Repaying loans with mobile money: impacts on female microfinance clients in Tanzania
Pre-analysis Plan*

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February 24, 2023

1 Introduction

Microfinance loans are immensely popular worldwide, and demand for them is growing. Unfortunately, microfinance loans have not had the transformative effects once hoped for (Banerjee, Karlan, Zinman, 2015). Recent evidence highlights that disbursing microfinance loan using mobile money accounts has the potential to increase the impact of these loans dramatically, raising both business profitability and women's empowerment (Riley, 2022). However, in that study use of mobile money for savings or regular business transactions was extremely low, a finding also highlighted in the Financial Inclusion insights surveys (FII Tanzania, 2017). One explanation for the low use of mobile money accounts for savings or business transactions is the need to learn about how to use these services in this manner and build habits (Breza, Kanz, Klapper, 2020). This suggests that helping women start to use mobile money services on a regular basis could permanently shift how they use these services.

We use a Randomised Controlled Trial (RCT) to examine the impact of repaying microfinance loans using mobile money on women's business outcomes and level of empowerment. Specifically, microfinance groups are randomly assigned to shift to mobile money collection

*This PAP was lodged before data collection was complete and any analysis carried out.

of loans, or remain with cash repayment, for their weekly loan repayment. In addition, within those groups assigned to mobile money collection, half will remain with weekly group in-person meetings and half shift to fortnightly group meetings. This design allows us to examine the impact of an exogenous shift in the intensity that women use mobile money services, requiring frequent savings on the account in order to repay their microfinance loan. We collect detailed data on mobile money use, business outcomes, microfinance group social cohesion and intra-household decision-making in order to examine the different mechanisms through which the digital collection of microfinance loans impacts women's businesses and empowerment.

2 Intervention

This study involves two treatment interventions:

1. **Mobile money loan repayment - weekly meetings**: women assigned to this treatment arm receive a training on how to use mobile money to repay their loan, administered by the microfinance group credit officer at their group meeting. They will be asked to use mobile money to make all their weekly loan repayments. Repayment using mobile money will be voluntary, with women free to continue cash repayment, however women will be encouraged to use mobile money and told this is the preferred repayment method.

2. **Mobile money loan repayment - bi-weekly meetings**: women assigned to this treatment arm will receive a training on how to use mobile money to repay their loan, administered by the microfinance group credit officer at their group meeting. They will be asked to use mobile money to make all their weekly loan repayments. Repayment using mobile money will be voluntary, with women free to continue cash repayment, however women will be encouraged to use mobile money and told this is the preferred repayment method. Women who make loan repayments with mobile money will only

be required to attend bi-weekly group meetings (two a month).

In addition, there is a randomised cross-cutting subsidy to the mobile money repayment fees of 50%. The subsidy was implemented such that the mobile money fee for making the loan repayment was half the standard fee.[1]

A control group continue to repay their loan as cash at weekly group meetings.

3 Sample and randomisation

3.1 Sampling

The study takes place at microfinance branches of BRAC in Tanzania. BRAC Tanzania have nearly 200,000 female microfinance clients across 151 branches. For this study, 7 branches were selected in one region, Mwanza, to minimise travel costs between branches while ensuring a good mix of groups in peri-urban and rural areas. 152 microfinance groups were selected randomly from the branches.

Women were selected from these groups to take part in the study. In order to be selected for the study sample, a woman had to have a mobile phone of her own. This data was collected prior to study start in order to understand how common phone ownership was. 3,460 women were members of the 152 groups selected for the study. Of these, 3,185 (92%) women had a mobile phone of their own. Within each microfinance group, 5 clients were randomly selected for the study from those women who owned a mobile phone, giving a sample size of 750 women.

3.2 Randomization

Randomization is at the microfinance group level. The 152 microfinance groups were randomly assigned to the 2 treatment or control arms, with 50/51 groups assigned to each. All

[1] ie the client could only benefit from the subsidy if they made a mobile money loan repayment and paid their half of the fee.

the women in that group would receive that treatment assignment, not just the 5 women selected to be surveyed. The randomization was stratified by 3 dummy variables constructed from the baseline data, averaged at the group level and compared to the median group:

1. Women in the group having average monthly profits above the median group's monthly profits

2. Women in the group being more interested in repaying their microfinance loan with mobile money than the median group

3. Women in the group being more likely to prefer weekly group meetings than the median group

4 Data

This study uses 4 main sources of data. Firstly, we use a baseline survey carried out in April 2022 before the intervention began. The baseline survey was carried out with the 5 randomly selected[2] women per group. The baseline survey focused on capturing the woman's business outcomes, including type of business, profits, sales, expenditures, assets, aspirations and goals for the business, employees, record keeping, stock management and use of technology. Additionally, detailed data on savings in different forms, credit and demand for credit were captured. The baseline survey also captured data on household demographics and income, household expenditures, women's empowerment and beliefs and attitudes. An endline survey was carried out 6 months after the start of the intervention, in February 2023. The endline survey was carried out with the same women and captured similar variables to the baseline survey.[3]

[2]from women with a mobile phone and who were not currently in arrears

[3]A midline survey was carried out with a small subsample of the study. 11-12 groups per treatment arm were randomly selected to have the midline survey carried out with the 5 women per group in the study sample, resulting in approx. 150 women being surveyed. The midline survey asked about use of mobile money services and is only being analysed descriptively.

In addition to the two surveys, we have two sources of administrative data provided by BRAC. Firstly, we have weekly data on the mode of payment used to make every loan repayment (cash or mobile money) and attendance at the group meeting. Secondly, we have data on the loan repayment behaviour, including if a woman was in arrears on her loan and if she took a subsequent loan during the study. This is available for all women in the microfinance group, not just for the study sample. We use this data to monitor takeup and treatment compliance, as well as any changes in the composition of the microfinance groups.

5 Outcomes

We consider 3 primary outcomes capturing the woman's use of mobile money services, her business profits and her level of empowerment. We also consider a number of secondary outcome measures.

5.1 Primary outcomes:

Each primary measure is highlighted in bold. Additional measures or index components are listed as sub-bullet points after each measure.

1. **Business profits last month (value)**
    (a) Weekly profit (value)
    (b) Profit each month last 6 months (value)
2. **Mobile money use index**
    (a) Last used mobile money this week (for a transaction other than their loan repayment)
    (b) Saves with mobile money
    (c) Amount saved with mobile money

(d) Number of services used with mobile money last 30 days (out of 10)

(e) Value of last transactions with mobile money

(f) Allows customers to pay with mobile money

(g) Buys from suppliers with mobile money

(h) Has taken a loan from a mobile money provider

3. **Empowerment index** (index of the following)

(a) sharing pressure index

i. Pressure to share money with spouse

ii. Doesn't decide how to spend income

iii. Doesn't discuss income with spouse

iv. Dummy variables for if chooses self over spouse in each of 7 decisions of an incentivised game

(b) permission index

i. Must ask spouse permission to open a bank account

ii. Must ask spouse permission to take a loan

iii. Must ask spouse permission to visit a friend or relative

iv. Must ask spouse permission to work for a wage

(c) household decision making index

i. Woman makes the decision alone or jointly for 7 areas of household decision making

ii. How much the woman reports being involved in household financial decisions

(d) business decision making index

i. Makes the decision alone for 4 areas of business decision making

5.2 Secondary outcomes

We consider 9 families of secondary outcomes. Where possible, we consider a primary measure for each family of secondary outcomes. This is highlighted in bold. Components of an index or sub-measures are listed as sub-bullet points below each primary measure.

1. **Well-being index**
    (a) Well-being scale
    (b) Discord with spouse
2. **Mobile money perceptions** (index of the first 3 below)
    (a) **Mobile money comfort index**
        i. Comfort leaving 30,000 UGX on a mobile money account (strongly agrees)
        ii. Happy leaving money a month or longer on a mobile money account
        iii. Comfort index (ease of carrying out 5 transactions)
        iv. Agreement with "I can easily access my mobile money wallet"
        v. Makes mobile money transactions herself
        vi. Has a mobile money account registered in own name
        vii. Has a regular mobile money agent that she uses
    (b) **Mobile money preference index**
        i. It is easier for me to save in a mobile money wallet than in cash
        ii. Chooses 20,000 TSH as mobile money over cash in hypothetical game
        iii. Would prefer to make loan repayments using mobile money
    (c) **Trust in mobile money index**
        i. My mobile money network provider is able to keep my money safe and secure
        ii. How much do you trust your mobile money network provider?

iii. How much do you trust your mobile money agent?

iv. How much do you trust mobile money agents in general?

v. Fraud index (3 questions on fraud likelihood, worries and coping)

vi. The cost of mobile money is fair for the service it provides

(d) **Problems with mobile money index**

i. Experience of 5 problems with mobile money

ii. Experience of 4 problems with mobile money agents

iii. My transactions are usually completed without any problems

3. **Other business outcomes** - each outcome below will be examined separately

(a) **Business sales value** (last 30 days)

(b) **Business expenses value** (last 30 days)

(c) **Business capital value** (assets and inventory value)

i. Asset value

ii. Inventory value

(d) **Hours of labour in the business** (owner and employee) last 30 days

i. Has employees (dummy)

ii. Hours spent by employees last 30 days

iii. Hours owner spent working in business last week

iv. Days business operating in last 30

(e) **Business mis-management index**

i. Runs out of stock less than once a month

ii. Value of lost sales due to items out of stock 30 days

iii. Lost sale due to insufficient change in the last month

iv. Value of lost sales due to no change 30 days

v. Closed the business in the last month

vi. Value of lost sales due to business closures last month

vii. Keeps a physical or digital record of sales and expenditures (reverse)

viii. Correct response to change question (reverse)

ix. Correct response to highest price per item question (reverse)

4. **Social cohesion index**

   (a) Share of women from the group interacts with in 6 domains

   (b) Trust in other group members

   (c) Prefers weekly group meetings

5. **BRAC sentiment and repayment index**

   (a) Trust in credit officer

   (b) Trust in BRAC

   (c) Late loan repayment (from admin data)

6. **Household outcomes**

   (a) **Household income (total)**

      i. Household income from work

      ii. Household income from non-work

      iii. Household income from remittances

      iv. Spouse income from work

      v. Spouse income from business

      vi. Woman's income from other (non-business) work

   (b) **Household food consumption (total)**

7. **Time use**: Time spent by the woman in each activity like sleep, leisure, household chores, working on her business, working on other household and non household farm, livestock or non farm enterprise, community and religious activities as well as time spent with children in the last 24 hours that was not a holiday.

8. **Savings value total**

   (a) Saving value in each account type

   (b) Financial security index composed of:

      i. Could handle a major unexpected expense (describes well or completely)

      ii. Just getting by financially (describes little or not at all)

      iii. Satisfied or very satisfied with financial situation

9. **Net loans value**

   (a) Took a loan in the last 6 months

   (b) Loans taken (value outstanding)

   (c) Gave a loan in the last 6 months

   (d) Loans given (value outstanding)

   (e) Allows customers to pay for goods on credit

5.3 Index construction

For some summary measures of outcome families, we will group several related variables into index variables following (Anderson, 2008). We will construct the indices in three steps. First, we will re-code all contributing outcomes so that higher values correspond to treatment effects in the same direction ("better" outcomes). Second, we will standardize the individual outcomes using the control group mean and standard deviation for that outcome. Third, we will calculate the average of the standardized constituent outcomes, weighted by the

inverse covariance matrix. We will estimate the covariance matrix and hence the weights using only observations that have non-missing values for all outcomes in the index. Where a specific outcome value is missing for a respondent, we calculate the value of the index for that respondent using the remaining outcomes.

6 Analysis

To assess the impact of the interventions, we will estimate:

$$\begin{aligned} Y_{ig} &= \beta_0 + \beta_1 \text{MM1}_g + \beta_2 \text{MM2}_g + \\ & \quad Y_{0ig} + X_{0ig} + \alpha_s + \epsilon_{ig} \end{aligned} \tag{1}$$

Where Y_{ig} is an outcome of interest for a woman i in group g, Y_{0ig} is the equivalent measure, or a close proxy, if available in the baseline survey, $MM1$ is an indicator for the woman's group being randomly assigned to mobile money repayment with weekly group meetings, $MM2$ is an indicator for the woman's group being randomly assigned to mobile money repayment with bi-weekly group meetings, X_{0ig} is a vector of covariates measured at baseline, α_s are stratification fixed effects and ϵ_{ig} is a random error term.

The hypothesis tests of interest are $\beta_{MM1} = 0$, $\beta_{MM2} = 0$ and $\beta_{MM1} = \beta_{MM2}$ i.e. the impact of mobile money loan repayment keeping group meetings weekly, the impact of mobile money loan repayment shifting to bi-weekly group meetings and the impact of meeting frequency under mobile money repayment.

The vector of controls X_{0ig} will be selected using LASSO from the variables included in the baseline survey for each of the summary outcomes.

6.1 Heterogeneity

We will test whether the impact of the treatments vary with pre-determined characteristics, denoted by X_{0ig}, by estimating:

$$\begin{aligned} Y_{ig} &= \beta_0 + \beta_1 \text{MM1}_g + \beta_3(\text{MM1}_g \times X_{ig}) + & (2) \\ &+\beta_2 \text{MM2}_g + \beta_4(\text{MM2}_g \times X_{ig}) + & (3) \\ &Y_{0ig} + X_{0ig} + \alpha_s + \epsilon_{ig} \end{aligned}$$

We will consider heterogeneous effects along the following dimensions measured in the baseline survey:

1. An indicator variable equal to one if the woman's **profits** were above the median
2. An indicator variable equal to one if the woman was above the median in an index of **mobile money use**
3. An indicator variable equal to one if the woman was above the median in an index of **social cohesion**
4. An indicator variable equal to one if the woman was above the median in an index of **empowerment**
5. An indicator variable equal to one if the woman was above the median in an index of **business management**
6. An indicator variable equal to one if the woman was above the median in an index of **aspirations, self-efficacy, locus of control and future orientation**

6.2 Multiple test correction

We will correct for testing multiple hypotheses across the 3 primary outcomes by calculating q-values adjusted for the false discovery rate following (Benjamini et al., 2006).

7 Take-up

We pre-specify 2 primary measures of take-up of the intervention using administrative data:

1. Any loan repayment with mobile money
2. At least 10 loan repayments with mobile money (of approximately 30 possible repayments)
3.

We will examine the correlates of take-up using the following specification:

$$Takeup_i = \beta_0 + \mathbf{X}_i + \alpha_s + \epsilon_i \tag{4}$$

Where $\mathbf{X}_i$ is a vector of baseline characteristics.

We will also examine the influence of the subsidy on takeup and whether take-up differs between the two treatment arms.

8 Attrition

To check for systematic attrition between treatment arms, we will execute the following regression:

$$Attrition_{ig} = \beta_0 + \beta_1 \text{MM1}_g + \beta_2 \text{MM2}_g + \alpha_s + \epsilon_{ig} \tag{5}$$

Where $Attrition_{ig}$ is if woman i from group g has not completed the survey questionnaire and zero otherwise. We will construct bounds on treatment parameters using the trimming procedure described in Lee (2009) if attrition is imbalanced by treatment by more than 2 percentage points.

To understand if the composition of the sample changes because of attrition, we will regress an indicator of attrition on a vector of baseline characteristics using the following specification:

$$Attrition_i = \beta_0 + \mathbf{X}_i + \alpha_s + \epsilon_i \tag{6}$$

Where $\mathbf{X}_i$ is a vector of baseline characteristics.

For any specification outcome where responses are missing for more than 15% of the sample, we will use the estimates from model (6) to construct the predicted probability of missing data for each observation, estimate model (1) using inverse probability weights, and implement the same hypothesis tests described in section 6. We will construct standard errors using a two-stage bootstrap algorithm where we estimate both the weights and the regression parameters in each bootstrap iteration.

References

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