu_s + X_{is} + \theta_t + \epsilon_{ist}, \end{aligned} \tag{1}$$

where Y_{ist} is the administrative outcome variable of interest for OISL client i, in strata s, in wave t. MB-IVR and Savings-IVR are the intervention dummies. β_1 and β_2 are the ITT effects of the Mobile Banking IVR and Savings IVR interventions, respectively. Y_i^0 is the value of the outcome measure at baseline, if available. μ_s is a vector of strata dummies, X_{is} are baseline controls, θ_t are wave dummies, and ϵ_{ist} are individually clustered standard errors.

For outcomes captured in the IVR endline survey, the following ITT specification is estimated:

$$Y_{is} = \gamma \text{MB-IVR}_{is} + \mu_s + X_{is} + \epsilon_{is}, \tag{2}$$

where Y_{is} is the survey outcome variables of interest for OISL client i, in strata s. γ_1 is the ITT effects of the Mobile Banking IVR intervention as compared to the Savings IVR.

For both of these specifications, we corrected for multiple hypotheses testing, by implementing Q-values which can adjust the false discovery rate, following Benjamini et al. (2006)'s method. We do this within the families of pre-defined upstream and downstream outcomes. We used post-double selection LASSO to select controls variables from a pre-specified list.

6 Results

6.1 Use of mobile banking

We begin by examining the impact of the Mobile Banking IVR and Savings IVR interventions on use of mobile banking services in Table 3.[11]

The Mobile Banking IVR intervention leads to a large increase in mobile banking use. In the control group, on average across the 4 months of the study, 2.4% of clients made a mobile banking transaction. In the Mobile Banking IVR group, this increases by 6.3 percentage points, to 8.7% of clients making a mobile banking transaction in a month. Likewise, the value of mobile banking transactions more than triples, from 11 Cedis in the control group to 40 Cedis in the Mobile Banking IVR group. The number of mobile banking transactions in a month almost doubles in the Mobile Banking IVR group compared to the control group, from 0.075 to 0.15. These results are highly significant at the 1% level, even when multiple hypothesis testing is taken into account.

In general, we do not see any impact of the Savings IVR messages on mobile banking use. However, the coefficients for all three outcome variables are negative, and one is significant at the 5% level, which does not survive the multiple testing correction. This suggests that encouragement to save had a negligible impact on reducing mobile banking transactions amongst those already carrying them out. We interpret the lack of impact of the Savings IVR intervention as suggesting that encouragement to save and repay loans is only effective if people have access to technology to enable them to do this.

An important question is whether this increase in the use of mobile banking is substituting for physical trips to the bank that would otherwise have been made or resulting in an increase in overall bank account transactions. We can provide some evidence to answer this. Appendix Table A9 show the extensive margin for whether any transaction occurred in the bank account in a given month, from either mobile banking or physical transactions.[12] We

[11] Results without controls are shown in Appendix Table A7

[12] We do not have access to the universe of transactions for the bank accounts, only for the mobile banking

see that Mobile Banking IVR has no impact on the likelihood that any transaction took place on the bank account in the last month, suggesting that mobile banking transactions are being carried out by clients who would otherwise have physically travelled to the bank to do a transaction. These clients are likely to benefit most from use of mobile banking, since they were previously paying high average travel costs to go to the bank (see Section 7).

Appendix Tables A10-A12 show the components of each mobile banking measure by transaction type. Table A10 shows the extensive margin use of mobile banking. Withdrawals are the largest component, explaining 5 percentage points of the 6.3 percentage point increase in mobile banking, on a mean of 2.2% making a withdrawal transaction in the control. However deposits also increase by 1.7 percentage points, which is a large increase compared to the mean of only 0.2% in the control group. Table A11 shows that the value of both deposits and withdrawals almost exactly cancel each other out, such that net deposits using mobile banking are small and insignificant. This suggests that we will not see any impacts on saving, at least coming directly through net mobile banking transactions. Since deposits are less common, the average value of deposit transactions must be larger than withdrawals. The number of transactions in Table A12 shows similarly that withdrawals drive the increase in the number of transactions for treated clients.[13]

6.2 Financial behaviours

Table 4 shows the impact of assignment to the Savings IVR or Mobile Banking IVR messages on savings, loans and bank visits.[14] Starting with the administrative data outcomes, we do not see any impact of either the Savings IVR or Mobile Banking IVR interventions on savings with the partner bank. This consists with the no-net increase the total value of deposits using mobile banking.

platform, and hence we cannot look at the total number of transactions, only whether transactions took place or not.

[13]In Appendix Table A17, we also see that self-reported use, knowledge of and satisfaction with mobile banking is higher in the Mobile Banking IVR group as compared to the Savings IVR, though only 100 people answered these questions

[14]Results excluding controls are shown in Appendix Table A8

However, we do see a large reduction in missed loan repayments amongst the micro-credit clients with loans before the study began. During the COVID-19 pandemic, late loan repayments increased substantially, from less than 10% to 30%. Those clients who received encouragement to use mobile banking are 2.4 percentage points less likely to have a late loan repayment, a 8% reduction, significant at the 5% level with conventional p-values but insignificant after a multiple test correction.[15] We anecdotally learned from the banking partner that this is because loan clients did not want to or were unable to attend group meetings (or travel to the bank) regularly during the COVID-19 outbreak, where they normally make their loan repayments. Mobile banking enabled clients to still make their repayments without needing to attend a meeting or travel to the bank. This has important implications for the microfinance industry, which has struggled during the COVID-19 crisis (Malik et al., 2020).

Looking at the IVR outcomes in Table 4, which are only available for 10% of the sample and only for the Savings IVR and Mobile Banking IVR groups, we can see that compared to those who received Savings IVR messages, Mobile Banking IVR resulted in clients being 6.3 percentage points more likely to save a larger amount overall,[16] and are 6.7 percentage points less likely to visit a bank in the last month, a 11% decline on the mean of 59% visiting the bank each month. While significant at the 5% levels, these findings do not survive the multiple test correction. The reduction in bank trips, combined with the result above that treated clients are no more likely to do transaction in a month than control clients, suggests that use of mobile banking substituted physical trips to the bank amongst those who would otherwise have travelled to the bank, reducing total number of trips. This not only would have saved clients money (see section 7) but was beneficial given the pandemic.

Local average treatment effect estimates are shown in Tables A13-A16,[17] using the primary and alternative compliance definitions. As expected the LATE estimates are similar

[15]This result is consistent with the lack of impact on savings, since the saving balance was only captured at month's end, after any loan repayments had been made.

[16]We see in Appendix Table A19 that treated clients are also more likely to report saving every month.

[17]Control clients could not be treated, so we have no "always compliers."

but larger than the ITT estimates, with the size of all coefficients increasing the more treatment messages were listened to, suggesting listening to more messages led to larger treatment effects.

6.3 Treatment effects over time

We use our rich admin data during and after the intervention to examine the impact of the treatments on mobile money use over time. Results for the interaction of each treatment with month fixed effects are shown in Table A20. Looking at the impact of the Mobile Banking IVR intervention, we see that while the Mobile Banking IVR increased the use of mobile banking immediately by 1.1 percentage points, impacts continue to grow significantly during the intervention (columns (1)-(3)). A similar pattern of increasing use over time is seen for the sum of the value of mobile banking transactions (column (2)) and the number of mobile banking transactions (column (3)). These findings suggest that the Mobile Banking IVR intervention had a increasing effect over time on mobile banking use, suggesting clients had to listen to sufficient messages before using the service.

The Mobile Banking IVR intervention did not impact savings at any point during or after the intervention (column (4)). The impact on reducing late loan repayments appears in August and is not statistically different for subsequent months (column (5)). The Savings IVR intervention may have caused some initial reduction in mobile banking use of 0.6 percentage points, that disappeared by November 2020.

6.4 Persistence of impacts

Using data from our bank partner from April 2021, we examine whether the increase in the use of mobile banking services persists beyond the intervention period. In Appendix Table A21 we see that Mobile Banking IVR impacts persist 5 months after the intervention ended, though declining in size. The Mobile Banking IVR group remains 50% more likely than the control group to use mobile banking services, with 4.2% of the Mobile Banking IVR group

making a digital transaction during April 2021, compared to only 2.8% of the control group. This reinforces the idea that this product is beneficial to banking clients, such that they continue to use it.

6.5 Heterogeneity

Heterogeneous treatment effects are shown in Appendix Tables A22-A26 by whether the client was female, a median split of age (<39 years), being from Accra, having savings or a loan at baseline.

Men, clients younger than 39 and those with savings are more likely to use mobile banking in the control group. Treatment effects on use of mobile banking for the Mobile Banking IVR intervention are significantly larger for older clients, those with some savings at baseline and non-loan clients, though there are still significant impacts for younger clients, those with no savings and loan clients. This could be related to the fact that older clients were much more likely to listen to the messages (see Appendix Table A4). There is a significant positive impact of Mobile Banking IVR on savings of 35 Cedis, 10% of the control mean, for those younger than the median age or from Accra. There is no heterogeneity by gender. The Savings IVR intervention seems to have had a small discouragement effect on mobile banking use amongst younger men without loans. Overall, impacts of the intervention do not seem to be concentrated only in particular subgroups, but more generalised across the study population.

We also examine heterogeneity in the number of messages listened to get an indication of how many messages needed to be listened to to generate treatment effects, noting that this was not randomised. Figure A2 and Table A27 interact the number of messages listened to with treatment. This suggests that listened to just one message had a treatment effect, increasing mobile banking use by 4.4 percentage points, with effects increases until around 5 messages, after which they plateau at around 10 percentage points increased use of mobile banking.

7 Conclusion and Discussion

We design and evaluate a mobile-phone-based high-frequency information campaign that promotes use of mobile banking technology. Our study demonstrates meaningful technology adoption through large-scale IVR-based information campaigns. We estimate sizeable impacts of the Mobile Banking IVR intervention on mobile banking usages as well as positive impacts on financial behaviour more generally and particularly on loan repayment.

Our intervention is also highly cost-effective. The monthly costs of sending the IVR and SMS messages to the Mobile Banking IVR group was $1,400 or $0.28 a month per client.[18] We estimate benefit to the clients using the cost of travelling to the bank, on the assumption that use of mobile banking replaces physical trips.[19] The average cost of travelling to the bank was 24 Cedis for a round trip.[20] From Table 3 column 3, we see that Mobile Banking IVR clients make 0.08 more digital transactions on average, at a cost of 1 Cedi ($0.16) a transaction. We therefore estimate the monthly benefit of using digital transaction to the Mobile Banking IVR group as $1,485. This gives a cost benefit ratio of 1.15 for clients, on average, during the intervention. After the intervention finished, we see a persistent 0.019 more transactions a month in the Mobile Banking IVR group, at a total value to clients of $350 a month. Therefore, the total cost benefit ratio over the 8 month period during and after the intervention is 1.49.

Our findings highlight two important policy lessons. First, information campaigns such as ours might be particularly effective for new technologies which people are unaware of, especially in the case of relatively simple technologies where practical information can be captured in a short message and utilised for at-scale uptake. Secondly, digital financial technologies can benefit consumers by substituting the high-transaction cost of physically

[18] This excluded fixed costs of setting up the IVR platform

[19] This assumption might not be true if clients use mobile banking to carryout more transactions than they did previously.

[20] Captured from focus groups with microfinance clients, who make 1/3 of the sample. Note that the cost of travel for microfinance clients may be different to the average cost for all clients, but we are unable to know whether this cost is likely higher or lower.

accessing banking services, particularly in areas with low-density coverage and transportation challenges. Hence digital financial technology integrated with existing banking product can enable greater use of traditional banking service.

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Table 1: Balance on Demographic and Loan Variables

	(1) Control Mean	(2) Savings IVR (S)	(3) Mobile Banking IVR (MB)	(4) p-value S=MB	(5) N
Panel A: Individual Characteristics					
Female	0.55	0.00	-0.00	0.63	15000
		(0.01)	(0.01)		
Age	39.93	0.22	0.22	0.98	15000
		(0.22)	(0.22)		
Savings Account Balance	295.96	-16.82	-25.02	0.67	15000
		(18.96)	(18.96)		
Branch in Accra†	0.34	-0.02**	-0.01*	0.78	15000
		(0.01)	(0.01)		
Branch in Ashanti Region†	0.29	-0.00	0.00	0.98	15000
		(0.01)	(0.01)		
Branch in Brong Region†	0.15	0.01	0.01	0.93	15000
		(0.01)	(0.01)		
Branch in Central Region†	0.08	0.00	0.00	0.54	15000
		(0.01)	(0.01)		
Branch in Eastern Region†	0.03	0.00	-0.00	0.24	15000
		(0.00)	(0.00)		
Branch in Western Region†	0.10	0.00	0.01	0.36	15000
		(0.01)	(0.01)		
Has a Loan†	0.29	0.00	0.00	1.00	15000
		(0.01)	(0.01)		
Panel B: Loan Variables					
Amount Disbursed	1757.94	-4.17	46.89	0.44	4385
		(44.44)	(44.44)		
Days in Arrears	16.23	1.06	0.34	0.87	4385
		(2.05)	(2.05)		
Loan Account Balance	35.83	-0.38	2.17	0.87	4385.00
		(5.13)	(5.13)		
Loan Cycle	1.80	-0.03	0.10	0.47	4385
		(0.11)	(0.11)		
F-test P-value		0.98	0.88		

Notes: Standard errors in parentheses. Each row is a separate regression. All regressions include strata dummy variables except the ones marked with †. Column 4 shows the p-value of the test that the placebo and treatment dummy coefficients are equal. The F-test p-value tests whether the coefficients jointly explain the treatment, for each of the placebo and treatment arms. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Proportion that listening to the main pitch of at least that many messages

	(1) Pure Control	(2) Savings IVR	(3) MB IVR
Number of calls in which listened to main pitch	0.00	4.38	3.71
	(0.000)	(2.822)	(2.752)
Listened to main pitch of at least 1 call	0.00	0.90	0.87
	(0.000)	(0.304)	(0.339)
Listened to main pitch of at least 2 calls	0.00	0.82	0.75
	(0.000)	(0.388)	(0.436)
Listened to main pitch of at least 3 calls	0.00	0.71	0.61
	(0.000)	(0.455)	(0.488)
Listened to main pitch of at least 4 calls	0.00	0.59	0.48
	(0.000)	(0.492)	(0.499)
Listened to main pitch of at least 5 calls	0.00	0.46	0.36
	(0.000)	(0.499)	(0.481)
Listened to main pitch of at least 6 calls	0.00	0.36	0.26
	(0.000)	(0.480)	(0.441)
Listened to main pitch of at least 7 calls	0.00	0.26	0.18
	(0.000)	(0.438)	(0.383)
Listened to main pitch of at least 8 calls	0.00	0.16	0.12
	(0.000)	(0.367)	(0.321)
Listened to main pitch of at least 9 calls	0.00	0.09	0.07
	(0.000)	(0.287)	(0.247)
Listened to main pitch of all 10 calls	0.00	0.04	0.03
	(0.000)	(0.187)	(0.164)
Average message length (s)	0.00	94.30	140.84

Table presents means, and standard deviations in parentheses.

Table 3: Effect of Treatment on mobile banking use

	(1) Any MoB	(2) Sum MoB	(3) No. MoB
Savings IVR	-0.004	-2.940	-0.027
	(0.002)	(2.948)	(0.012)
	[0.108]	[0.322]	[0.031]**
	{0.296}	{0.585}	{0.169}
MB IVR	0.063	29.52	0.079
	(0.004)	(3.722)	(0.017)
	[0.000]***	[0.000]***	[0.000]***
	{0.000}***	{0.000}***	{0.000}***
Observations	60000	60000	60000
Control Mean	0.024	11.345	0.075
Outcome at Baseline	No	No	No
p-Value Savings = MB	0.000	0.000	0.000

All regressions control for strata fixed effects, wave fixed effects and the following controls: age, age squared, gender, saving balance and saving balance squared. Any MoB is a dummy variable equal to one if any mobile banking transaction was carried out during the month. Sum MoB is the sum of the value of mobile banking transactions in a month, in Ghanian cedis. No. MoB is the number of mobile banking transactions carried out in a month. Control mean is the mean for the outcome variable in the control group in August. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.

Table 4: Effect of Treatment on financial behaviour

	(1) Savings Balance	(2) Late Loan Payment	(3) Saves Over 50 Cedis	(4) Visits Bank < Monthly
Savings IVR	4.106	-0.015		
	(11.478)	(0.012)		
	[0.721]	[0.199]		
	{1.000}	{0.597}		
MB IVR	18.368	-0.024	0.063	0.067
	(11.488)	(0.012)	(0.032)	(0.029)
	[0.110]	[0.036]**	[0.048]**	[0.023]**
	{0.229}	{0.134}	{0.134}	{0.134}
Observations	60000	17540	872	1133
Omitted Category Mean	285.447	0.295	0.642	0.590
Outcome at Baseline	Yes	Yes	No	No
p-Value Savings = MB	0.218	0.443	-	-
Wave FE	Yes	Yes	No	No

All regressions control for strata fixed effects and the following controls: age, age squared, gender, saving balance and saving balance squared. Savings balance is the end of month balance in GHS in the partner bank account only. Late loan payment is a dummy variable if the client has missed the a loan repayment deadline. It is missing for non-loan clients. Saves over 50 cedis is a dummy variable if the client reported more than 50 cedis in savings across all saving forms. Visit bank < monthly is a dummy variable if the client reported not going to the bank in the last month. Columns (1) and (2) use administrative data and columns (3) and (4) use the IVR survey data. Omitted Category mean is the mean for the outcome variable in the control group (columns (1)-(3)) in August or placebo group at endline (columns (4) and (5)). Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.

A Additional Tables and Figures

Table A1: IVR Messages Content

Week	**Savings IVR (Placebo)**	**Mobile Banking IVR (Treatment)**
One 13th August	COVID-19 health reminder	COVID-19 health reminder Mobile banking introduction
Two 19th August	Saving to repay loans	Making deposits with Mobile Money to repay loans
Three 26th August	Inspiring Bible verse	Inspiring Bible verse Making withdrawals with Mobile Banking
Four 2nd September	Saving to prevent unnecessary spending	Transferring money to another bank account using Mobile Banking Saving to prevent unnecessary spending
Five 16th September	Regularly saving each week	Mobile Banking client testimonials Regularly saving
Six 7th October	Keeping track of money	Keeping track of money with Mobile Banking
Seven 14th October	Financial goals	Checking balance using Mobile Banking to meet financial goals
Eight 23 October	Saving for business	Saving for business using Mobile Banking
Nine 28th October	Saving for emergencies	Saving for emergencies using Mobile Banking
Ten 4th November	Tips to increase savings	Doing artime top-ups using Mobile Banking Tips to increase savings

Notes: Control group did not receive any IVR messages during these 10 weeks. Only one message was received during a one-month period in September. This was because we designed and recorded the messages in two batches of five, and there were some delays from the voice recording company in recording and finalising the second batch of messages. We moved message five back a week to avoid a month long gap between the batches.

Figure A1: OISL Ghana branch locations

Table A2: Proportion that Completed Each Week's Main Message

	(1) Pure Control	(2) Savings IVR	(3) MB IVR
Main Pitch week 1	0.00	0.67	0.61
	(0.000)	(0.469)	(0.489)
Main Pitch week 2	0.00	0.45	0.33
	(0.000)	(0.497)	(0.471)
Main Pitch week 3	0.00	0.51	0.43
	(0.000)	(0.500)	(0.495)
Main Pitch week 4	0.00	0.47	0.37
	(0.000)	(0.499)	(0.483)
Main Pitch week 5	0.00	0.32	0.33
	(0.000)	(0.465)	(0.470)
Main Pitch week 6	0.00	0.40	0.34
	(0.000)	(0.491)	(0.475)
Main Pitch week 7	0.00	0.40	0.34
	(0.000)	(0.491)	(0.474)
Main Pitch week 8	0.00	0.42	0.33
	(0.000)	(0.493)	(0.470)
Main Pitch week 9	0.00	0.38	0.33
	(0.000)	(0.486)	(0.470)
Main Pitch week 10	0.00	0.35	0.30
	(0.000)	(0.478)	(0.459)

Table presents means, with standard deviations in parentheses.

Table A3: Treatment prediction of compliance by definition

	(1) 3 Messages	(2) Any Messages	(3) 5 Messages	(4) 7 Messages
MB IVR	-0.101***	-0.029***	-0.101***	-0.080***
	(0.009)	(0.006)	(0.010)	(0.008)
Observations	10000	10000	10000	10000
F statistic	60.551	13.378	64.827	49.495
p-value	0.000	0.000	0.000	0.000
Mean Compliance (Savings IVR)	0.708	0.897	0.464	0.259

Notes: Compliance defined as number of message main pitches listened to. Regression controls for strata fixed effects.

Table A4: Baseline predictors of compliance by definition

	(1) 3 Messages	(2) Any Messages	(3) 5 Messages	(4) 7 Messages
Female	0.023**	-0.004	0.029***	0.013
	(0.010)	(0.006)	(0.010)	(0.008)
Age/ 100	0.789***	0.279***	0.892***	0.701***
	(0.059)	(0.044)	(0.059)	(0.049)
Age^2/ 10,000	-0.284***	-0.167***	-0.283***	-0.209***
	(0.029)	(0.024)	(0.024)	(0.016)
Loan Client	0.083***	0.031***	0.100***	0.072***
	(0.010)	(0.007)	(0.011)	(0.010)
Lives in Accra	0.023**	0.020***	0.042***	0.016*
	(0.010)	(0.007)	(0.011)	(0.009)
Savings at Baseline	0.000***	0.000***	0.000***	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	10000	10000	10000	10000
R^2	0.029	0.008	0.037	0.031
F statistic	39.369	13.466	52.021	41.201
p-value	0.000	0.000	0.000	0.000
Mean Compliance	0.658	0.882	0.413	0.218

Notes: Compliance defined as number of message main pitches listened to. All variables included in the regression simultaneously

Table A5: Attrition by question, IVR survey

	(1) Q1	(2) Q2	(3) Q3	(4) Q4	(5) Q5	(6) Q6	(7) Q7	(8) Q8	(9) Q9	(10) Q10	(11) Q11
Mobile Banking IVR	0.012*	-0.000	0.010	0.008	-0.002	0.001	0.000	0.002	0.003	0.003	0.002
	(0.007)	(0.006)	(0.006)	(0.006)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
F statistic	2.481	1.498	2.246	2.870	2.449	1.571	1.222	2.000	1.809	1.872	1.701
p-value	0.042	0.200	0.062	0.022	0.044	0.179	0.299	0.092	0.124	0.112	0.147
Mean Attrition (Savings IVR)	0.845	0.887	0.887	0.909	0.968	0.979	0.989	0.986	0.987	0.987	0.988

Outcome variable is a dummy variable for whether each question was not answered by the client. Regression controls for strata fixed effects.

Table A6: Attrition by question, IVR survey

	(1) Q1	(2) Q2	(3) Q3	(4) Q4	(5) Q5	(6) Q6	(7) Q7	(8) Q8	(9) Q9	(10) Q10	(11) Q11
Female	0.043***	0.043***	0.042***	0.025***	0.012***	0.006**	0.002	0.005**	0.005**	0.005**	0.005**
	(0.007)	(0.006)	(0.006)	(0.005)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Loan Client	-0.028***	-0.026***	-0.027***	-0.014**	-0.009**	-0.005	-0.004	-0.004	-0.003	-0.003	-0.003
	(0.008)	(0.007)	(0.007)	(0.006)	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Lives in Accra	0.001	0.000	-0.002	0.011*	0.008**	0.006*	0.005**	0.002	0.002	0.002	0.001
	(0.008)	(0.007)	(0.007)	(0.006)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age/ 100	0.095*	0.165***	0.144***	0.112***	0.038	0.053**	0.038**	0.039**	0.040**	0.039**	0.041**
	(0.054)	(0.047)	(0.047)	(0.041)	(0.027)	(0.022)	(0.016)	(0.017)	(0.017)	(0.016)	(0.016)
Age^2/ 10,000	-0.008	-0.036	-0.028	-0.024	-0.007	-0.015	-0.012	-0.011	-0.010	-0.010	-0.011
	(0.042)	(0.036)	(0.036)	(0.032)	(0.021)	(0.017)	(0.012)	(0.013)	(0.013)	(0.013)	(0.012)
Savings at Baseline	-0.000	-0.000***	-0.000*	0.000	-0.000	0.000	-0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
R^2	0.0053	0.0090	0.0074	0.0042	0.0024	0.0019	0.0015	0.0017	0.0017	0.0016	0.0017
F statistic	6.695	11.365	9.264	5.215	2.980	2.319	1.930	2.185	2.076	1.995	2.134
p-value	0.000	0.000	0.000	0.000	0.002	0.018	0.051	0.026	0.035	0.043	0.029
Mean Attrition	0.851	0.893	0.892	0.920	0.967	0.980	0.989	0.987	0.988	0.989	0.989

Outcome variable is a dummy variable for whether each question was not answered by the client. All explanatory variables included in the regression simultaneously.

Table A7: Effect of Treatment on mobile banking use - no controls

	(1) Any MoB	(2) Sum MoB	(3) No. MoB
Savings IVR	-0.005	-3.599	-0.032
	(0.002)	(2.974)	(0.013)
	[0.041]**	[0.226]	[0.012]**
	{0.113}	{0.415}	{0.065}*
MB IVR	0.062	28.995	0.074
	(0.004)	(3.741)	(0.017)
	[0.000]***	[0.000]***	[0.000]***
	{0.000}***	{0.000}***	{0.000}***
Observations	60000	60000	60000
Control Mean	0.029	16.410	0.109
p-Value MB = Savings IVR	0.000	0.000	0.000
Controls	No	No	No

All regressions control for strata fixed effects and wave fixed effects. Any MoB is a dummy variable equal to one if any mobile banking transaction was carried out during the month. Sum MoB is the sum of the value of mobile banking transactions in a month, in Ghanian cedis. No. MoB is the number of mobile banking transactions carried out in a month. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A8: Effect of Treatment on financial behaviour - no controls

	(1) Savings Balance	(2) Late Loan Payment	(3) Saves Over 50 Cedis	(4) Visits Less than Monthly
Savings IVR	2.985	-0.015		
	(11.573)	(0.012)		
	[0.796]	[0.211]		
	{1.000}	{0.632}		
MB IVR	17.920	-0.025	0.063	0.059
	(11.490)	(0.012)	(0.034)	(0.030)
	[0.119]	[0.030]**	[0.061]*	[0.051]*
	{0.248}	{0.169}	{0.169}	{0.169}
Observations	60000	17540	872	1133
Omitted Category Mean	316.234	0.253	0.642	0.590
Outcome at Baseline	No	No	-	-
p-Value MB = Savings IVR	0.218	0.443	-	-
Wave FE	Yes	Yes	-	-
Controls	No	No	No	No

All regressions control for strata fixed effects and wave fixed effects. Savings balance is the end of month balance in GHS in the partner bank account only. Late loan payment is a dummy variable if the client has missed the a loan repayment deadline. It is missing for non-loan clients. Saves over 50 cedis is a dummy variable if the client reported more than 50 cedis in savings across all saving forms. Visit bank < monthly is a dummy variable if the client reported not going to the bank in the last month. Columns (1) and (2) use administrative data and columns (3) and (4) use the IVR survey data. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A9: Effect of Treatment on any bank transaction in a month

	(1) Any bank transaction
Savings IVR	0.003
	(0.006)
MB IVR	-0.002
	(0.006)
Observations	60000
Control Mean	0.669
p-Value Treatment = Placebo	0.442
Outcome at Baseline	Yes
Strata FE	Yes
Wave FE	Yes

All regressions control for strata fixed effects and the following controls: age, age squared, gender, saving balance and saving balance squared. Any bank transaction is a dummy for whether any transaction (physical or mobile) took place in the bank account that month. This outcome was not pre-specified. By construction, all accounts had a transaction occur in the 6 months prior to baseline. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.

Table A10: Any use of mobile banking by type of transaction

	(1) Any MoB	(2) Any Deposit	(3) Any Withdrawal	(4) Any Transfer	(5) Any Airtime
Savings IVR	-0.004	-0.000	-0.004	-0.000	-0.002
	(0.002)	(0.001)	(0.002)	(0.000)	(0.002)
MB IVR	0.063***	0.017***	0.050***	0.001**	0.014***
	(0.004)	(0.002)	(0.003)	(0.000)	(0.002)
Observations	60000	60000	60000	60000	60000
Control Mean	0.024	0.002	0.022	0.001	0.011
p-Value S = MB	0.000	0.000	0.000	0.006	0.000

All regressions control for strata fixed effects, wave fixed effects and the following controls: age, age squared, gender, saving balance and saving balance squared. Any MoB is a dummy variable equal to one if any deposit or withdrawal mobile banking transaction was carried out during the month. Any deposit is a dummy variable equal to one if any deposit transaction was carried out during the month, from the mobile money account to the bank account. Any withdrawal is a dummy variable equal to one if any withdrawal transaction was carried out during the month, from the bank account to the mobile money account. Any transfer is a dummy variable equal to one if any transfer transaction was carried out during the month, where a transfer is from one OISL bank account to another. Any airtime is a dummy variable equal to one if any airtime transaction was carried out during the month, which means the mobile banking platform was used to directly purchase airtime credit to make calls. Control mean is the mean for the outcome variable in the control group for female clients in August. Standard errors in parenthesis *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.

Table A11: Sum of value of mobille banking transactions by type of transaction

	(1) Sum MoB	(2) Sum Deposit	(3) Sum Withdrawal	(4) Sum Transfer	(5) Sum Airtime	(6) Net MoB
Savings IVR	-2.940	-0.038	-2.902	-0.147	-0.094**	2.864
	(2.948)	(1.961)	(2.002)	(0.272)	(0.039)	(2.649)
MB IVR	29.519***	13.803***	15.716***	0.300	0.095*	-1.913
	(3.722)	(2.404)	(2.559)	(0.292)	(0.052)	(3.287)
Observations	60000	60000	60000	60000	60000	60000
Control Means	11.345	1.944	9.402	0.282	0.185	-7.458
p-Value S = MB	0.000	0.000	0.000	0.084	0.000	0.164

All regressions control for strata fixed effects, wave fixed effects and the following controls: age, age squared, gender, saving balance and saving balance squared. Sum MoB is the sum of the value of deposit and withdrawal mobile banking transactions in a month, in Ghanian cedis. Sum Deposit is the sum of the value of deposit mobile banking transactions in a month, in Ghanian cedis. Sum Withdrawal is the sum of the value of withdrawal mobile banking transactions in a month, in Ghanian cedis. Sum Transfer is the sum of the value of transfer mobile banking transactions in a month, in Ghanian cedis. Sum airtime is the sum of the value of airtime mobile banking transactions in a month, in Ghanian cedis. Net MoB is the value of deposits minus withdrawals using mobile banking. Control mean is the mean for the outcome variable in the control group in August. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.

Table A12: Number of mobile banking transactions by transaction type

	(1) No. MoB	(2) No. Deposit	(3) No. Withdrawal	(4) No. Transfer	(5) No. Airtime
Savings IVR	-0.027**	0.000	-0.027**	-0.001	-0.012*
	(0.012)	(0.002)	(0.012)	(0.001)	(0.007)
MB IVR	0.079***	0.020***	0.059***	0.000	0.020*
	(0.017)	(0.003)	(0.016)	(0.001)	(0.012)
Observations	60000	60000	60000	60000	60000
Control Mean	0.075	0.002	0.073	0.001	0.036
p-Value S = MB	0.000	0.000	0.000	0.091	0.003

All regressions control for strata fixed effects, wave fixed effects and the following controls: age, age squared, gender, saving balance and saving balance squared. No. MoB is the number of deposit or withdrawal mobile banking transactions carried out in a month. No. Deposit is the number of deposit mobile banking transactions carried out in a month. No. Withdrawal is the number of withdrawal mobile banking transactions carried out in a month. No. Transfer is the number of transfer mobile banking transactions carried out in a month. No. Airtime is the number of airtime mobile banking transactions carried out in a month. Control mean is the mean for the outcome variable in the control group in August. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.

Table A13: LATE estimates: primary administrative outcomes - listened to 3 messages

	(1) Any MoB	(2) Sum MoB	(3) No. MoB	(4) Savings (GHS)	(5) Late Repayment
Listened Savings IVR	-0.005	-4.158	-0.038**	5.793	-0.020
	(0.003)	(4.162)	(0.017)	(16.203)	(0.015)
Listened MB IVR	0.104***	48.610***	0.129***	30.246	-0.035**
	(0.006)	(6.124)	(0.028)	(18.914)	(0.017)
Observations	60000	60000	60000	60000	17540
Omitted Category Mean	0.029	16.410	0.109	316.234	0.253
Placebo = Treatment	0.000	0.000	0.000	0.171	0.334
Outcome at Baseline	No	No	No	Yes	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes

Notes: All regressions include strata and wave fixed effects. Compliance definition is listened to the main pitch of 3 or more messages, which 71% of the placebo arm and 61% of the treated arm met. Compliance is instrumented with assignment to treatment. Standard errors in parenthesis *** p < 0.01, ** p < 0.05, ** p < 0.1.

Table A14: LATE estimates: primary administrative outcomes, listened to any message

	(1) Any MoB	(2) Sum MoB	(3) No. MoB	(4) Savings (GHS)	(5) Late Repayment
Listened Savings IVR	-0.006**	-4.012	-0.036**	3.325	-0.016
	(0.003)	(3.315)	(0.014)	(12.899)	(0.013)
Listened MB IVR	0.072***	33.420***	0.086***	20.652	-0.028**
	(0.004)	(4.305)	(0.019)	(13.239)	(0.013)
Observations	60000	60000	60000	60000	17540
Placebo = Treatment	0.000	0.000	0.000	0.189	0.354
Outcome at Baseline	No	No	No	No	No
Strata FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes

Notes: All regressions include strata and wave fixed effects. Compliance definition is listened to the main pitch of any message, which 90% of the Savings IVR arm and 87% of the treated arm met. Compliance is instrumented with assignment to treatment. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** p < 0.01, ** p < 0.05, ** p < 0.1.

Table A15: LATE estimates: primary administrative outcomes, listened to 5 messages

	(1) Any MoB	(2) Sum MoB	(3) No. MoB	(4) Savings (GHS)	(5) Late Repayment
Listened Savings IVR	-0.011**	-7.763	-0.069**	6.427	-0.027
	(0.005)	(6.416)	(0.027)	(24.945)	(0.022)
Listened MB IVR	0.172***	80.010***	0.205***	49.431	-0.056**
	(0.010)	(10.375)	(0.047)	(31.689)	(0.025)
Observations	60000	60000	60000	60000	17540
Placebo = Treatment	0.000	0.000	0.000	0.140	0.227
Outcome at Baseline	No	No	No	No	No
Strata FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes

Notes: All regressions include strata and wave fixed effects. Compliance definition is listened to the main pitch of 5 of more messages, which 46% of the Savings IVR arm and 36% of the treated arm met. Compliance is instrumented with assignment to treatment. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.

Table A16: LATE estimates: primary administrative outcomes, listened to 7 messages

	(1) Any MoB	(2) Sum MoB	(3) No. MoB	(4) Savings (GHS)	(5) Late Repayment
Listened Savings IVR	-0.019**	-13.916	-0.123**	11.549	-0.045
	(0.009)	(11.503)	(0.049)	(44.725)	(0.036)
Listened MB IVR	0.350***	162.533***	0.416***	100.462	-0.106**
	(0.022)	(21.402)	(0.095)	(64.426)	(0.049)
Observations	60000	60000	60000	60000	17540
Placebo = Treatment	0.000	0.000	0.000	0.123	0.158
Outcome at Baseline	No	No	No	No	No
Strata FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes

Notes: All regressions include strata and wave fixed effects. Compliance definition is listened to the main pitch of 7 or more messages, which 26% of the Savings IVR arm and 18% of the treated arm met. Compliance is instrumented with assignment to treatment. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.

Table A17: IVR survey: Knowledge and use secondary outcomes

	(1) Knowledge of MoB Index	(2) Used MoB	(3) Knows of MoB	(4) Satisfied with MoB
MB IVR	0.073	0.121**	0.108*	0.171*
	(0.195)	(0.058)	(0.063)	(0.094)
Observations	110	294	204	112
Placebo Mean	0.174	0.405	0.625	0.452

All regressions control for strata fixed effects and the following controls: age, age squared, gender, saving balance and saving balance squared. Knowledge of Mob index is a standardised index of the correct answer to IVR endline questions 7-10. Used MoB is a dummy variable for self reported use of mobile banking (Q6). Knows of MoB is a dummy variable if the respondent has heard of mobile banking (Q6). Satisfied with MoB is answered satisfied (Q11). Omitted Category mean is the mean for the outcome variable in the placebo group at endline. Standard errors in parenthesis. *** p < 0.01, ** p < 0.05, ** p < 0.1.

Table A18: IVR survey: saving secondary outcomes

	(1) 0-50 cedis	(2) 50-100 cedis	(3) 100-500 cedis	(4) 500-1,000 cedis	(5) Over 1,000 cedis	(6) Over 50 cedis
MB IVR	-0.063**	0.004	0.042	0.009	0.008	0.063**
	(0.032)	(0.028)	(0.026)	(0.024)	(0.023)	(0.032)
Observations	872	872	872	872	872	872
Placebo Mean	0.358	0.197	0.162	0.140	0.144	0.642
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes

All regressions control for strata fixed effects and the following controls: age, age squared, gender, saving balance and saving balance squared. Dummy variables for selecting each category of total saving balance (Q4). Omitted Category mean is the mean for the outcome variable in the placebo group at endline. Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A19: IVR survey: Banking secondary outcomes

	(1) Saves w/Opportunity	(2) Saves Monthly	(3) Visits < Monthly	(4) Visits < Last Year
MB IVR	0.039	0.061**	0.067**	0.085
	(0.025)	(0.030)	(0.029)	(0.056)
Observations	1486	1081	1133	327
Placebo Mean	0.550	0.400	0.590	0.543
Strata FE	Yes	Yes	Yes	Yes

All regressions control for strata fixed effects and the following controls: age, age squared, gender, saving balance and saving balance squared. Saves with opportunity is a dummy variable if the respondent does most of their saving with Opportunity (Q1). Saves monthly is a dummy variable if the respondent reports saving every month (Q3). Visits < monthly is a dummy variable if the respondent visits the bank less often than month (Q2). Visits < last year is a dummy variable if the respondent visits the bank less frequently than at the same time last year (Q5). Omitted Category mean is the mean for the outcome variable in the placebo group at endline. Standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.

Table A20: Effect of Treatment on mobile banking use over time

	(1) Any MoB	(2) Sum MoB	(3) No. MoB	(4) Savings balance	(5) Late Loan Payment
Savings IVR	-0.006**	-2.126	-0.029***	2.805	-0.009
	(0.003)	(3.387)	(0.011)	(10.811)	(0.013)
Savings IVR					
× September	0.000	0.262	0.000	8.377	-0.010
	(0.003)	(5.516)	(0.013)	(10.980)	(0.012)
× October	0.000	-0.115	0.002	-6.986	-0.011
	(0.003)	(4.222)	(0.015)	(13.777)	(0.015)
× November	0.008**	-3.402	0.005	3.815	-0.003
	(0.004)	(5.606)	(0.017)	(16.500)	(0.018)
MB IVR	0.011***	6.776*	0.015	13.239	-0.026**
	(0.003)	(3.800)	(0.015)	(10.992)	(0.012)
MB IVR					
× September	0.038***	19.641***	0.047***	9.159	-0.006
	(0.004)	(6.121)	(0.015)	(10.787)	(0.012)
× October	0.079***	34.819***	0.090***	8.483	0.011
	(0.005)	(5.840)	(0.016)	(14.442)	(0.016)
× November	0.093***	36.514***	0.119***	2.874	0.005
	(0.005)	(7.529)	(0.018)	(16.914)	(0.018)
Observations	60000	60000	60000	60000	17540
Savings = MB	0.000	0.013	0.000	0.349	0.165
Savings IVR					
September = October	0.898	0.947	0.922	0.210	0.956
September = November	0.025	0.574	0.778	0.776	0.649
October = November	0.007	0.519	0.777	0.416	0.553
Mobile banking IVR					
September = October	0.000	0.028	0.004	0.957	0.197
September = November	0.000	0.043	0.000	0.694	0.506
October = November	0.000	0.811	0.053	0.687	0.655
Control Mean	0.024	11.345	0.075	285.447	0.295
Outcome at Baseline	No	No	No	Yes	Yes

All regressions control for strata fixed effects and the following controls: age, age squared, gender, saving balance and saving balance squared. Any MoB is a dummy variable equal to one if any mobile banking transaction was carried out during the month. Sum MoB is the sum of the value of mobile banking transactions in a month, in Ghanian cedis. No. MoB is the number of mobile banking transactions carried out in a month. Standard errors in parentheses. Savings balance is the end of month balance in the bank account. Late loan payment is a dummy equal to one if the client is late with their loan payment, for clients who had a loan at baseline. Control mean is the mean for the outcome variable in the control group in August. Standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A21: Persistence of mobile banking use

	(1) Any MoB	(2) Sum MoB	(3) No. MoB
Savings IVR	-0.002	-15.570*	-0.004
	(0.003)	(9.128)	(0.011)
MB IVR	0.013***	2.060	0.019*
	(0.003)	(9.126)	(0.011)
Observations	15000	15000	15000
Omitted Category Mean	0.028	26.556	0.062
S = MB	0.000	0.053	0.036
Outcome at Baseline	No	No	No
Strata FE	Yes	Yes	Yes

Notes: Impact of treatments on mobile banking use in April 2021, 5 months after the intervention ended. All regressions include strata fixed effects. Any MoB is a dummy variable equal to one if any mobile banking transaction was carried out during the month. Sum MoB is the sum of the value of mobile banking transactions in a month, in Ghanian cedis. No. MoB is the number of mobile banking transactions carried out in a month. Control mean is the mean for the outcome variable in the control group for clients without any saving in August. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.

Table A22: Heterogeneity (Female)

	(1) Any MoB	(2) Sum MoB	(3) No. MoB	(4) Savings	(5) Late Repayment
Savings IVR	-0.013***	-7.885	-0.065***	-1.705	-0.003
	(0.004)	(6.070)	(0.024)	(20.472)	(0.018)
MB IVR	0.055***	27.642***	0.060*	13.068	-0.026
	(0.006)	(6.818)	(0.033)	(19.950)	(0.017)
Savings IVR × Female	0.014***	7.792	0.060**	8.455	-0.020
	(0.005)	(6.439)	(0.027)	(24.076)	(0.024)
MB IVR × Female	0.014*	2.293	0.025	8.328	0.003
	(0.008)	(7.835)	(0.036)	(23.840)	(0.023)
Female	-0.031***	-21.928***	-0.122***	-54.261***	0.062***
	(0.004)	(4.560)	(0.022)	(16.735)	(0.017)
Observations	60000	60000	60000	60000	17540
Control Mean	0.041	22.093	0.142	353.889	0.179
P-value S=MB	0.000	0.000	0.000	0.463	0.159
Total effect	0.069	29.935	0.085	21.396	-0.024
Total Effect p-value	0.000	0.000	0.000	0.100	0.135
Outcome at Baseline	No	No	No	Yes	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes

*Notes: All regressions include strata and wave fixed effects. Any MoB is a dummy variable equal to one if any mobile banking transaction was carried out during the month. Sum MoB is the sum of the value of mobile banking transactions in a month, in Ghanian cedis. No. MoB is the number of mobile banking transactions carried out in a month. Savings balance is the end of month balance in GHS in the partner bank account only. Late loan payment is a dummy variable if the client has missed the a loan repayment deadline. It is missing for non-loan clients. Control mean is the mean for the outcome variable in the control group for male clients in August. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.*

Table A23: Heterogeneity (Above Median Age)

	(1) Any MoB	(2) Sum MoB	(3) No. MoB	(4) Savings	(5) Late Repayment
Savings IVR	-0.010**	-7.216	-0.068***	17.114	-0.019
	(0.004)	(5.176)	(0.024)	(16.862)	(0.020)
MB IVR	0.051***	22.001***	0.046	35.025**	-0.032
	(0.006)	(5.781)	(0.028)	(17.457)	(0.020)
Savings IVR × Age	0.011**	7.199	0.073***	-27.998	0.006
	(0.005)	(5.972)	(0.026)	(23.109)	(0.025)
MB IVR × Age	0.024***	13.928*	0.058*	-33.513	0.010
	(0.007)	(7.478)	(0.034)	(23.122)	(0.024)
Age	-0.035***	-16.362***	-0.146***	11.012	-0.028
	(0.004)	(4.270)	(0.020)	(16.254)	(0.018)
Observations	60000	60000	60000	60000	17540
Control Mean	0.040	16.775	0.130	320.559	0.285
P-value S=MB	0.000	0.000	0.000	0.311	0.503
Total effect	0.074	35.929	0.104	1.512	-0.022
Total Effect p-value	0.000	0.000	0.000	0.920	0.130
Outcome at Baseline	No	No	No	Yes	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes

*Notes: All regressions include strata and wave fixed effects. Any MoB is a dummy variable equal to one if any mobile banking transaction was carried out during the month. Sum MoB is the sum of the value of mobile banking transactions in a month, in Ghanian cedis. No. MoB is the number of mobile banking transactions carried out in a month. Savings balance is the end of month balance in GHS in the partner bank account only. Late loan payment is a dummy variable if the client has missed the a loan repayment deadline. It is missing for non-loan clients. Control mean is the mean for the outcome variable in the control group for clients under age 39 (below the median) in August. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.*

Table A24: Heterogeneity (Accra)

	(1) Any MoB	(2) Sum MoB	(3) No. MoB	(4) Savings	(5) Late Repayment
Savings IVR	-0.005	-3.697	-0.021	2.690	-0.018
	(0.003)	(3.889)	(0.013)	(13.213)	(0.013)
MB IVR	0.064***	31.014***	0.073***	22.989*	-0.030**
	(0.004)	(4.729)	(0.016)	(13.358)	(0.013)
Savings IVR × Accra	-0.001	0.338	-0.037	1.015	0.014
	(0.005)	(5.465)	(0.032)	(26.777)	(0.030)
MB IVR × Accra	-0.007	-6.918	0.002	-17.374	0.022
	(0.008)	(7.416)	(0.046)	(26.098)	(0.030)
Accra	-0.022***	-14.232**	-0.071***	5.880	0.130***
	(0.006)	(5.647)	(0.026)	(19.056)	(0.022)
Observations	60000	60000	60000	60000	17540
Control Mean	0.022	11.449	0.080	250.432	0.253
P-value S=MB	0.000	0.000	0.000	0.132	0.352
Total effect	0.058	24.095	0.076	5.616	-0.007
Total Effect p-value	0.000	0.000	0.081	0.802	0.789
Outcome at Baseline	No	No	No	Yes	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes

*Notes: All regressions include strata and wave fixed effects. Any MoB is a dummy variable equal to one if any mobile banking transaction was carried out during the month. Sum MoB is the sum of the value of mobile banking transactions in a month, in Ghanian cedis. No. MoB is the number of mobile banking transactions carried out in a month. Savings balance is the end of month balance in GHS in the partner bank account only. Late loan payment is a dummy variable if the client has missed the a loan repayment deadline. It is missing for non-loan clients. Control mean is the mean for the outcome variable in the control group for clients not from Accra in August. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.*

Table A25: Heterogeneity (Any Savings)

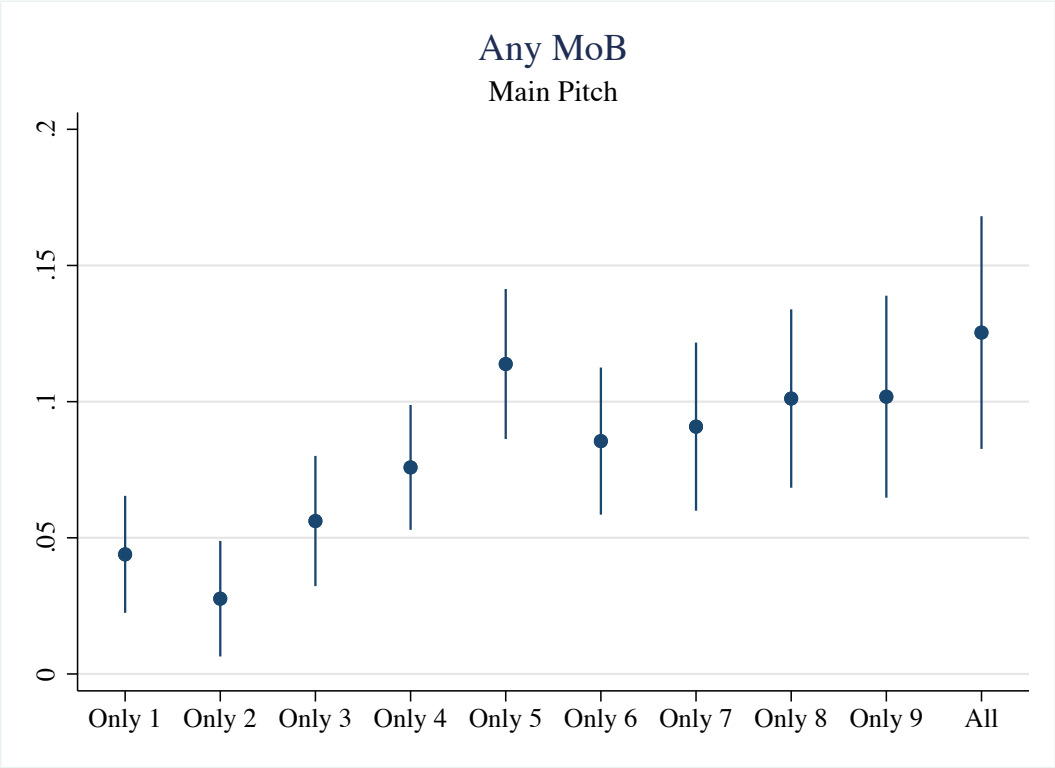
	(1) Any MoB	(2) Sum MoB	(3) No. MoB	(4) Savings	(5) Late Repayment
Savings IVR	-0.006***	-1.310	-0.023*	-10.233	-0.004
	(0.002)	(1.824)	(0.014)	(7.812)	(0.016)
MB IVR	0.044***	11.489***	0.043***	1.947	-0.027*
	(0.004)	(2.598)	(0.015)	(7.312)	(0.016)
Savings IVR × Saving	0.002	-4.624	-0.019	23.896	-0.022
	(0.005)	(6.575)	(0.032)	(19.758)	(0.019)
MB IVR × Saving	0.037***	34.665***	0.061*	27.271	0.002
	(0.007)	(8.113)	(0.034)	(17.924)	(0.019)
Saving	0.032***	27.986***	0.139***	264.010***	-0.361***
	(0.004)	(4.915)	(0.025)	(12.716)	(0.014)
Observations	60000	60000	60000	60000	17540
Control Mean	0.010	2.613	0.022	2.538	0.399
P-value S=MB	0.000	0.000	0.000	0.117	0.155
Total effect	0.081	46.154	0.104	29.219	-0.025
Total Effect p-value	0.000	0.000	0.001	0.125	0.040
Outcome at Baseline	No	No	No	Yes	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes

*Notes: All regressions include strata and wave fixed effects. Any MoB is a dummy variable equal to one if any mobile banking transaction was carried out during the month. Sum MoB is the sum of the value of mobile banking transactions in a month, in Ghanian cedis. No. MoB is the number of mobile banking transactions carried out in a month. Savings balance is the end of month balance in GHS in the partner bank account only. Late loan payment is a dummy variable if the client has missed the a loan repayment deadline. It is missing for non-loan clients. Control mean is the mean for the outcome variable in the control group for clients without any saving in August. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.*

Table A26: Heterogeneity (Loan Client)

	(1) Any MoB	(2) Sum MoB	(3) No. MoB	(4) Savings	(5) Late Repayment
Savings IVR	-0.008**	-6.399	-0.051***	-5.616	-0.015
	(0.003)	(3.901)	(0.017)	(15.478)	(0.012)
MB IVR	0.068***	33.001***	0.081***	18.111	-0.025**
	(0.005)	(5.001)	(0.023)	(15.423)	(0.012)
Savings IVR × Loan	0.009**	9.575*	0.065***	29.423	
	(0.005)	(5.424)	(0.022)	(20.058)	
MB IVR × Loan	-0.019***	-13.700**	-0.023	-0.644	
	(0.007)	(6.492)	(0.026)	(19.752)	
Loan	-0.021***	-15.044***	-0.097***	-9.162	
	(0.005)	(5.423)	(0.019)	(16.313)	
Observations	60000	60000	60000	60000	17540
Control Mean	0.030	14.314	0.098	357.468	0.253
P-value S=MB	0.000	0.000	0.000	0.129	0.375
Total effect	0.049	19.300	0.058	17.466	
Total Effect p-value	0.000	0.000	0.000	0.156	
Outcome at Baseline	Yes	Yes	Yes	Yes	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes

*Notes: All regressions include strata and wave fixed effects. Any MoB is a dummy variable equal to one if any mobile banking transaction was carried out during the month. Sum MoB is the sum of the value of mobile banking transactions in a month, in Ghanian cedis. No. MoB is the number of mobile banking transactions carried out in a month. Savings balance is the end of month balance in GHS in the partner bank account only. Late loan payment is a dummy variable if the client has missed the a loan repayment deadline. It is missing for non-loan clients. Control mean is the mean for the outcome variable in the control group for non-loan clients in August. Standard errors in parentheses. p-values in square brackets. q-values in curly brackets. *** $p < 0.01$, ** $p < 0.05$, ** $p < 0.1$.*



Notes: Coefficients on MB-IVR treatment interacted with number of messages listened to on any use of mobile banking. There is no impact of treatment for those who listened to zero messages. Point estimate and 95% confidence interval bars shown.

Figure A2: Treatment effects by number of messages listened to: Any Mobile Banking use

Table A27: Number of Messages on Primary Outcomes

	(1) Any MoB	(2) Sum MoB	(3) Number MoB	(4) Savings (GHS)	(5) Late Repayment
MB IVR	0.007	1.034	0.060	10.303	-0.034
	(0.005)	(4.828)	(0.044)	(28.375)	(0.039)
MB IVR					
× Only 1	0.044***	34.813***	0.047	-4.993	-0.036
	(0.011)	(11.642)	(0.056)	(46.405)	(0.059)
× Only 2	0.028**	21.238	0.011	43.429	0.022
	(0.011)	(13.299)	(0.060)	(45.500)	(0.056)
× Only 3	0.056***	31.017**	0.067	5.665	0.018
	(0.012)	(13.041)	(0.087)	(41.648)	(0.051)
× Only 4	0.076***	33.020**	0.064	87.421*	0.018
	(0.012)	(14.432)	(0.057)	(44.729)	(0.051)
× Only 5	0.114***	36.018***	0.128**	-55.425	0.042
	(0.014)	(11.226)	(0.055)	(49.506)	(0.053)
× Only 6	0.086***	42.192***	0.061	-9.822	0.061
	(0.014)	(14.131)	(0.063)	(46.673)	(0.054)
× Only 7	0.090***	56.880***	0.016	41.437	0.043
	(0.016)	(14.766)	(0.058)	(59.419)	(0.052)
× Only 8	0.101***	53.096***	0.066	-49.115	0.024
	(0.017)	(12.985)	(0.055)	(49.532)	(0.051)
× Only 9	0.102***	43.783***	0.028	48.970	-0.040
	(0.019)	(12.140)	(0.054)	(53.670)	(0.060)
× All messages	0.125***	57.630***	0.071	-82.239	-0.081
	(0.022)	(16.927)	(0.050)	(51.086)	(0.068)
Observations	40000	40000	40000	40000	11696
Omitted Category Mean	0.018	9.598	0.051	303.612	0.256
Outcome at Baseline	No	No	No	No	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes

Notes: Interaction of treatment with number of messages listened to (listened to exactly that many messages). Excluded group is the Saving IVR group. Regression controls for number of messages listened to by the Saving IVR group (not shown).