Digital Financial Services and Women's Empowerment: Experimental Evidence from Tanzania

Rachel Heath & Emma Riley*

March 25, 2026

Abstract

Can increasing women's use of digital financial services raise their empowerment? We test this hypothesis using a randomized control trial with 152 female microfinance groups in Tanzania, where treated groups were randomly switched from cash to mobile money loan repayment. This exogenous increase in women's use of mobile money leads women to expand their use for other types of transactions, including business payments and saving. Women's control over their finances increases and they are more empowered within the household. Over time, women's businesses become more profitable. These findings highlight the benefits of shifting payments to digital for women.

JEL codes: O33, D13, O12, J16

Keywords: women's empowerment; digital financial services; mobile money; microfinance

*Riley (Corresponding author): University of Michigan, erileyg@umich.edu. Heath: University of Washington, rmheath@uw.edu. We thank the DigiFi, WEE-DiFine, IPA Financial Inclusion Initiatives and the University of Washington Royalty Research Fund for the generous funding of this research. We thank Larissa Chen, Suvekshya Gautam, and Theradapuzha V Ninan for excellent research assistance. This study was determined as exempt by the University of Washington Human Subjects Division (IRB number STUDY00014187) and is registered in the AEA RCT Registry with the identifying number AEARCTR-0009006 (along with a Pre-analysis plan).

1 Introduction

Women's empowerment is a frequent goal of policy-makers, both as an important outcome in its own right and as a channel towards other outcomes such as improved children's health and education (Doepke and Tertilt, 2019, Duflo, 2012). Many efforts to raise women's empowerment have focused on increasing women's income or income-generating potential through treatments like cash transfers (Almås et al., 2018, Haushofer et al., 2019, Hidrobo et al., 2016) and graduation programs (Angelucci et al., 2023, Bedoya et al., 2019). However, women must retain *control over* this income for their status in the household to improve (Anderson and Eswaran, 2009). Increasing women's control over their resources, even in the absence of changes in the total amount of resources, may therefore raise their empowerment. Digital financial services like mobile money offer a potential way to increase women's control over their resources by providing them with a private, secure place to store money in their name (Aker et al., 2016, Field et al., 2021, Riley, 2024).[1] However, despite the widespread adoption of mobile money services, there are large gender gaps in usage, with women using mobile money less often, making fewer types of transactions of smaller value (Demirgüç-Kunt et al., 2022).

In this study, we examine whether increasing women's use of digital financial services improves their empowerment. We exogenously increase women's use of digital financial services by permanently switching the weekly loan repayments of microfinance borrowers from cash to mobile money. We examine the impact of this change on women's wider use of mobile money services, women's financial control and decision-making power within the household and women's income-generation using two rounds of survey data collected after 9-months and 3-years.

To do this, we use a Randomised Controlled Trial (RCT) with 750 female clients from 152 microfinance groups in Tanzania. Microfinance groups, and all the members of those groups, were randomly assigned to switch their weekly loan repayment method from cash to mobile money.[2] While almost everyone in the sample had used mobile money at baseline, use was limited to basic transactions, predominantly sending and receiving remittances. Few women saved or ever made or received payments using mobile money, meaning there is significant potential for women to expand their use of mobile money services beyond basic transactions and adopt more advanced financial behaviours. The shift in loan repayment to mobile money represented a large increase in women's use of mobile money, in terms of the frequency of payments, the types of transactions and the size of those transactions.[3] Repayment with mobile money was voluntary in the

[1] Use of mobile money services has been shown to lead to many benefits for households, particularly with regards to smoothing consumption shocks and facilitating migration through remittances (Batista and Vicente, 2023, Jack and Suri, 2014, Lee et al., 2021, Riley, 2018, Suri and Jack, 2016). Mobile money services have also been shown to benefit women by facilitating entrepreneurship (Suri and Jack, 2016).

[2] The requirement to physically attend a group meeting was not changed in the treatment arm.

[3] On average, women made weekly loan repayments of USD 40 PPP, compared to average transaction

treatment group and they incurred a 1% fee from the mobile network operator. Despite this, we see high take-up of this method, with 66% of the treatment group making at least one loan repayment with mobile money, and treated women making on average 8 out of 23 loan repayments using mobile money during the first 9-months of the study. Three years later, treated women remain 52 percentage points more likely to have ever made a loan repayment using mobile money.[4]

We find that switching the groups' loan repayment method to mobile money results in a large increase in women's use of mobile money services for other types of transactions. We see a 0.37 standard deviation increase in treated women's use of mobile money services at both 9-months and 3-years. This is driven by increases in the likelihood that they allow and make mobile money payments in their business, increases in the frequency and value of transactions, and increases in the likelihood and value of savings with mobile money. Treated women report improvements in comfort using mobile money services, and they are more likely to make mobile money transactions by themselves. The treatment, therefore, substantially and persistently increased women's wider use of mobile money services and for more advanced financial behaviours.

This increased use of mobile money services is accompanied by large improvements in an index of women's control over their finances of 0.37-0.39 standard deviations in both the short and medium term, driven by improvements in their stated control over their money, reductions in reported pressure to share money with family members and decreased willingness to pay to control money in an incentivised game. Women's decision-making involvement in the household increases by 0.18-0.22 standard deviations in both the short and medium-run, with decision-making about food and clothing and their general involvement in financial decisions increasing significantly. Heterogeneous treatment effects show that these improvements are concentrated in women who had the lowest levels of empowerment at baseline, consistent with the mechanism of increased financial control. We see no evidence that women experience a backlash as a result of this increased financial control and decision-making, as there are no changes in their reported well-being or discord with their spouses. We also see no effects on the income of other household members, ruling out negative effects from reducing their access to the wife's resources (Bernhardt et al., 2019).

While we see no effects on women's business outcomes in the short-run, in the medium term we see increases in women's business profits and sales of 22% and 32% respectively. The positive business impacts are consistent with the increase in digital payments (both

values of 110 USD PPP a month through their mobile money accounts. Treatment, therefore, more than doubled their monthly mobile money transaction values on average.

[4]14% of the control group report ever having made a loan repayment with mobile money by 3-years, as this option was rolled out to all groups after the first 9-months of the study. Due to changes in their IT systems, the microfinance organisation was not able to provide us with repayment data beyond the first 9-months of the study. Some take-up by the control group would be expected to bias downwards our estimates of the 3-year treatment effects.

to suppliers and from customers) which we see treated women increasingly making with time, allowing treated businesses to make more sales and decreasing the cost of purchasing inventory. Small increases in saving on the mobile money account could also have enabled women to invest more in their business over time. Both suggest a lag before positive effects for the business emerge.

While total household consumption does not change, we observe changes in the allocation of expenditure to different categories, consistent with a shift towards categories that women value.[5] Spending on food outside the household, primarily snacks, declined in the short term, while spending on children's clothing and children's schooling increased in the short run, with the increase in spending on schooling persisting in the long run.[6] Similar effects are seen when examining the share of expenditure by category. Increased spending on children's clothing and schooling has previously been used in the literature as suggesting women's preferences are being better reflected, and so we interpret this as also supporting an increase in women's decision-making within the household (Bobonis, 2009, Hidrobo et al., 2016). These kinds of spending are also more "lumpy", requiring the woman to accumulate savings before making the expenditure, and so may only be possible if the woman has sufficient financial control and a place to accumulate saving, such as the mobile money account.

There is no evidence that the increase in savings on the mobile money account is coming from a reduction in savings in other forms, with, in fact, savings in all forms increasing in both the short and medium term. This suggests that our intervention is "crowding in" other forms of savings. In focus groups, women discussed accumulating small amounts of money on their mobile money account to use for planned expenditures, helping to reduce unplanned spending. Consistent with this, we see a reduction in spending on snacks outside the home in the short run.

Over time, women cease being clients of the microfinance provider, with only 60% of the sample still with an active loan at 9-months and 28% of women still with an active loan after 3-years. While there are no differences in loan outcomes at 9-months, by 3-years, treated women have higher values of outstanding loans with the partner microfinance provider. Since treated women are no more likely to have a loan or be in default, the higher values must be because they were issued larger loans. Since larger loans are issued to women seen as being able to successfully repay them, this is consistent with the higher profits seen for treated women by the 3-year endline.

In our conceptual framework, we argue that increased use of mobile money could enhance women's financial control through three potential channels: transaction costs, earmarking and privacy. We argue that privacy is an unlikely channel to explain the

[5]These outcomes were not pre-specified.

[6]We also see increases in the value of mobile money transactions on school fees consistent with this, suggesting treated women may be saving on the mobile money account and then using the balance to pay their children's school fees.

effects seen here since treatment increases the likelihood the woman discusses her income with her spouse. We also see no heterogeneity by whether anyone else knew the woman's mobile money pin number, and hence could access her account, at baseline. Similarly, we find no heterogeneity by whether the woman and her spouse share the same mobile money operator at baseline, a proxy for transaction costs, since fees are higher for transferring funds to a different mobile money operator. We consider earmarking the most plausible channel through which the use of mobile money services enhances women's empowerment, though given our study design, we are not able to rule out any mechanisms definitively. Women report being less likely to to be asked for funds kept on a mobile money account compared to cash when their spouse or family knows they have money in this form, and they report lower expectations to share mobile money than cash. Treated women are also more likely to report having somewhere they can save for their own purpose. Focus group discussions paint a consistent picture: women describe using their mobile money account to save for specific purposes, particularly school fees and their businesses, and that these purposes are respected by others. We also rule out other mechanisms through which our treatment could have raised women's empowerment, such as changes in time use, loan access, loan investment behaviour, income changes, or changes in social cohesion.

Our study makes two important contributions. First, we show that women's empowerment can increase through enhanced control over existing resources. Most of the literature on women's empowerment has focused on the role of the woman's outside option through her income, income-generating potential, and resources.[7] However, *control* over income and resources determines women's ultimate status within the household (Anderson and Eswaran, 2009).[8] We show that expanding women's use of digital financial services can strengthen their control over existing resources and increase empowerment without any change in income or relative economic position. Unlike studies that digitize specific payments such as wages, loans, or transfers (Breza et al., 2020, Field et al., 2021, Greco et al., 2025, Riley, 2024), we examine a broader shift in everyday financial behaviour towards digital services.[9] Our results point to earmarking and liquidity management as possible

[7]For example in the form of variables like job availability (Majlesi, 2016), the receipt of inheritances (Harari, 2019, Heath and Tan, 2020), cash transfers given to women (Almås et al., 2018, Attanasio and Lechene, 2002, Haushofer et al., 2019, Hidrobo et al., 2016) or comprehensive graduation-type interventions that change women's ability to generate an independent income (Angelucci et al., 2023, Bedoya et al., 2019) See Chang et al. (2020) for a comprehensive review on policy interventions' impact on women's empowerment.

[8]Indeed, many programs such as microfinance, savings groups and job programs that have tried to increase women's access to income and resources without corresponding increases in their control have found mixed success (Banerjee et al., 2015, Beaman et al., 2014, Bernhardt et al., 2019, Fiala et al., 2017).

[9]See Table A1 for a summary of papers examining financial accounts and women's empowerment. Compared to these, our study examines a fuller set of outcomes in the causal chain between financial account use, financial control and women's empowerment and is able to rule out effects from changes in other financial resources, such as income and credit access. We also provide evidence on the mechanism through which financial control is enhanced, whereas the existing literature can only speculate on the potential mechanisms.

mechanisms: routine use of mobile money enables women to separate, time, and protect funds for their priorities. This provides the first evidence that increased routine use of digital financial services—rather than the form of a particular transfer—can directly enhance women's financial control and decision-making power.

Second, we contribute to the literature on the benefits of financial inclusion. Mobile money has been shown to lead to many benefits for households, particularly with regard to smoothing consumption shocks and facilitating remittances (Batista and Vicente, 2020, Jack and Suri, 2014, Lee et al., 2021, Riley, 2018, Suri and Jack, 2016), though there is mixed evidence on whether such accounts can facilitate saving (Aggarwal et al., 2020, Bastian et al., 2018, De Mel et al., 2022, Riley et al., 2024).[10] We find that encouraging women to use mobile money in a new way - loan repayment - leads them to also start saving on these accounts. These savings support lumpy expenditures such as school fees and business investment. At the same time, increased use of mobile money leads to greater acceptance and use of digital payments with customers and supplier. Over time, these shifts translate into higher business income. Because nearly all women already held mobile money accounts at baseline, our results highlight, in contrast to (Dupas and Robinson, 2013), that the key barrier is not access but experience and repeated use. Consistent with learning-by-doing (Bachas et al., 2021, Breza et al., 2020, Giné and Goldberg, 2023), routine use enables women to build confidence and habits, leading them to adopt higher–value-added financial services. Our findings emphasize the crucial role of policymakers and organizations in integrating digital financial services with other financial products, thereby enhancing women's engagement, usage, and overall benefits from these services.

The paper is organized as follows. Section 2 describes the conceptual framework, Section 3 discusses the background to the study, Section 4 discusses the intervention and study design, Section 5 discusses the data and empirical specification and Section 6 the results. Section 7 discusses alternative mechanisms and Section 8 concludes.

2 Conceptual framework

We see that mobile money loan repayment increases respondents' use of mobile money for other activities. At baseline, women primarily used mobile money for the sending and receiving of remittances. After treatment, women are holding larger savings balances on their mobile money accounts, conducting larger value transactions more regularly and making payments directly to and from their mobile money accounts, rather than cashing them out first.

[10]Much of the literature on encouraging saving with mobile money has provided strong short term incentives to save on the account in the form of bonus interest rates or temporary withdrawal fee waivers (Aggarwal et al., 2020, Batista et al., 2022, Dizon et al., 2020).

This change in use of mobile money could affect women's empowerment by increasing a woman's *control* over her income and resources, thus raising her outside option by increasing the resources she would take with her upon exiting the marriage, or by increasing her income directly.[11] Women's ability to enact their preferences could also be enhanced if, for example, use of mobile money accounts increases women's ability to enact their saving preferences (Anderson and Baland, 2002, Ashraf et al., 2010) or make spending decisions independently (Ashraf, 2009). We consider here three main mechanisms through which use of mobile money could raise women's financial control: transaction costs, earmarking and privacy. In section 7.1 we provide evidence that patterns of heterogeneity in the data are most consistent with the earmarking channel described here.

Transaction costs

A husband might take money from his wife if it is stored in the form of cash, but not be willing to pay the cost to do so when it is stored as mobile money and thus require some cost to access it for himself (namely, going to visit a mobile money agent and paying a fee to cash out). This could represent the travel cost of visiting the mobile money agent and fee to cash out in a neo-classical framework,[12] or some sort of psychological cost if storage of funds on an account in the wife's name increases the salience that he is taking the wife's money and he does not think this is acceptable behaviour. Indeed, Schaner (2017) finds that the provision of ATM cards that allow easier access to savings increased men's saving but not women's, presumably because women think it will be harder to resist their spouse's claims on the money when it is less costly to do so. By raising transaction costs, our intervention may increase women's ability to accumulate funds, allowing them to save for purposes they value and determine how those savings are spent.

Earmarking

A related channel is earmarking. Prior literature has highlighted the importance of earmarking for enabling women to save (Anderson and Baland, 2002, Ashraf et al., 2010). Money stored on a mobile money wallet may be allocated for a specific purpose and so better earmarked, resulting in the woman exhibiting greater control over it. In a recent study, Lee et al. (2024) find evidence that mobile money is earmarked for certain purposes and so less fungible than cash. Riley (2024) provides evidence for such a mechanism in

[11] While we don't see increases in business profits in the short term, we do by 3-years. Even in the short term, mobile money could still increase women's expected earnings if they anticipate that it will increase the set of future profitable business opportunities available to them. Hence we cannot rule out that increases in women's empowerment in the short run could still be due to *potential* income increases due to increased use of mobile money.

[12] While travel costs are relatively low in this setting, with 99% of women reporting living within 15 minutes walk of a mobile money agent, transaction fees for using mobile money can be high, particularly for transactions to other networks. Fees are typically 2-5% of the transaction amount.

her study of disbursing microfinance loans with mobile money. She argues that the loan is unlikely to be private given the visibility of group meetings in the community. She argues that the likely mechanisms through which mobile disbursement changes the use of the loan is either earmarking or transaction costs. This is also likely to be the case for money stored on a mobile money wallet, again increasing the woman's ability to save and determine how money is spent.

Privacy

Previous literature has found that an individual's ability to conceal outcomes from other household members affects household outcomes (Ashraf, 2009, Ashraf et al., 2014, Carranza et al., 2022, Jakiela and Ozier, 2016). Mobile money is plausibly more concealable than cash and thus may allow a woman to keep her financial resources hidden from her spouse. The treatment may have given women a plausible excuse to substantially increase their use of mobile money, thus increasing their ability to use mobile money to hide funds.[13] This ability to hide could allow a woman to retain a greater share of her personal income in the context of, for instance, a model in which there is a sunk cost to having a conversation with a spouse about how to spend money in their control or to co-opting a share of that income for oneself.

3 Background

3.1 Mobile Money in Tanzania

Mobile money allows money to be stored and transferred from a basic (non-smart) mobile phone. It works over the USSD cellular system, meaning an internet connection and smartphone are not required. Cashing in and out of the system takes place through a network of agents, who are usually existing airtime sellers or operate small businesses and offer mobile money services on the side. Users pay a fee for withdrawal services of 1-6%, from which agents receive a commission. Users also pay fees for transferring funds directly from their mobile money wallet to other individuals or businesses, with fees tied to the size of the transfer, and typically greater for off-network transfers or to non-registered users.

Worldwide, there are 1.6bn registered mobile money accounts, and accounts are growing rapidly at 13% a year, driven by growth in Sub-Saharan Africa (GSMA, 2023). In Sub-Saharan Africa, 42% of the population and 37% of women now have a mobile money account, and for 70% of them, their mobile money account is their only financial account (Demirgüç-Kunt et al., 2022). Tanzania looks typical for a Sub-Saharan African country,

[13]Note that the primary potential difference here is privacy over the woman's income and savings given increased use of mobile money: we do not think privacy of the loan itself would have changed. The fact that the woman has a microfinance loan is highly visible due to the weekly in-person group meetings, and the woman's husband is frequently the guarantor on her loan.

with 50% of the population, and 46% of women, owning a mobile money account. In Tanzania, the mobile money agent network grew quickly and is extremely dense: in 2020, 85% of villages nationally had a mobile money agent (Tanzania National Panel Survey 2020-2021). For people in villages without agents, the median distance to the nearest agent was only 3km.

However, despite these high rates of uptake and rapid growth of mobile money services, usage of mobile money for savings and business transactions remains low, particularly among women. As of 2021, only 36% of mobile money users in Tanzania reported using mobile money for savings, and women are half as likely as men to save using mobile money. Only 4% of men and 1% of women reported making digital merchant payments (Demirgüç-Kunt et al., 2022). Gender gaps in use and use for a limited range of services therefore limit women's ability to benefit from mobile money services.

3.2 BRAC Microfinance

BRAC is the largest microfinance institution in Tanzania with over 200,000 clients in 162 branches across 25 regions and 116 districts throughout Tanzania. 99% of clients are women. Microfinance loans are given for an existing small enterprise. As part of the loan application process, the business is verified by the credit officer. Loans range in size from USD 300 PPP - USD 3,000 PPP, with a median loan size of USD 1,200 PPP, and women progress to larger loans by successfully repaying smaller loans. Loans are for 40 weeks with a 25% interest rate. Women make repayments of fixed amounts each week, with the median installment amount USD 40 PPP. Disbursement of the loan is made in cash at the microfinance branch.

Women apply for microfinance loans by creating or joining an existing group within their community. Groups contain between 8 and 30 members, with an average of 23 members. Loans are individual liability loans,[14] with the group playing a role in screening members and, through social pressure and local knowledge, ensuring loan repayment. Loan repayments are made at weekly group meetings in the women's communities as cash, with a credit officer travelling to the community to collect the loan repayments. In peri-urban and rural settings such as those in this study, there is typically only one microfinance group per community.

[14]Women have a guarantor on their loans, who is often their husband.

4 Experimental Design

4.1 Sample

The study took place at microfinance branches of BRAC in Tanzania. For this study, 7 branches were selected in one region, Mwanza,[15] to minimise travel costs between groups. 152 microfinance groups were selected randomly from the 176 groups at these branches, with between 18-25 groups selected per branch depending on the number of groups at that branch. Out of the approximately 3,500 women in these 152 microfinance groups at the start of the study, five women per group, 750 women total, were randomly selected to be surveyed.[16] Since the sample was selected from existing microfinance clients, all the women in the study had already received a loan from BRAC. Note that within the same microfinance group, women generally received loans at different times from each other.[17]

Sixty-six percent of the women in the sample were married or living with a partner at baseline, with an average time with the partner of 17 years (Table A3). The remaining women were never married (8.4%), widowed (11.3%), or divorced/separated (14.3%). Of the partnered women, 95% of partners worked at baseline, earning an average of USD 455 PPP per month, which is 50% higher than the women's average earnings (Table A5). Husbands/partners were an average of 7.5 years older and more educated than the women; 40% had completed secondary education, compared to 23% of women.

Because BRAC works with existing entrepreneurs, the women in the sample may be different from other women in Mwanza. Panel B of table A2 uses data from the 2022 Demographic and Health Survey to compare self-employed women in Mwanza to other women in Mwanza. While women who are self-employed are somewhat more likely to participate in decisions about large household purchases than other women (77% of self-employed women, vs 69% of non-self-employed women), the difference is relatively small. The self-employed women were significantly more likely to have mobile phones and complete mobile transactions.

[15] Panel A of table A2 uses national data from the 2022 Demographic and Health Survey to illustrate how Mwanza compares to the rest of Tanzania. Women in Mwanza are somewhat more educated (91% have a primary education, vs 83% in the rest of Tanzania) and have a higher rate of participation in large household decisions (71%, vs 64% in the rest of Tanzania). They are more likely to own cell phones, but slightly less likely to have used those phone for mobile transations.

[16] We excluded women who were behind on their loan repayments from the study sample, since these women may not have attended meetings or continued to make future loan repayments, and so may have had low take-up of the intervention if assigned to the treatment group. This results in the study sample being representative of "good" borrowers.

[17] While new groups initially all start out with all members getting a loan at the same time, some repay their loans early and are then eligible to take a new loan, and some women pause borrowing between loans for a couple of weeks or months. New members also join over time, resulting in women in established groups rarely receiving loans at the same time.

4.2 Intervention

The intervention was designed with BRAC to test whether loan repayments could successfully be collected using mobile money. Prior to the study, mobile money had not been an option to make loan repayments, and both loan repayments and disbursements were made as cash.

Women in the treatment arm received information on how to use mobile money to repay their loan, administered by the microfinance group credit officer at their group meeting. This information was very narrowly focused on loan repayment, telling women the number they needed to send the payment to and how to enter their loan ID so that the payment would be matched to them.[18]

Repayment of the loan with mobile money was actively encouraged in the treatment group. Women were asked to use mobile money to make all their weekly loan repayments and told this was the preferred repayment method. However, women could still use cash to make loan repayments if they wish. Women incurred a 1% fee for making a loan repayment using mobile money, charged by the mobile money operator.[19]

Nothing else was changed about the loan contract or loan disbursement. Women still attended the group meeting in person, where they would show the credit officer the text message confirming they had successfully sent their loan repayment using mobile money. This was a permanent shift allowing mobile money loan repayment in the treatment groups, and continued beyond the study end.[20] After an initial 9-month period of active encouragement to use mobile money for loan repayment, women in treated groups were told they could continue to use whichever payment method they liked going forward (and were free to use a different method for each payment as they preferred).

We view the intervention as changing women's intensity of using mobile money services, rather than introducing them to mobile money for the first time or teaching them new skills, as baseline use of mobile money was high. Women regularly conducted simple mobile money transactions like sending and receiving money and checking their balance at baseline, and usually conducted these by themselves.[21] However, the intervention required them to start using mobile money services every week for considerably larger transaction values than they had previously carried out: The average loan repayment was USD 40 PPP a week. At baseline, women conducted transactions using mobile money worth USD 110 PPP a month. The intervention also likely changed their incentives for

[18]The credit officers did not provide any broader information on how to use mobile money. The assumption was that women already knew how to use mobile money or could easily find out how by asking other women in their groups. No mention was made of other benefits to using mobile money, such as improved privacy or earmarking.

[19]The median weekly installment amount was USD 40 PPP, so the median women would have paid USD 0.4 PPP per repayment with mobile money.

[20]BRAC now offer mobile money repayment in all their microfinance groups in Tanzania.

[21]See Section 5.2 for a discussion of use, comfort, preferences and trust in mobile money services at baseline.

storing money on their mobile money wallet and accepting digital payments, since now these balances could be put towards their loan repayment instead of needing to be cashed out.

Women in the control group continued to repay their loans as cash at the weekly microfinance group meeting. After 9-months, mobile money also became available as a loan repayment option in the control group, though women were not told this was the preferred repayment method, as they had been in the treatment group during the first 9-months of the study (see Section 5.5).

4.3 Randomisation

The randomisation was done at the microfinance group level.[22] The 152 microfinance groups were randomly assigned to the treatment or control arms using a stratified randomisation. As strata, we used three criteria: women's stated preference for using mobile money for loan repayment; women's stated preference for weekly over fortnightly group meeting frequency; and the profitability of the women's businesses. For each criterion, we calculated the mean at the microfinance group level and used a median split by whether the group's mean was above the median calculated over all groups. 101 groups were assigned to treatment and 51 to control.[23] All the women in the group received the same treatment assignment and, in treatment groups, every group member was offered the treatment (i.e. all the, on average 23, women in the group were treated, not only the 5 sampled for the surveys).

5 Data and empirical strategy

5.1 Data

We have 3 types of data for the analysis: Survey data, focus groups and administrative data. The survey data includes a baseline and two endline surveys 9-months and 3-years after the start of the intervention, carried out with the sample of 750 women in the 152 microfinance groups. The baseline survey was carried out in April 2022 and the intervention began in May 2022. The focus groups were carried out after 4 months and 3-years, each with 30 women from six treatment groups. The selection of the focus

[22]Groups do not typically have contact with each other and so this design minimises spillovers between treatment arms.

[23]Those assigned to treatment were additionally randomly assigned to attend group meetings weekly or bi-weekly, holding repayment fixed at weekly. Women in the bi-weekly arm had the option of skipping every other group meeting if they repaid their loan using mobile money in advance of the meeting. 51 groups were assigned to treatment with weekly group meetings and 50 groups to treatment with bi-weekly meetings. After the treatment assignment, BRAC decided to not implement the bi-weekly meeting skip option, due to concerns about this reducing repayment rates. We therefore pool the treatments together for most analysis. Table A13 confirms no differential effects on our main outcomes by sub-treatment.

groups was stratified by take-up, such that we had three high-use of mobile money loan repayment groups and three low use groups. We have two types of administrative data from BRAC capturing 1) the repayment method used for every loan repayment during the first 9-months[24] of the study for all the approximately 3,500 women in the 152 microfinance groups and 2) the overall loan status at baseline, 9-months and 3-years for all approximately 3,500 women in the 152 microfinance groups. The administrative data from BRAC at baseline was used to select the 152 groups and five women per group randomly for the baseline survey.

An incentivised game used frequently in similar contexts was played during both the baseline and endline surveys to measure willingness to pay to control money (Almås et al., 2018, Fiala et al., 2017, Jayachandran et al., 2023, Riley, 2024). This incentivised game is a nice complement to the self-reported measures of empowerment collected in the survey. In this game, women make a series of real choices between receiving \$3 themselves and their spouse receiving increasing amounts of money: \$3.2, \$4, \$5.2, \$6.4, \$9.6 and \$12.8.[25] Either payment is via mobile money tomorrow. If the woman selects herself instead of her spouse when, for example, offered the choice of \$3 herself or \$3.2 to her spouse, this is interpreted as being willing to pay \$0.2 to control the money herself. In this game, we see that 46% of women would rather get \$3 themselves than have their spouse receive \$12.8 - a similarly high willingness to pay as seen in previous contexts (Fiala et al., 2017, Riley, 2024).[26]

5.2 Baseline mobile money use and preferences

In Table A4 we report summary statistics of key variables capturing women's baseline use of mobile money, comfort, preferences and trust. In general, women use mobile money services regularly for remittances and airtime topup, and are comfortable performing basic transactions themselves. However, they do not make payments or save using mobile money, and prefer to make payments as cash, highlighting areas of potential for women to adopt more advanced financial behaviours. They have high trust in mobile money services and agents, but think costs are high.

96% of women reported ever using mobile money before, with 41% using the service in the past week. On average, women used 2.4 services a month, with sending and receiving money and making airtime purchases the most common transactions. Only 6% of women

[24]BRAC's IT systems did not automatically generate the repayment method (mobile or cash), since this was being piloted for the first time during the study. Repayment method data was generated by staff on a weekly basis specifically for the study at some effort. BRAC was not willing to continue generating this data beyond the initial 9-month horizon of the study.

[25]One in ten women were selected to have a randomly chosen choice actually paid as mobile money to either themselves or their spouse directly.

[26]It is possible that willingness to pay to control money is higher in this artificial context than it would be without a windfall payment, but the game still suggests a very high willingness to give up money at the household level in order to receive it personally.

reported paying for a good or service using mobile money, though 40% paid a bill using mobile money. Only 17% received a payment from a customer and 4% made a payment to a supplier using mobile money. Fewer than 5% of women made school fee payments, received a benefit from the government or received a wage through mobile money. Taking digital loans was relatively common, with 27% of women reporting ever having had a loan from a mobile money provider. Only 15% of women reported saving with mobile money, and on average their savings were only 16 USD PPP.

Women are quite comfortable using mobile money: they are willing to store 30,000 TSH ($10) of money on their mobile money account for 30 days, one-third regularly leave money on their account for a month or longer, and they are generally comfortable completing transactions, sending money and checking their balance. 80% perform mobile money themselves. However, 44% have told family members the pin number to their mobile money account.

While they frequently use and are comfortable using mobile money, most prefer cash. Only 10% of women would choose to receive $8 as mobile money rather than as cash. However, 50% of women would be willing to make loan repayments using mobile money. Trust in mobile money is high, and women are not overly worried about experiencing fraud, though some think the cost of transactions is unfair.

5.3 Experimental integrity

We confirm the validity of the experiment by performing a balance test on a range of covariates, results for which are shown in Table A5.[27] As well as reporting the mean and standard deviation of each covariate for the treatment and control group, the final column shows the difference and standard error from a regression of each outcome on the treatment indicator, controlling for strata dummies and with standard errors clustered by microfinance group. We see that out of the 20 variables, only one is statistically significantly different at the 5% level: Women in the treatment group are 3 percentage points less likely to have used mobile money ever, on a mean of 98% in the control group. We control for mobile money use in subsequent analysis. We also perform an omnibus test regressing all the covariates on the treatment variables and testing if they are jointly significant. The F-statistic and p-value from this test are 1.26 and 0.21, implying that the characteristics do not jointly predict treatment assignment.

This table also provides summary statistics of the sample and for key outcomes. The women are 40 years old on average, and nearly all have completed primary school but only 24% have completed secondary school. Just under 70% of them are married, and they live in households with 4.2 other people, of which 1.3 are under 12 years old. They make 330 USD PPP a month profit in their business, on sales of 800 USD PPP and

[27] A balance table by the original randomised sub-treatments is shown in the Appendix Table A6.

inventory of 700 USD PPP. They have been operating their businesses for almost 7.5 years, but only one-third of them employs anyone else in their business. 64% of women have a retail business, mainly small stores or market stalls, 17% make and sell food and 16% operate a service such as tailoring or hairdressing.[28]

Their household income is 630 USD PPP, meaning that the woman's business contributes half of household income on average. Monthly regular consumption is 400 USD PPP.[29] Women have 400 USD PPP saved on average and their total outstanding loans are 1,100 USD PPP. Most of their debt is the BRAC loan - women borrowed 1,200 USD PPP on average and have 880 USD PPP remaining on their loan with BRAC.

Attrition was extremely low during the short-run endline at 9-months due to the outstanding efforts of the survey team to find all the respondents.[30] The team completed phone surveys with women who had moved out of the study area, further reducing attrition. Attrition by treatment status is shown in Table A7. Only 3% of the sample could not be found at 9-months and this did not differ by treatment. By 3-years, attrition is still low at only 8% and remains not differential by treatment. We also examine characteristics that predict attrition in Table A7. Given the low rate of attrition, we do not find strong predictors of attrition for either endline round. After 9-months, women with businesses with larger inventory values are less likely to attrit and women who saved with mobile money at baseline are slightly more likely to attrit. After 3-years, older women from bigger households are less likely to attrit.

5.4 Empirical Strategy

To assess the impact of the treatment, we estimate:

$$Y_{ig} = \beta_0 + \beta_{MM}\text{Treated}_g + \gamma Y_{0ig} + \mathbf{X}'_{0ig}\boldsymbol{\delta} + \alpha_s + \epsilon_{ig} \quad (1)$$

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, $Treated$ is an indicator for the woman's group being randomly assigned to mobile money repayment, $\mathbf{X}'_{0ig}$ is a vector of covariates measured at baseline, α_s are stratification fixed effects where s indexes strata and ϵ_{ig} is a random error term. Standard errors are clustered at the microfinance group level. We estimate this separately for each endline round. The parameter of interest is β_{MM} i.e. the impact of the group being assigned to mobile money loan repayment (Intention-to-treat estimate).[31]

[28]The other 3% do manufacturing or agriculture.

[29]The baseline measure of consumption excluded spending on school fees and durable goods and hence is an underestimate of true consumption.

[30]Note that there is no attrition when looking at administrative data.

[31]While we expect the treatment to primarily operate through own use of mobile money for loan repayment, women could also be influenced by other women in their group using mobile money for their

All outcomes were pre-specified in a pre-analysis plan and any departures from this are clearly specified.[32] The vector of controls X_{0ig} is selected using post double selection LASSO from the variables included in the baseline survey for each outcome. We show all monetary outcomes in USD PPP at an exchange rate of 1 USD to 890 Tanzanian Shilling. All monetary values are winsorized at the 1% level.

As we consider three primary outcomes, we adjust the p-values of the coefficients of interest for multiple statistical inference by calculating sharpened q-values that control for the false discovery rate (FDR) (Benjamini et al., 2006). For summary measures of outcome families and when looking at heterogeneous effects, we group several related variables into index variables following Anderson (2008).

5.5 Take-up

Women in the treatment group were able to make loan repayments using mobile money or cash. They were encouraged to use mobile money and told this was the preferred method, but they could continue to use cash. Take-up of the intervention therefore indicates women's willingness to use mobile money for their loan repayments. We define take-up in four different ways using administrative data from the first 9-months of the study, the first two of which were pre-specified: 1) any use of mobile money to repay the loan 2) making at least 10 loan repayments using mobile money (out of 23 on average)[33] 3) the number of loan repayments made using mobile money (not pre-specified) and 4) the share of loan repayments made using mobile money (not pre-specified).

Take-up by treatment status is shown in Table A8. We see that 66% of the treatment group ever made a loan repayment using mobile money, compared to 2% of the control group.[34] 42% of the treatment group made more than 10 loan repayments using mobile money, compared to none of the control group. On average, women in the treatment group made 8 loan repayments out of 23, or 1/3 of their loan repayments, using mobile money, compared to 0.04 loan repayments using mobile money in the control group. Treated women made 32% of their loan repayments using mobile money.

On average, 36% of treated women made a loan repayment with mobile money in any given week of the study. This varied from 10% in the first week of the study to 58% at a peak in week 40 of the study (Figure A1).[35] Overall, take-up was high in the

loan repayments. These intra-group spillovers will also be captured in the treatment effect.

[32]The pre-analysis plan is available here. Departures are outlined in Appendix B.

[33]The maximum number of possible payments a woman could make during the first 9-months of the study was 39. However, due to gaps between loans and some women ceasing to be clients during the study, most women did not make this many payments. The median number of payments made during the study by women was 26, mean 23 and standard deviation 11.

[34]The mean in the control group is not always zero as in one of the groups assigned to the control arm, women were accidentally instructed to repay their loan using mobile money. This was stopped as soon as it was observed.

[35]Implementation of the treatment took a few weeks to get going, with most treatment groups not

treatment group and extremely small in the control group, highlighting the success of the encouragement design. This high take-up is encouraging given that women incurred a 1% fee for making loan repayments by mobile money, and suggests that, despite the cost, women perceived value in making their loan repayments digitally.

Figure A2 shows the percentage of women by treatment arm making a given proportion of their payments using mobile money.[36] The distribution amongst treatment women is relatively flat, with approximately 15% of the sample making each of 20-40%, 40-60%, 60-80% and more than 80% of their loan repayments using mobile money.

Table A9 shows predictors of each of the four take-up definitions in the treatment group. Richer clients as measured by their business asset value make more repayments with mobile money. At the extensive margin, being in a larger household, having fewer children under 12 and having used mobile money before also predicts any use of mobile money for loan repayment, suggesting family composition may create barriers to using mobile money for loan repayment. Those who had used mobile money before (96% of the sample) were more likely to make any loan repayments using mobile money, though intensive margin measures of use of mobile money and preference for loan repayment with mobile money do not predict any of the take-up measures. Women who had higher decision making power in the household at baseline are less likely to make loan repayments with mobile money, and women who had higher financial control are less likely to make any loan repayment with mobile money.

Take-up is highly correlated within group. Figure A3 shows that in 50% of treatment groups between 80 and 100% of women made any payment with mobile money. In 8% of treatment groups less than 20% of women made a payment using mobile money. The correlation within treatment group in any use of mobile money for loan repayment is 0.51. The reason for this is that the credit officer was essential to pass on the required information to make mobile money repayments and encourage women to use this payment method. Consistent with this, we see that the most common reason women in treated groups gave for not making loan repayments with mobile money was that they did not know they could repay their loan with mobile money (33%), followed by preferring cash (28%), high fees (19%) and not knowing how to make the loan repayment with mobile money (9%).

We do not have administrative data on the loan repayment method beyond 9-months and therefore cannot observe whether treated women continued to use mobile money for their loan repayment, or whether control women started doing so. However, during the 3-year endline survey we asked women about their use of mobile money for loan repayment. These measures rely on long-term recall and fewer than 30% of women were still active

actually training and offering mobile money repayment until 3 months into the study.

[36]Note that due to varying times remaining on women's loans at the start of the study, women varied considerably in how many loan repayments they made during the study. Hence it is more informative to look at the proportion of loan repayments made with mobile money than the number of loan repayments.

BRAC borrowers, but they remain informative—particularly for understanding control group behavior once mobile repayment became available to all.

Table A10 shows large persistent differences between use of mobile money for loan repayment between treated and control women. Treated women are 52 percentage points more likely to report ever having made a loan repayment with mobile money, relative to 14% of the control group. The overall rate of ever making a loan repayment using mobile money (67%) closely matches that seen at 9-months in the administrative data and very few women report making loan repayments at 3-years who did not do so by 9-months. Treated women are more confident making loan repayments using mobile money and more likely to report receiving training. Amongst the 30% of the sample who remain current microfinance clients, treated women are 22 percentage points more likely to report making the current loan repayment with mobile money, triple the control group's report of 12%. Treated women report making 5 loan repayments using mobile money on their current loan (out of 13 on average), compared to only 1.5 in the control group.

These patterns imply two important points for interpreting subsequent results. First, because many women exited over time, the take-up gap is driven primarily by the early months when most were active borrowers and treated women were actively encouraged to repay digitally. The large downstream effects therefore indicate that even a short period of inducement to use mobile money for a new type of transaction can lead to large and permanent changes in wider use of mobile money services. Second, among women who remained clients, early exposure permanently increased willingness to repay digitally, suggesting that continued use reflects perceived benefits. This highlights the value of temporary "nudges" to overcome initial barriers to adopting digital payments.

6 Results

As outlined in the pre-analysis plan, the three primary outcomes of this study are an index of use of mobile money services (excluding loan repayment or money accumulated for loan repayment in the treatment group), an index of women's empowerment and the woman's last month's business profits. In the short term after 9-months we see large and significant increases in mobile money and empowerment, and in the medium-term after 3-years we see large and significant increases in all three measures, all of which survive a multiple hypothesis test correction (Table A11).[37] We examine each of these primary outcomes and the component measures below.

[37]In Table A12 we show robustness of the main results to excluding control variables.

6.1 Mobile Money use

We first look at mobile money use to understand whether encouragement to use mobile money for loan repayment changed usage patterns for other types of transactions. Our measures of mobile money use focus on capturing intensive margin changes, given nearly all women had used mobile money before at baseline. Note that all the measures of mobile money use exclude the mechanical effects of making loan repayment and any savings intended for making a loan repayment.

We see a large increase in an index of mobile money use for treated women of 0.37 standard deviations after 9-months, an effect that persists after 3-years (Table 1). Looking at the drivers of the increase in mobile money use, we see that multiple dimensions of mobile money use are increasing in the treatment arm. Women in treated groups are more likely to allow customers to pay for items using mobile money in both the short and long-run,[38] a 50% increase on the control mean of 15%. Over time, treated women also become more likely to pay suppliers using mobile money. In the short-run, they are 15 percentage points more likely to have used mobile money in the last week, compared to 49% in the control group using mobile money in the last week. While they have not carried out more mobile money transactions in the last month, the value of their transactions is 35 USD PPP (32%) larger at 9-months and 113 USD PPP (91%) higher by 3-years. They are 6.2 percentage points more likely to save using mobile money in the short run, and they have nearly 16 USD PPP more saved in their mobile money wallet in the short run, a 132% increase on the control mean of 12 USD PPP, and USD 23 PPP in the medium-run, a 74% increase on the control group mean of USD 32 PPP.[39] Overall, we see strong evidence of substantially increased use of mobile money services as a result of being able to make loan repayments using mobile money in both the short and medium term.[40]

We break down the value of transactions with mobile money in the last 30 days from column (6) by each category in Table A15. Interestingly, we can see that the increase in value is being driven by increases in the value of transactions intended for saving, payments from customers and school fee payments of around 12, 9, and 10 USD PPP

[38]The share of sales made using mobile money is still less than 1% (Table A27). Treated women are less likely to have to pay a premium to pay a supplier using mobile money, suggesting they may be selecting into suppliers that accept mobile money without charging a surcharge. Over time, they pay for more expenses using mobile money.

[39]The saving effects are encouraging as they suggest that incentives or bonus interest rates do not need to be offered to induce women to save with mobile money, as seen in other studies Batista et al. (2022), Batista and Vicente (2020).

[40]We show Local average treatment effects (LATE) where we instrument for any use of mobile money for loan repayment with treatment in Table A14. The mobile money index increases by 0.56-0.58 standard deviations for women induced to make mobile money loan repayments by the treatment. However, note that the exclusion restriction is likely violated in this case, since assignment to treatment could have affected women through channels other than their own use of mobile money for loan repayment, such as from observing other women in their group using mobile money for loan repayment. These results should therefore be interpreted with caution.

respectively in the short-run, with larger and broader increases in the medium-run. This is consistent with the effects of treatment on the stock of savings and willingness to accept mobile money payments seen in Table 1. The increase in school fee payments with mobile money could suggest a use for the women's savings on their mobile money accounts, and represents a particularly big shift in behaviour given payments of school fees in the control group are less than USD 1 PPP. The increase in use of mobile money for school fees is also consistent with the increase in spending on children's education discussed below.

The increase in use of mobile money is accompanied by an increase in comfort with using mobile money of 0.17 standard deviations in the short-run, though this dissipates somewhat by 3-years (Table A16). Treated women feel more comfortable with most transactions related to mobile money. The woman is also 6 to 7 percentage points more likely to report making mobile money transactions herself, on a mean of 76% in the control group.

Interestingly, we see a decrease in preference for digital payments in the treatment groups of 0.17 standard deviations in the short run (Table A17). The change in the preference for digital payments is entirely driven by treated women having a lower preference for repaying their loan with mobile money. This is somewhat counter-intuitive, given we see high take-up despite the voluntary nature of making loan repayments using mobile money. However, women incurred a 1% fee on all mobile money loan repayments and, while women must have seen it as worth paying this fee given it was voluntary, they still may have disliked it. Consistent with this, we see that the main reason women gave for not wanting to make loan repayments with mobile money was the cost.[41] The fee may have put women off making repayments with mobile money, and women in the control group would not have been aware that there was a 1% fee associated with mobile money loan repayments when answering this question. It is also possible that women responded negatively to this question in the hope that BRAC might cover the fee for them going forward.[42] By 3-years, treated women are as likely as control to express a preference for mobile money loan repayment, possibly due to diminished salience of the fees when most women are no longer making loan repayments.

There is no significant change in women's trust in mobile money (Table A18). This contrasts with studies like Bachas et al. (2021) and Breza et al. (2020) which see changes in trust as a key mechanism in their studies of debit card introduction and paying wages through mobile money respectively. This could be because trust in mobile money was already high in this setting: in the control group, women scored 4.4 out of 5 for how safe mobile money is and 4.38 out of 5 for their trust in their mobile money operator (Table A18 columns (2) and (3)). We see no significant change in women's experience of problems

[41]The cost of making repayments with mobile money also came up during all the focus group discussions, with women asking for this fee to be removed.

[42]This is more likely given the study was described to the women as a pilot, and their feedback was being elicited on their experiences.

using mobile money, though the point estimate suggests treated women encountered more problems, likely driven by greater use and larger transaction values (Table A19).

A concern might be that these are all self-reported outcomes and so could be subject to experimenter demand effects given the intervention was about using mobile money. A piece of evidence that goes against this comes from questions that asked the treatment group about their use of mobile money for loan repayment. 53% of the treatment group self-report as having made a loan repayment using mobile money after 9-months, and 67% after 3-years, similar to the 66% we see actually made a loan repayment with mobile money in the administrative data at 9-months. If experimenter demand effects were leading women to exaggerate their use of mobile money, we would have expected them to be largest in response to this question. The fact that we don't see evidence on exaggeration here is therefore suggestive that experimenter demand effects are not causing women to over-report use of mobile money services.

6.2 Financial control and women's empowerment

We see a large increase in women's empowerment of 0.22 standard deviations in the treatment group in both the short and medium-term, driven by increases in financial control and household decision making (Table A20).[43] Treated women see a 0.37-0.39 standard deviation increase in an index of financial control (Table 2). Treated women are more likely to report deciding how to spend their own income, report less pressure to share money with their spouse, and are more likely to discuss their income with their spouse in the short-run. An increased willingness to discuss income with the spouse is suggestive that privacy might not be the main channel through which mobile money use increases financial control. Treated women are less likely to choose themselves in every choice in an incentivised game measuring willingness to pay to control money, interpreted as women having higher empowerment (Almås et al., 2018) (see description of this game in Section 5.1), though this is only statistically significant in the short-run.[44] Overall, this suggests that treated women feel more in control of their money, and hence are more comfortable discussing it with their spouse and less willing to pay to control additional money. This highlights that increased use of digital financial services can meaningfully increase women's financial control and mitigate sharing pressure.

An index of women's decision making in the household increases by 0.18-0.22 standard

[43]We show Local average treatment effects (LATE) where we instrument for any use of mobile money for loan repayment with treatment in Table A14. The women's empowerment index increases by 0.36-0.40 standard deviations for women induced to make mobile money loan repayments by the treatment. However, note that the exclusion restriction is likely violated in this case, since assignment to treatment could have affected women through channels other than their own use of mobile money for loan repayment, such as from observing other women in their group using mobile money for loan repayment. These results should therefore be interpreted with caution.

[44]This increased willingness to choose their spouse in the incentivised game could be consistent with women's bargaining power increasing because their outside option has improved.

deviations for women in treated groups (Table 3). This is a similar order of magnitude to other treatments found to empower women – such as an increase of 0.17 standard deviations from a wife receiving a cash transfer instead of her husband (Haushofer and Shapiro, 2016), an increase of 0.17 standard deviations from an inheritance law reform (Heath and Tan, 2020), or a 0.14 or 0.25 (with an index constructed using equal weights or factor analysis, respectively) standard deviation increase from a commitment savings product (Ashraf et al., 2010) – though higher than the average treatment effect of the direct deposit of earnings of 0.015 standard deviations in Field et al. (2021).[45] The increase in women's household decision-making in the treatment arm is driven by an increase in decisions about clothing and food in the short-run, and fertility decisions after 3-years, and an increase in their general involvement in financial decisions in both endline rounds. We do not see any significant changes in an index of requiring spousal permission to carry out different activities or in decision making in the woman's business (Tables A21 and A22).

In Table 5 we show that there is heterogeneity in the treatment effects on empowerment, with women who had above-median empowerment at baseline seeing smaller treatment effects in both the short and medium run. This suggests that the treatment benefits are concentrated amongst less empowered women. There is little evidence of heterogeneity by baseline business profits or use of mobile money.

We also see that women's own and second order beliefs about who should make decisions in the household, whether women should earn income and whether it will cause problems if the woman earns more than her husband improve substantially after 3 years in the treatment group (Table A23).[46] An index of these three types of norms improves by 0.16 standard deviations. Most elements show more progressive norms, but the improvement seems to be driven more by improvements in second order beliefs (those about the beliefs of others) than the respondents own beliefs, with beliefs about whether others in the community think it acceptable for a woman to have an income generating activity the only individually statistically significant change. It is possible this is responding to women's own experience of not suffering consequences in the community from earning more and making more household decisions.

Reassuringly, we see no change in discord with the spouse for treated women (Table A24), suggesting women are not experiencing a backlash as a result of their greater financial control and input into decision making. If anything, the coefficient on discord suggests a reduction in major arguments with the spouse. We see no significant effect on women's happiness, which could suggest that the increase in women's preferences being represented in household decision-making may not be enough to improve women's

[45]Field et al. (2021) do find a positive and statistically significant effect of 0.075 standard deviations among women whose labour supply was considered "constrained" at baseline, whom they argue drive the labour supply results of the direct deposit treatment.

[46]These questions were added to the survey at 3-years and are not available for the 9-month endline.

assessments of their overall well-being.

6.3 Business effects

We do not find any impact of treatment on women's business profits in the short run. In the medium run, however, profits increase significantly, whether measured over the last month, last week, or the prior month (Table 4).[47] This pattern suggests that it took time for women's increased use of mobile money services and/or increased financial control to translate into improved business performance. The medium-run profit gains are driven by higher sales rather than lower costs (Table A25). We find no changes in business hours, number of employees, or the likelihood that the business is still operating (Table A26).

Two main channels could explain how increased use of digital payments translated into higher profits: (i) improved operational efficiency through increased digital transactions with customers and suppliers, and (ii) increased business investment enabled by higher savings. Evidence is strongest for the first channel, suggesting that mobile money payments increased sales, particularly by reducing lost marginal transactions, and lowered the costs associated with re-stocking.

On the customer side, treatment increases the likelihood that women accept mobile money payments by 7.4–7.8 percentage points, roughly 50% more than the control-group rate (Table 1 column (3)). Correspondingly, the value of sales made through mobile money rises by USD 9-16 PPP (Table A27 column (3)).[48] While this direct increase in mobile-money-paid sales is modest relative to the overall increase in total sales, it likely captures only a small subset of the broader response, since most transactions continue to be conducted in cash.[49] Importantly, digital sales appear to reduce failed transactions at the margin: treated businesses are 6 percentage points less likely to report losing a sale due to insufficient change in the past 30 days (Table A28 column (4)).

On the supplier side, only 7% of suppliers allow mobile money payments in the control group, and treatment doesn't increase this in the short-run. In the medium run, however, treated women are 9 percentage points more likely to have suppliers who accept mobile money (Table 1 column (2)). Treated women are also more likely to have suppliers who charge them the same for mobile money payments as cash: while only 3-4% of control women report that their suppliers charge them the same price for payment in mobile money as cash, this share increases by 2.0 percentage points in the short run and 10.0

[47] LATEs, where we instrument for any use of mobile money for loan repayment with treatment, also show no effects on profits in Table A14, though the exclusion restriction is likely violated in this case and so the results should be interpreted cautiously.

[48] The outcomes in Table A27 were not pre-specified.

[49] The relatively small effects here are consistent with the finding that larger interventions at the market level are needed to encourage businesses and customers to use mobile money simultaneously due to complementarities in digital payment adoption (Alvarez et al., 2023, Higgins, 2022).

percentage points in the medium-run, (Table A27 column (2)). This suggests that treated women increasingly source suppliers who accept mobile payments or negotiate to avoid price premia. Consistent with this, the value of inventory purchases paid via mobile money is three times as large in the treatment group (USD 9.9 PPP) compared to the control group (USD 3.11 PPP) in the medium run (Table A27 column (4)). Treated women are also twice as likely to order inventory digitally, by calling a supplier and having goods delivered, and correspondingly report lower transport expenses (Table A27 columns (5) and (6)).

These changes in supplier ordering seem to have improved the operational efficiency of women's businesses: treated women report being 11 percentage points less likely to run out of stock, saving USD 8 PPP a month in lost sales (Table A28 columns (2) and (3)). They are also 11 percentage points less likely to have to close the business to get change or inventory or because they have run out of stock, saving USD 13 PPP in lost sales (Table A28 columns (6) and (7)).[50] Taken together, these patterns indicate that while some expansion in digital sales occurs relatively quickly, it takes time for changes in supplier relationships and payment terms to materialize, which helps explain the lag between increased digital payment use and higher profits.

The second potential channel by which the profits of treated women's businesses could have increased is through greater savings and investment into the business.[51] Treated women save more, both with mobile money and overall, with effects increasing over time (Table A29). It's therefore possible that they are investing more into their businesses. However, the point estimate on the value of business capital, capturing the value of stock and inventory and assets owned by the business, while positive is not statistically significant and is relatively small at only USD 46 PPP compared to the USD 198 PPP higher monthly sales seen (Table A25 column (4)). This makes it unlikely that reinvestment into the business alone can explain the increase in sales and profits of treated women's businesses.

6.4 Savings and household outcomes

Savings on the mobile money account do not crowd out other forms of saving, and if anything we see a crowd-in of savings: Total savings increased by 65 USD PPP in the short-run and 90 USD PPP in the medium run, driven by the increase in savings with

[50]Improved supplier ordering and efficiency came up frequently during the focus groups: mobile money facilitated procurement by enabling women to pay suppliers remotely and receive goods without traveling. Women emphasized reduced transport costs and time away from the business, and some linked mobile payments to smoother restocking when they were busy and out of supplies.

[51]In Riley (2024), business profits increased because digital loans resulted in greater investment of the loan in the business: there was no indication that subsequent business profits were put onto the mobile money account or reinvested into the business, with most of the increased profit appearing to be consumed.

mobile money (Table A29).[52] We see that there are insignificant increases in saving with friends (9 USD PPP), at home (10 USD PPP) and in VSLAs (14 USD PPP) in the short-run and of bank savings (65 USD PPP) in the medium-run. Since banking services also increasingly became linked with mobile money over time, this could suggest women are moving funds to and from their mobile money and bank account to help meet their saving needs. The crowd-in of other kinds of saving suggests that increasing financial control through increased mobile money account use allows women's preferences for greater saving to be reflected in the household. Consistent with these greater savings, we see in table A33 that women report that they are less likely to have to take an adverse action to mitigate a negative shock, such as needing to cut back on food, sell business assets or take a child out of school.

We see no significant changes in household total consumption or total income in the short or medium-run (Table A30). The point estimates are positive and moderately large, and so consistent with the increased profitability of treated women's businesses seen in the medium-run. Importantly, there are no negative effects on the income of the spouse from greater financial control on the part of the woman.

Finally, consistent with the increase in women's decision-making within the household, we see changes in the allocation of expenditures (Tables A31 and A32).[53] In value terms, treated women reduce spending on food outside the home (primarily snacks and treats) in the short-run, and increase spending on girls and boys clothing in the short-run and children's schooling in both the short and medium-run. These shifts are large in relative terms: The reduction in spending on snacks is 5 USD PPP, a 15% decline, while the increases in spending on school fees for boys and girls are 5 USD and 7 USD in the short-run, around 19-23% increases from the control mean of 29 USD on each, and a 10 USD PPP increase on girls school fees in the medium-run, a 64% increase. We see the same pattern when looking at expenditure shares. This could indicate a shift in spending towards things women indicate they value, and thus signal an improvement in their empowerment, as has been inferred in the literature (Bobonis, 2009, Hidrobo et al., 2016). Further, spending on clothing and schooling is more "lumpy" than on snacks and treats, so shifts in expenditure in this direction are consistent with the idea that women can save up for larger, less frequent expenditures. In the focus groups, women brought up that they could save up for lumpy-expenditures on the mobile money account, and that this reduced unplanned spending, including on treats.

More broadly, Table A31 shows that spending on food in the short-run declines around

[52]Prior literature has not found consistent overall increases in savings from interventions involving the provision of mobile money accounts when strong incentives to save on the mobile money account are provided, such as waiving withdrawal fees, paying bonus interest rates, setting saving goals and sending reminders to save (Aggarwal et al., 2020, Batista et al., 2022, Dizon et al., 2020). Such incentives may therefore encourage crowding out of other forms of saving.

[53]Total expenditure was pre-specified as an outcome but the components and shares were not pre-specified.

13 USD PPP while spending on education increases around 16 USD PPP. Education spending is more "lumpy" than food spending, requiring savings before payment at the start of the school term.[54] One explanation is that women are cutting down on small, regular food expenditures, particularly snacks, saving on their mobile money account and then spending more on their children's schooling, as well as clothing. This could also account for the increased savings seen in the short run, when there was no change in women's business income. This pattern is also consistent with the increase in the value of monthly transactions on the mobile money account for school fees, seen in Table A15. Finally, in Table A33, we see that, consistent with the increased spending on school fees, children of treated women aged 13-18 are marginally more likely to be in school. This could also be a result of higher savings and better ability to manage negative shocks without having to take adverse actions like withdraw children from school.

6.5 Loan and group behaviour

We find no effects of treatment on BRAC loan repayment outcomes in the short run. By the 3-year endline, however, treated women hold larger loans and more savings with BRAC (Table A34).[55] At this point, only 28% of women still have an active BRAC loan, a share that is insignificantly 3.6 percentage points higher in the treatment group. We see similar patterns when examining administrative outcomes for all women in the study groups, not just the survey sample (Table A35).[56] Since treated women are no more likely to hold a loan but have higher outstanding balances, they must have received larger loans. Because loan size reflects credit officers' and group members' assessments of repayment capacity, this is consistent with the higher business profits observed among treated women. Overall, these results suggest that switching to mobile money repayment does not harm repayment performance and may allow BRAC to extend larger loans to more profitable clients.

We find limited evidence of broader changes in group dynamics. An index of social cohesion does not change significantly in either the short or medium run (Table A37), and sentiment toward BRAC remains unchanged, likely reflecting already high baseline trust (Table A38). In the short run, however, treated women are 10 percentage points less likely to prefer weekly meetings, from a control mean of 80%. While meeting frequency was not experimentally varied, this suggests that women perceive less need for weekly meetings

[54]For this reason, food expenditures were asked on a 7 day recall and educational expenditures on a 6 month recall. Both are then scaled to 30 days.

[55]Survey data show no significant changes in loan access from BRAC or other sources; while the point estimate on BRAC loans is imprecise, it is similar in magnitude to the administrative estimate (Table A36).

[56]The study sample excludes women who were behind on repayments at baseline. It therefore skews towards better repayment behaviour than the average client, and has slightly lower exit rates than the full group population at both endlines.

when repayments are made digitally. Consistent with this, meetings are about 10 minutes shorter in treated groups due to the removal of cash counting, roughly offset by the time spent making mobile money payments. These effects largely fade by the medium run, likely reflecting the fact that only one-third of women remain in microfinance groups by that point.

7 Mechanisms

Here we explore the potential ways that mobile money could have improved financial control and hence women's empowerment, finding suggestive evidence in favour of earmarking, though we cannot rule out other channels such as increased privacy or transaction costs.

We then discuss alternative mechanisms through which the use of mobile money services for loan repayment could have affected women's empowerment. We argue that income changes, credit access, changes in loan investment, time savings and social cohesion are unlikely to be channels for the effects seen. However, we cannot rule out that income changes and credit access play a role in the empowerment gains seen in the 3-year endline.

7.1 Privacy, transaction costs and earmarking

To understand the mechanisms through which financial control increases, we examine three potential channels: earmarking, privacy and transaction costs. First, we use a series of questions included in the 3-year endline to understand whether women perceive mobile money as being better earmarked than cash, having more privacy or simply harder to access. We then further assess the privacy channel by exploring heterogeneity based on whether the woman reported at baseline that someone else knew her mobile money account PIN. Note that women could easily change their PIN and may have done so in response to treatment, making this measure a noisy proxy; however, we did not collect endline information on PIN sharing. At baseline, 44% of women reported that another household member knew their PIN. Finally, we examine transaction costs by exploiting heterogeneity in whether the woman and her spouse used the same mobile money network provider at baseline. Transfers across networks are more expensive, implying higher transaction costs for couples using different providers. Higher transaction costs may increase women's control over funds (Schaner, 2017). These fees are relatively large—on the order of 2–5%. If higher transaction costs were the primary mechanism through which mobile money increases financial control, we would expect larger treatment effects for women whose spouses used a different provider at baseline. In our sample, 31% of women had a different network provider from their spouse, though, as with PINs,

network choice could have changed during the study period. We caution that both pieces of heterogeneity use noisy proxies, and we are under powered for heterogeneity analysis, meaning that we should not interpret a lack of heterogeneity as strong evidence that privacy and transaction costs play no role.

At the three year endline, a number of questions were asked to capture perceptions of pressure to share money kept on a mobile money account compared to cash (Table A40 and A39). Treated women report less pressure to share money with their spouse, whether held as cash or mobile money, and report that it's easier to say no to requests from family for mobile money, consistent with the increase in financial control observed. The patterns in the control group are also informative in understanding norms around sharing cash compared to mobile money. Across the board, respondents report being asked less to share mobile money than cash and less pressure to share money as mobile money than cash. For example, 26% of women reported that their spouse would ask for their cash if he needed it for his business, but none said that he would ask her to send mobile money. We interpret this as consistent with mobile money being better earmarked for specific purposes and so less subject to pressure to share money than cash. Consistent with this, treated women are more likely to say they had saved somewhere for a purpose of her choosing in the last 12 months (Table A41).

Earmarking also emerged repeatedly in focus group discussions, where women described mobile money balances as reserved for specific purposes or future moments—most commonly school fees or business investments. Funds held on the phone were viewed as set aside and distinct from cash kept at home, which participants described as more vulnerable to everyday claims. Women emphasized that household cash is easily spent on small requests from relatives or daily needs, whereas mobile balances helped them "hold money until the right time." This language reflects commitment and earmarking rather than concealment or transaction costs.

We find little evidence of heterogeneous treatment effects by baseline PIN sharing (Table A43). Although women who reported that others knew their PIN experienced smaller increases in mobile money use following treatment—significantly smaller at the 10% level in the short run—the estimated effects on empowerment are small, statistically insignificant, and often positive. This pattern is suggest that privacy is not the primary mechanism through which mobile money increases financial control, and is also consistent with findings in Greco et al. (2025). Further evidence against a privacy-based explanation comes from the fact that treated women were more likely to report discussing their income with their spouses. Focus group discussions reinforce this interpretation: women described openly discussing their mobile money use with partners and family members, and did not frame mobile balances as hidden funds.

We also examined privacy of mobile money during the 3-year endline: we see mixed evidence on how private mobile money is, with, for example, 45% of respondents reporting

someone else knows their mobile money PIN but only 8% saying they would have to show someone their mobile money balance (Table A42). There is no evidence that treatment affected the privacy of the woman's mobile money account. This suggests that the gains in financial control are unlikely to operate primarily through changes in privacy, though they could still reflect greater use of an account that already offers some degree of privacy relative to cash.

Similarly, we find little evidence of heterogeneity by whether the woman and her spouse shared the same mobile money provider at baseline (Table A43), again with the caveat that provider choice could have changed over time. This suggests that transaction costs are unlikely to be the primary mechanism driving improvements in financial control.

Taken together, these results point toward earmarking as the most plausible mechanism through which mobile money use enhances women's empowerment, although the evidence is not definitive.

7.2 Income changes

In the short-run, we do not see any effects of treatment on either the woman's or the household's income. As a result, it is unlikely that improvements in short-run empowerment are driven by increased income under the woman's control. However, we cannot rule out that an increase in empowerment could be due to an increase in a woman's potential to earn income (in the event of leaving the marriage) due to increased use of mobile money services, which increases her outside option, and given we see subsequent improvements in the woman's income, this is certainly feasible. Despite this possibility, it seems unlikely that women could have fully internalised how use of mobile money would improve their income generating potential, leaving this explanation unable to fully explain our findings.

7.3 Credit

If mobile money repayment improved women's repayment behaviour, it could in turn have increased their access to credit, potentially enhancing empowerment through greater financial resources. However, Tables A34–A36 show no evidence of short-run effects on loan outcomes. In the short term, treated women experience no changes in outstanding loan balances, default rates, or the likelihood of taking subsequent loans from BRAC.[57] These results suggest that improved credit access is unlikely to explain the short-run gains in women's empowerment.

[57] Almost all women's credit comes from BRAC even three years after the intervention, when most women no longer have outstanding BRAC loans: 96% of the value of outstanding loans is from BRAC at nine months, and 87% at three years (Table A36). We also find no significant increase in treated women's access to mobile money (digital) loans (Table 1).

At the three-year endline, we do find some evidence that treated women hold higher outstanding loan balances, consistent with improved access to credit. Given that there is no corresponding increase in the likelihood of having any loan, we interpret this pattern as reflecting higher loan sizes, most plausibly driven by more profitable enterprises. At this longer horizon, we cannot disentangle improvements in credit access, increased profitability of women's businesses, and greater financial control, and all three likely contribute to the observed improvements in women's empowerment.

7.4 Loan investment behaviour

In this study, the loan disbursement method did not change and remained as cash. The treatment also began mid-way through women's loan cycles, after their loan had already been disbursed, sometimes many months ago. As a result, we think it unlikely that women are depositing their loan onto their mobile money account and so increasing their control over the loan, as in Riley (2024). However, without transaction records from the mobile money accounts, we cannot rule this out. We note though that Riley (2024) did not find effects of disbursing loans on mobile money accounts on financial control, as women did not learn to use the mobile money accounts for other types of transactions. In her study, women also did not deposit subsequent loans onto the mobile money account, suggesting women are unlikely to start doing this here. She does find large positive effects on business outcomes due to increased investment of the loan in the business. This contrasts with our findings here, and so it seems unlikely that our treatment could be working through a similar mechanism. We also think it unlikely that the treatment increased the privacy of the loan, for the reasons already mentioned above, and because the fact the woman had a loan is highly public due to the weekly in-person group meetings.[58]

7.5 Time savings

A reduction in the time required to make loan repayments is one possible alternative mechanism through which the treatment could have improved outcomes for women. However, we think that this is unlikely to have played a large role here for a number of reasons. First, women still had to attend group meetings despite making their loan repayments with mobile money. Second, the reduction in the time that group meetings took was only 10 minutes on average for a meeting that took over 2 hours. This is a small time saving even on a weekly basis. Third, treated women also had to go to an agent to deposit money to their mobile money account if they did not have a sufficient balance for their loan repayment. On average this took 12 minutes (median 10), which almost exactly compensates for the reduced meeting time. As a result, there isn't evidence that the

[58] Women also frequently list their husband as the guarantor on their loan.

treatment increased the time that women could dedicate to other activities. Finally, if time savings was the relevant mechanism, we would expect effects on women's empowerment to only materialise through increases in income. We do not see any changes in women's income in the short run despite observing large improvements in empowerment, leaving no clear mechanism through which time savings could have empowered women.

7.6 Social cohesion

The increase in empowerment could be a result of improvements in social cohesion of the women in the groups, and thus an improvement in their ability to call on support from others (Feigenberg et al., 2013). However, in our context, women were already in established groups and had moderate levels of interaction with group members. While we see some small increases in social interaction in the short-run, these have dissipated by the long-run, when most women are no longer in their groups. We therefore do not think that changes in social cohesion could be driving the improvement in empowerment.

8 Conclusion

Women's empowerment is a frequent goal of policy-makers. Most prior research has sought to raise women's empowerment by increasing their income or resources, assuming that women retain control over some portion of that income or resource. Here we focus on the control of resources itself, and the idea that raising financial control can empower women even in the absence of any changes in their resources. Using a randomised controlled trial, we encourage women to increase their use of mobile money, a ubiquitous financial service offering enhanced financial control by providing a secure, private place to store money. We encourage the use of mobile money services by shifting women's weekly microfinance loan repayments from cash to mobile money. We find that treatment raises women's use of mobile money services and comfort using them substantially in both the short and medium-run. Women's control of their finances and decision making both improve, and household expenditure shares shift to be more aligned with women's preferences. Women are able to save up for lumpier expenditures such as clothing and school fees. These changes occur despite no changes in the woman's income in the short-run. Our findings show the importance of increasing women's financial control for enhancing their empowerment.

In the medium-term, we see increased use of digital financial services for business payments, greater sales and business profits. This finding highlights that routine use of digital financial services can improve women's business outcomes, an important finding given self-employment is the main source of income for women in developing countries.

Our results highlight that new technology can have important benefits for women. Our findings imply that shifting more payments and transactions to digital forms will positively benefit women.[59]

We find that shifting to digital loan repayment leads to no changes in group social cohesion, with some indication that interaction between group members may have in fact increased. This is because women still met weekly in their groups in the treated groups. However, treated women had a strong preference to reduce meeting frequency to bi-weekly or monthly meetings. It is possible that our findings would be different amongst new groups who never repaid in cash, if new clients selected in because digital repayment would allow them to not attend group meetings in person or if BRAC accompanied digital loan repayment with a reduction in meeting frequency. Of more concern, treated women were less likely to prefer repaying their loan with mobile money over cash, driven by the need to pay a fee to utilise mobile money repayment. This suggests that cost could be a barrier to women choosing to utilise digital loan repayment despite their potential benefits.

[59] On the basis of our findings, BRAC has rolled out the option to repay loans with mobile money across all groups at the study branches.

Table 1: Impact of treatment on Mobile Money Use

	(1) Use index	(2) Pay supplier	(3) Allow customer pay	(4) Used last week	(5) Transaction count	(6) Transaction value	(7) Digital loan	(8) Any saving	(9) Amount saved
Panel A: 9 months									
Treated	0.374***	0.031	0.074**	0.149***	0.062	35.294**	0.068	0.062*	15.579**
	(0.097)	(0.022)	(0.031)	(0.044)	(0.110)	(16.722)	(0.042)	(0.036)	(6.222)
Observations	723	723	723	723	723	723	723	723	723
Control Mean	-0.00	0.07	0.15	0.49	2.44	110.64	0.26	0.17	11.83
Panel B: 3 year									
Treated	0.369***	0.085***	0.078**	0.026	0.244*	112.879***	0.017	0.030	23.371**
	(0.089)	(0.026)	(0.036)	(0.039)	(0.126)	(24.741)	(0.038)	(0.040)	(9.996)
Observations	686	686	686	686	686	686	686	686	686
Control Mean	-0.00	0.08	0.22	0.55	2.38	124.53	0.36	0.30	31.69

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index of columns (2)-(9). Pay supplier is a dummy variable capturing if the women pays suppliers using mobile money. Allow customer pay is a dummy variable if the woman allows customers to make payments in her business using mobile money. Last used week is a dummy variable capturing if the woman used mobile money in the last week (excluding for loan repayment). Transaction count is the number of different types of mobile money transactions performed in the last month from a list of 12 types, excluding loan repayment. Transaction value is the sum of the value of the transactions made using mobile money in the last month, excluding loan repayment. Digital loan refers to whether the woman has ever taken a loan through her mobile money provider. Any savings captures if the woman reports saving on the mobile money account and Amount saved is the value of savings on the mobile money account. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 2: Impact on Financial Control

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Self-reported			Incentivised					
	Index	Decides spend income	Pressure share money	Discusses income spouse	Chooses self 1	Chooses self 2	Chooses self 3	Chooses self 4	Chooses self 5	Chooses self 6
Panel A: 9 months										
Treated	0.371***	0.282*	-0.587**	0.245**	-0.108***	-0.093*	-0.109**	-0.116**	-0.139***	-0.147***
	(0.102)	(0.149)	(0.297)	(0.108)	(0.039)	(0.048)	(0.046)	(0.048)	(0.049)	(0.049)
Observations	723	723	441	441	723	723	723	723	723	723
Control Mean	0.00	3.83	3.09	3.04	0.83	0.70	0.63	0.59	0.58	0.58
Panel B: 3 year										
Treated	0.389***	0.386***	-1.119***	-0.020	0.008	-0.021	-0.003	0.020	-0.006	-0.021
	(0.095)	(0.093)	(0.300)	(0.130)	(0.033)	(0.038)	(0.043)	(0.043)	(0.045)	(0.043)
Observations	686	686	381	359	686	686	686	686	686	686
Control Mean	-0.00	4.25	3.02	2.83	0.79	0.72	0.63	0.57	0.54	0.53

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline and control variables selected by LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index composed of columns (2)–(10). Decides spend income is a self-assessment from 1–5 on whether the woman decides how to spend her own income. Pressure share money is a self-assessment from 1–5 of whether the woman experiences pressure to share money with her spouse (married women only). Discusses income spouse is a 1–4 measure of how frequently (never–often) the woman discusses her income with her spouse (married women only). Chooses self 1–6 are indicators for whether the woman chose herself when offered the choice between USD 3 for herself and increasing amounts to her spouse; choosing herself is interpreted as willingness to pay to control money. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3: Impact of treatment on household decision making

	(1) Index	(2) Clothing	(3) Food	(4) Education	(5) Small purchase	(6) Work	(7) Fertility	(8) Saving	(9) Involvement
Panel A: 9 months									
Treated	0.216**	0.070**	0.076**	-0.004	0.006	0.033	0.016	0.043	0.105*
	(0.090)	(0.031)	(0.038)	(0.035)	(0.025)	(0.033)	(0.037)	(0.028)	(0.061)
Observations	723	723	723	723	723	723	723	723	723
Control Mean	-0.00	0.85	0.81	0.82	0.92	0.90	0.86	0.90	3.05
Panel B: 3 year									
Treated	0.175**	0.022	0.033	0.004	0.013	0.027	0.045**	0.017	0.152**
	(0.077)	(0.026)	(0.031)	(0.034)	(0.023)	(0.025)	(0.019)	(0.025)	(0.068)
Observations	686	686	686	686	686	686	686	686	686
Control Mean	-0.00	0.89	0.85	0.84	0.92	0.90	0.92	0.88	3.18

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index of columns (2)–(9). Columns (2)–(8) show results for dummy variables capturing if the woman made decisions relating to that domain either jointly or alone. Column (9) captures the woman's overall perception of involvement in household decisions on a 1–5 scale where 5 is more involvement. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4: Impact of treatment on Profits

	(1) Last 30 days	(2) Weekly	(3) Profit m-2	(4) Profit m-3	(5) Profit m-4	(6) Profit m-5	(7) Profit m-6	(8) Profit m-7
Panel A: 9 months								
Treated	4.437	4.669	-16.599	-29.103	9.601	1.531	10.539	8.729
	(26.941)	(7.231)	(38.491)	(39.555)	(32.409)	(30.101)	(29.326)	(30.752)
Observations	723	723	723	723	723	723	723	723
Control Mean	307.25	72.37	341.30	324.80	280.40	279.12	271.06	289.23
Panel B: 3 year								
Treated	46.998**	13.419**	40.916*	21.575	2.962	14.613	8.977	15.708
	(20.496)	(5.598)	(22.196)	(18.444)	(18.854)	(18.656)	(17.999)	(24.133)
Observations	686	686	686	686	686	686	686	686
Control Mean	213.98	48.49	191.61	176.91	168.70	152.11	149.07	211.23

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Profits in USD PPP. Last 30 days corresponds to the month prior to the survey (Jan 2023 in Panel A; June 2025 in Panel B). Weekly profits is the week before the survey. Profit m-k refers to profits in the k-th month prior to the last-30-days month. Monetary values winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5: Heterogeneous treatment effects

	(1) MM use	(2) Empowerment	(3) Profit
Panel A: 9 months			
Treated	0.225*	0.276**	10.547
	(0.115)	(0.112)	(35.736)
Profit * Treated	0.333*	-0.119	-12.472
	(0.171)	(0.145)	(53.356)
Treated	0.324***	0.195*	14.315
	(0.117)	(0.115)	(33.352)
MM use * Treated	0.100	0.038	-19.661
	(0.165)	(0.131)	(46.239)
Treated	0.431***	0.342***	-6.695
	(0.121)	(0.115)	(37.397)
Empowerment * Treated	-0.110	-0.261*	22.249
	(0.149)	(0.134)	(52.116)
Control Mean	-0.00	-0.00	307.25
Observations	723	723	723
Panel B: 3 year			
Treated	0.344***	0.256**	14.696
	(0.108)	(0.106)	(25.506)
Profit * Treated	0.059	-0.082	69.568
	(0.168)	(0.151)	(48.930)
Treated	0.423***	0.311***	27.085
	(0.123)	(0.108)	(29.117)
MM use * Treated	-0.113	-0.188	40.454
	(0.178)	(0.124)	(45.448)
Treated	0.398***	0.334***	24.448
	(0.112)	(0.103)	(27.416)
Empowerment * Treated	-0.058	-0.242*	45.857
	(0.153)	(0.139)	(41.502)
Control Mean	-0.00	0.00	213.98
Observations	686	686	686

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Each dimension of heterogeneity captures if the woman was above the median in that dimension at baseline. Regressions also control for the dimension of heterogeneity being examined. Business profits is from the last 30 days in USD PPP. Mobile money use index is an index of 8 dimensions of mobile money use excluding loan repayment. Women's empowerment is an index capturing four domains of women's empowerment: financial control, household decision making, requiring the spouse's permission to do certain activities and business decision making. Monetary values winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

References

Aggarwal, S., Brailovskaya, V., and Robinson, J. (2020). Cashing in (and out): Experimental evidence on the effects of mobile money in malawi. *AEA papers and proceedings*, 110:599–604.

Aker, J. C., Boumnijel, R., McClelland, A., and Tierney, N. (2016). Payment mechanisms and antipoverty programs: Evidence from a mobile money cash transfer experiment in niger. *Economic Development and Cultural Change*, 65(1):1–37.

Almås, I., Armand, A., Attanasio, O., and Carneiro, P. (2018). Measuring and changing control: Women's empowerment and targeted transfers. *The Economic Journal*, 128(612):F609–F639.

Alvarez, F. E., Argente, D., Lippi, F., Méndez, E., and Van Patten, D. (2023). Strategic complementarities in a dynamic model of technology adoption: P2p digital payments. Technical report, National Bureau of Economic Research.

Anderson, M. L. (2008). Multiple inference and gender differences in the effects of early intervention: A reevaluation of the abecedarian, perry preschool, and early training projects. *Journal of the American Statistical Association*, 103(484):1481–1495.

Anderson, S. and Baland, J.-M. (2002). The economics of roscas and intrahousehold resource allocation. *The quarterly journal of economics*, 117(3):963–995.

Anderson, S. and Eswaran, M. (2009). What determines female autonomy? evidence from bangladesh. *Journal of development Economics*, 90(2):179–191.

Angelucci, M., Heath, R., and Noble, E. (2023). Multifaceted programs targeting women in fragile settings: Evidence from the democratic republic of congo. *Journal of Development Economics*, 164:103146.

Ashraf, N. (2009). Spousal control and intra-household decision making: An experimental study in the philippines. *American Economic Review*, 99(4):1245–1277.

Ashraf, N., Field, E., and Lee, J. (2014). Household bargaining and excess fertility: an experimental study in zambia. *American Economic Review*, 104(7):2210–2237.

Ashraf, N., Karlan, D., and Yin, W. (2010). Female empowerment: Impact of a commitment savings product in the philippines. *World development*, 38(3):333–344.

Attanasio, O. and Lechene, V. (2002). Tests of income pooling in household decisions. *Review of economic dynamics*, 5(4):720–748.

Bachas, P., Gertler, P., Higgins, S., and Seira, E. (2021). How debit cards enable the poor to save more. *The Journal of finance*, 76(4):1913–1957.

Banerjee, A., Karlan, D., and Zinman, J. (2015). Six randomized evaluations of microcredit: Introduction and further steps. *American Economic Journal: Applied Economics*, 7(1):1–21.

Bastian, G., Bianchi, I., Goldstein, M., and Montalvao, J. (2018). Short-term impacts of improved access to mobile savings, with and without business training: Experimental evidence from tanzania.

Batista, C., Sequeira, S., and Vicente, P. C. (2022). Closing the gender profit gap? *Management Science*, 68(12):8553–8567.

Batista, C. and Vicente, P. C. (2020). Improving access to savings through mobile money: Experimental evidence from african smallholder farmers. *World Development*, 129:104905.

Batista, C. and Vicente, P. C. (2023). Is mobile money changing rural africa? evidence from a field experiment. *Review of Economics and Statistics*, pages 1–29.

Beaman, L., Karlan, D., and Thuysbaert, B. (2014). Saving for a (not so) rainy day: A randomized evaluation of savings groups in mali. Technical report, National Bureau of Economic Research.

Bedoya, G., Coville, A., Haushofer, J., Isaqzadeh, M., and Shapiro, J. P. (2019). No household left behind: Afghanistan targeting the ultra poor impact evaluation. Technical report, National Bureau of Economic Research.

Benjamini, Y., Krieger, A. M., and Yekutieli, D. (2006). Adaptive linear step-up procedures that control the false discovery rate. *Biometrika*, 93(3):491–507.

Bernhardt, A., Field, E., Pande, R., and Rigol, N. (2019). Household matters: Revisiting the returns to capital among female microentrepreneurs. *American Economic Review: Insights*, 1(2):141–160.

Bobonis, G. J. (2009). Is the allocation of resources within the household efficient? New evidence from a randomized experiment. *Journal of Political Economy*, 117(3):453–503.

Breza, E., Kanz, M., and Klapper, L. F. (2020). Learning to navigate a new financial technology: Evidence from payroll accounts. Technical report, National Bureau of Economic Research.

Carranza, E., Donald, A., Grosset, F., and Kaur, S. (2022). The social tax: Redistributive pressure and labor supply. Technical report, National Bureau of Economic Research.

Chang, W., Diaz-Martin, L., Gopalan, A., Guarnieri, E., Jayachandran, S., and Walsh, C. (2020). What works to enhance women's agency: Cross-cutting lessons from experimental and quasi-experimental studies. *J-PAL Working Paper*, 87.

De Mel, S., McIntosh, C., Sheth, K., and Woodruff, C. (2022). Can mobile-linked bank accounts bolster savings? evidence from a randomized controlled trial in sri lanka. *Review of Economics and Statistics*, 104(2):306–320.

Demirgüç-Kunt, A., Klapper, L., Singer, D., and Ansar, S. (2022). The global findex database 2021: Financial inclusion, digital payments, and resilience in the age of covid-19. Technical report.

Dizon, F., Gong, E., and Jones, K. (2020). The effect of promoting savings on informal risk sharing: experimental evidence from vulnerable women in kenya. *Journal of Human Resources*, 55(3):963–998.

Doepke, M. and Tertilt, M. (2019). Does female empowerment promote economic development? *Journal of Economic Growth*, 24:309–343.

Duflo, E. (2012). Women empowerment and economic development. *Journal of Economic literature*, 50(4):1051–1079.

Dupas, P. and Robinson, J. (2013). Saving constraints and microenterprise development: Evidence from a field experiment in kenya. 5:163–192.

Feigenberg, B., Field, E., and Pande, R. (2013). The economic returns to social interaction: Experimental evidence from microfinance. *Review of Economic Studies*, 80(4):1459–1483.

Fiala, N. et al. (2017). Business is tough, but family is worse: Household bargaining and investment in microenterprises in uganda.

Field, E., Pande, R., Rigol, N., Schaner, S., and Troyer Moore, C. (2021). On her own account: How strengthening women's financial control impacts labor supply and gender norms. *American Economic Review*, 111(7):2342–2375.

Giné, X. and Goldberg, J. (2023). Experience in financial decision-making: Field evidence from malawi. *Journal of Development Economics*, 161:103036.

Greco, G., Gulesci, S., Prabhakar, P., and Sulaiman, M. (2025). (digital) cash transfers, privacy and women's empowerment: Evidence from uganda. Technical report, Trinity College Dublin, Economics Department.

Harari, M. (2019). Women's inheritance rights and bargaining power: Evidence from kenya. *Economic Development and Cultural Change*, 68(1):189–238.

Haushofer, J., Ringdal, C., Shapiro, J. P., and Wang, X. Y. (2019). Income changes and intimate partner violence: Evidence from unconditional cash transfers in kenya. Technical report, National Bureau of Economic Research.

Haushofer, J. and Shapiro, J. (2016). The short-term impact of unconditional cash transfers to the poor: experimental evidence from kenya. *The Quarterly Journal of Economics*, 131(4):1973–2042.

Heath, R. and Tan, X. (2020). Intrahousehold bargaining, female autonomy, and labor supply: Theory and evidence from india. *Journal of the European Economic Association*, 18(4):1928–1968.

Hidrobo, M., Peterman, A., and Heise, L. (2016). The effect of cash, vouchers, and food transfers on intimate partner violence: evidence from a randomized experiment in northern ecuador. *American Economic Journal: Applied Economics*, 8(3):284–303.

Higgins, S. (2022). Financial technology adoption: Network externalities of cashless payments in mexico. *Northwestern University: Kellogg School of Management*.

Jack, W. and Suri, T. (2014). Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution. *American Economic Review*, 104(1):183–223.

Jakiela, P. and Ozier, O. (2016). Does africa need a rotten kin theorem? experimental evidence from village economies. *The Review of Economic Studies*, 83(1):231–268.

Jayachandran, S., Biradavolu, M., and Cooper, J. (2023). Using machine learning and qualitative interviews to design a five-question survey module for women's agency. *World Development*, 161:106076.

Kipchumba, E. and Sulaiman, M. (2020). Digital finance and intra-household decision-making: Evidence from mobile money use in kenya.

Lee, J. N., Morduch, J., Ravindran, S., Shonchoy, A., and Zaman, H. (2021). Poverty and migration in the digital age: Experimental evidence on mobile banking in bangladesh. *American Economic Journal: Applied Economics*, 13(1):38–71.

Lee, J. N., Morduch, J., Ravindran, S., and Shonchoy, A. S. (2024). The social meaning of mobile money: Earmarking reduces the willingness to spend in migrant households. *Journal of Economic Behavior & Organization*, 221:675–688.

Majlesi, K. (2016). Labor market opportunities and women's decision making power within households. *Journal of Development Economics*, 119:34–47.

Riley, E. (2018). Mobile money and risk sharing against village shocks. *Journal of Development Economics*, 135:43–58.

Riley, E. (2024). Resisting social pressure in the household using mobile money: Experimental evidence on microenterprise investment in uganda. *American Economic Review*, 114(5):1415–1447.

Riley, E., Shonchoy, A., and Darko Osei, R. (2024). Incentives or endorsement for technology adoption: Evidence from mobile banking in ghana. Technical report, Working Paper.

Schaner, S. (2017). The cost of convenience?: Transaction costs, bargaining power, and savings account use in kenya. *Journal of Human Resources*, 52(4):919–945.

Suri, T. and Jack, W. (2016). The long-run poverty and gender impacts of mobile money. *Science*, 354(6317):1288–1292.

Appendix

For Online Publishing

A Additional tables and figures

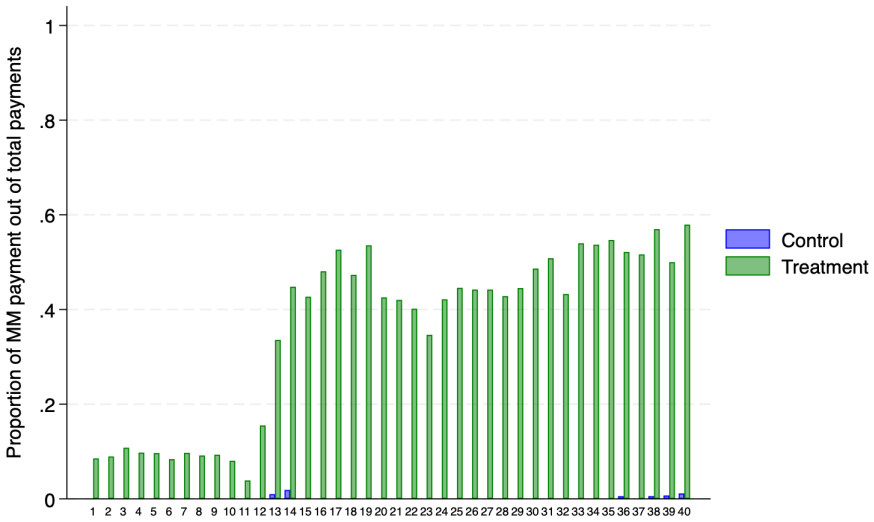


Figure A1: Proportion of payments with mobile money by treatment arm by week
Notes: Proportion of payments made using mobile money each week during first 9-months of the study, by treatment.

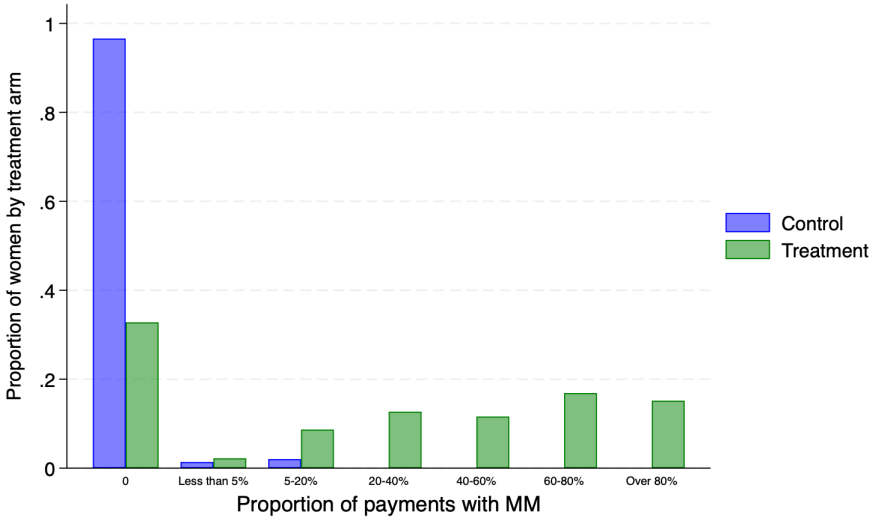


Figure A2: Proportion of payments with mobile money by treatment arm
Notes: Percentage of women making at least that proportion of payments using mobile money during the first 9-months of the study.

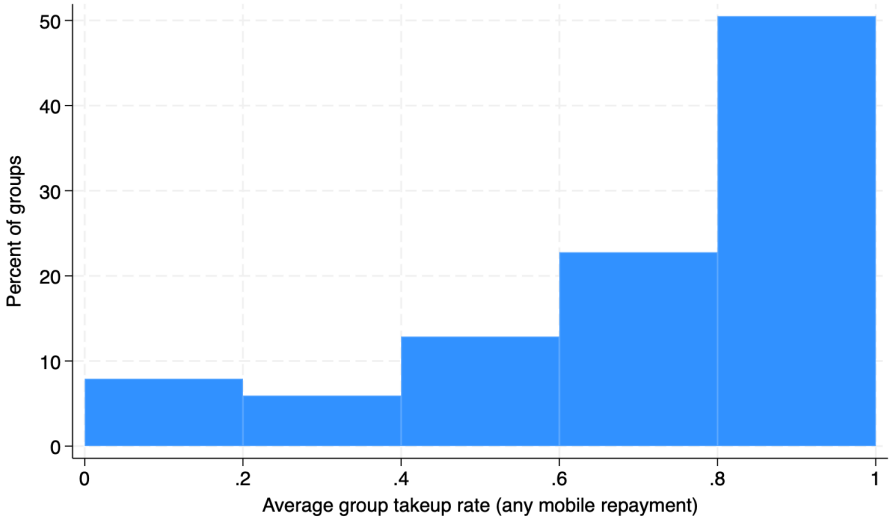


Figure A3: Average take-up rate by group: any mobile payment
Notes: Treatment groups only. Percentage of groups where on average women made at least that proportion of payments using mobile money during the first 9-months of the study.

Table A1: Results from experiments on financial accounts and women's empowerment

			Findings					
	Setting	**Intervention**	**Financial account use**	**Financial control**	**Income (woman)**	**Saving**	**Empowerment**	**Mechanism**
Published								
Aker et al. (2016)	Female social protection recipients Niger	Social protection monthly transfers as mobile money compared to cash.	+***	-	na (all arms receive transfer)	na	+**	Time savings from digital disbursement, plus enhanced privacy of the transfer, increased women's empowerment.
Field et al. (2021)	Married women from rural areas India	Bank account deposit of MGNREGS earnings + training versus bank account provision alone.	+***	+***	+* (earnings past month)	na	+** Only constrained women	Increased financial control over wages raises women's empowerment, increasing labour supply and earnings of women previously constrained from working by their spouse.
Riley (2024)	Urban Uganda, female microfinance clients	Mobile money deposit of microfinance loan to a labelled mobile money account versus cash loan.	- (accounts used short term only)	-	+*** (profits)	-	+***	Increased control over the loan at disbursement led to higher business investment and profits, and empowerment. No persistent effects on mobile money use or deposit of subsequent loas to the account.
Working papers								
Aggarwal et al. (2020)	Entrepreneurs in Malawi	Opened and trained in first mobile money accounts. Withdrawal fees waived	+***	na	-*** (not gender de-aggregated)	+***	na	Increased savings led to shifts from entrepreneurship to agriculture. No effects on transfers. No gender breakdown.
Bastian et al. (2018)	Female entrepreneurs Tanzania	Mobile money saving account encouragement and training, with and without business training. Use of the saving account enabled eligibility for digital credit.	+***	+** (say in how business money is spent)	-	+***/-*** (save more in mobile money and less in other forms, net effect not shown).	+**	Posits financial control enhanced due to privacy of saving on the mobile money account. Access to digital loans also improves in treatment group.
Related but did not look at empowerment directly								
Batista et al. (2022)	Female entrepreneurs Mozambique	Mobile savings account (incentivised) cross-cut with financial management training	+***	na	+*** (profits)	+*** mobile money savings. Total saving not reported	na	Increased saving through the mobile money accounts allowed women to invest in their businesses and raise profits.
Breza et al. (2020)	Female garment workers Bangladesh	Switched wage payments from cash to a bank or mobile money account.	+***	na	na	+***	na	See improved shock coping ability from higher savings due to wage payments via mobile money.
Greco et al. (2025)	Refugees Uganda	One-off $50 cash transfer as cash or mobile money crossed with with privacy or spouse informed	na	+***	+**	na	+***	Women invest the cash transfer in their own income-generating activity when it's received as mobile money, raising their income and empowerment. No effects of privacy.
Non-experimental								
Kipchumba and Sulaiman (2020)	Kenya	NA - instrumented for use of mobile money with roll out	na	+***	na	na	+***	Suggestive evidence that privacy is the mechanism through which financial control increases.

Where a study has multiple treatment arms, only arms including financial accounts and discussed in the intervention description are included in this table. + denotes positive effect on outcome. − denotes negative effect on outcome. - denotes outcome examined and no effect. Na denotes outcome not examined. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A2: Summary Statistics: Mwanza vs rest of Tanzania

Panel A	*Mwanza*	*Rest of Tanzania*
Completed primary education	0.907	0.833
Completed secondary education	0.330	0.305
Married	0.394	0.438
HH size	6.275	5.979
Number of children	2.735	2.637
Works outside home currently	0.484	0.605
Self employed	0.248	0.282
Participates in decisions about large hh purchases	0.708	0.638
Owns mobile phone	0.662	0.588
Has completed a mobile financial transaction in last 12 months	0.406	0.441
Observations	592	14,662

Panel B (within-Mwanza)	*Self-Emp*	*Not Self Emp*
Completed primary education	0.916	0.904
Completed secondary education	0.219	0.367
Married	0.483	0.365
HH size	5.796	6.434
Number of children	4.042	2.304
Participates in decisions about large hh purchases	0.765	0.686
Owns mobile phone	0.897	0.584
Has completed a mobile financial transaction in last 12 months	0.599	0.342
Observations	141	451

Source is the 2022 Tanzania Demographic and Health Survey women's sample (eligible women were ages 15-49). Sampling weights used. Self employment is defined by answering "self-employed" to the question asked to women who indicated currently working: "Do you work for your family, for someone else, or self-employed." It may thus be an underestimate of self-employment because it misses those whose business is not currently active.

Table A3: Summary statistics marriage and spouse of married women

	Mean	Std dev.	25th	50th	75th
Married	0.66	0.47	0.00	1.00	1.00
Widowed	0.11	0.32	0.00	0.00	0.00
Divorced	0.14	0.35	0.00	0.00	0.00
Never married	0.08	0.28	0.00	0.00	0.00
Spouse Characteristics					
Spouse age	45.32	9.87	38.00	45.00	51.00
Spouse age difference	7.46	6.90	3.00	6.00	10.00
Long married (yrs)	17.20	9.26	10.00	16.00	23.00
Spouse Completed Primary Education	0.97	0.17	1.00	1.00	1.00
Spouse Completed Secondary Education	0.40	0.49	0.00	0.00	1.00
Spouse works	0.95	0.22	1.00	1.00	1.00
Spouse income	455.89	340.23	224.57	393.00	572.66
Observations	750				

This table shows baseline summary statistics for variables related to marital status and the spouses of married women

Table A4: Summary statistics mobile money

	Mean	Std dev.	Min	25th	50th	75th	Max
Mobile Money Use							
Used MM	0.96	0.20	0.00	1.00	1.00	1.00	1.00
Used MM this week	0.41	0.49	0.00	0.00	0.00	1.00	1.00
Number of services used 30 days	2.35	1.93	0.00	1.00	2.00	4.00	10.00
Sent money 30 days	0.60	0.49	0.00	0.00	1.00	1.00	1.00
Received money 30 days	0.83	0.38	0.00	1.00	1.00	1.00	1.00
Deposited money 30 days	0.30	0.46	0.00	0.00	0.00	1.00	1.00
Purchased airtime 30 days	0.54	0.50	0.00	0.00	1.00	1.00	1.00
Paid bill 30 days	0.39	0.49	0.00	0.00	0.00	1.00	1.00
Purchased good/service 30 days	0.06	0.24	0.00	0.00	0.00	0.00	1.00
Payment customer 30 days	0.17	0.37	0.00	0.00	0.00	0.00	1.00
Paid supplier 30 days	0.04	0.20	0.00	0.00	0.00	0.00	1.00
Paid school fees 30 days	0.01	0.12	0.00	0.00	0.00	0.00	1.00
Received benefit gov 30 days	0.05	0.21	0.00	0.00	0.00	0.00	1.00
Received wage 30 days	0.01	0.07	0.00	0.00	0.00	0.00	1.00
MM loan ever	0.27	0.44	0.00	0.00	0.00	1.00	1.00
Saves with MM	0.15	0.36	0.00	0.00	0.00	0.00	1.00
Savings value MM	16.01	57.57	0.00	0.00	0.00	0.00	449.15
Mobile Money Comfort							
Comfort leave 30,000 UGX 30 days	6.29	3.57	0.00	3.00	7.00	10.00	10.00
Happy leave month	0.35	0.48	0.00	0.00	0.00	1.00	1.00
Comfort complete transactions	4.11	1.43	0.00	4.00	5.00	5.00	5.00
Comfort correct error	3.82	1.56	0.00	3.00	5.00	5.00	5.00
Comfort reverse transaction	3.98	1.49	0.00	3.00	5.00	5.00	5.00
Comfort send money	4.09	1.47	0.00	4.00	5.00	5.00	5.00
Comfort check balance	4.19	1.41	0.00	4.00	5.00	5.00	5.00
Easily access MM wallet	4.23	1.30	0.00	4.00	5.00	5.00	5.00
Makes MM transactions herself	0.81	0.40	0.00	1.00	1.00	1.00	1.00
Others know PIN	0.44	0.50	0.00	0.00	0.00	1.00	1.00
Mobile Money Preferences							
Chooses MM in game	0.10	0.30	0.00	0.00	0.00	0.00	1.00
Easier to save in MM	3.71	1.50	0.00	3.00	4.00	5.00	5.00
Willing make loan repayments MM	0.51	0.50	0.00	0.00	1.00	1.00	1.00
Mobile Money Trust							
Trust in MM network provider	4.33	0.94	1.00	4.00	5.00	5.00	5.00
Trust in MM agent	4.67	0.68	2.00	5.00	5.00	5.00	5.00
Likelihood experience fraud	6.25	3.26	1.00	4.00	6.50	10.00	10.00
Not worried experience fraud	6.22	3.33	1.00	3.00	6.00	10.00	10.00
Confidence detect fraud attempts	7.73	2.75	1.00	7.00	9.00	10.00	10.00
Agrees cost fair	3.02	1.54	1.00	2.00	3.00	5.00	5.00
Observations	750						

This table shows baseline summary statistics for variables related to mobile money use and preferences

Table A5: Summary statistics and balance test - combined treatment

Variable	(1) Control	(2) Treatment	(3) Difference
Age	39.337	38.168	-1.190
	(9.223)	(9.136)	(0.872)
Completed Primary Education	0.924	0.942	0.018
	(0.266)	(0.234)	(0.020)
Completed Secondary Education	0.245	0.220	-0.025
	(0.431)	(0.414)	(0.035)
Married	0.695	0.643	-0.051
	(0.461)	(0.480)	(0.036)
HH size	5.177	5.158	-0.024
	(1.928)	(1.930)	(0.189)
Children under 12	1.309	1.395	0.079
	(0.923)	(0.931)	(0.081)
Last 30 days profit	327.533	299.443	-27.722
	(294.845)	(271.424)	(19.362)
Business sales value	788.648	755.505	-30.818
	(834.696)	(829.132)	(60.661)
Inventory value	685.947	784.431	101.509
	(974.057)	(997.740)	(77.199)
Business experience (yr)	7.455	6.983	-0.484
	(5.985)	(6.176)	(0.492)
Has employees	0.341	0.331	-0.010
	(0.475)	(0.471)	(0.040)
Retail	0.610	0.653	0.042
	(0.489)	(0.477)	(0.046)
Food vendor	0.189	0.158	-0.033
	(0.392)	(0.365)	(0.031)
Services	0.149	0.168	0.019
	(0.356)	(0.374)	(0.032)
Used MM	0.980	0.950	-0.032**
	(0.141)	(0.218)	(0.014)
Mobile money use index	0.011	-0.005	-0.014
	(0.999)	(1.001)	(0.090)
Empowerment index	-0.029	0.015	0.048
	(1.018)	(0.992)	(0.083)
HH total monthly income	663.959	610.472	-52.811
	(479.798)	(496.808)	(35.401)
Total monthly consumption	415.645	401.003	-13.894
	(235.447)	(264.331)	(25.089)
Total savings value	418.686	351.967	-65.996
	(786.896)	(551.168)	(50.932)
Saves with MM	0.161	0.146	-0.015
	(0.368)	(0.353)	(0.029)
Savings value MM	17.037	15.496	-1.572
	(55.423)	(58.656)	(4.087)
Net loans value	1,123.621	1,097.898	-28.969
	(756.381)	(694.994)	(73.861)
Principal outstanding	881.485	858.261	-25.427
	(467.730)	(509.975)	(49.331)
Disbursed amount	1,219.367	1,192.342	-30.088
	(537.636)	(600.143)	(57.690)
Observations	249	501	750

All monetary amounts in USD PPP. Column (1) shows the mean and standard deviation in parentheses in the control group. Column (2) shows the mean and standard deviation in parentheses in the treatment group. Column (3) shows the difference and standard error from a regression of each variable on a treatment indicator, controlling for strata and clustering the standard errors at the group level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A6: Summary statistics and balance test - separate treatments

	Control		MM weekly		MM bi-weekly		T-test p-value			F- test p-value	
	(1)		(2)		(3)		(1)-(3)	(1)-(2)	(3)-(2)	(4)	(5)
	mean	sd	mean	sd	mean	sd				joint	pooled
Age	39.34	9.22	37.94	9.11	38.40	9.18	0.35	0.17	0.66	0.37	0.18
Completed primary education	0.92	0.27	0.95	0.21	0.93	0.25	0.72	0.23	0.35	0.42	0.39
Completed secondary education	0.24	0.43	0.22	0.42	0.22	0.41	0.51	0.56	0.94	0.78	0.48
Married	0.69	0.46	0.66	0.47	0.62	0.49	0.10	0.45	0.38	0.26	0.16
HH Size	5.18	1.93	5.12	1.93	5.19	1.93	0.93	0.80	0.71	0.93	0.92
Children under 12	1.31	0.92	1.35	0.98	1.44	0.88	0.18	0.65	0.34	0.37	0.32
Last 30 days profit	327.53	294.84	307.66	286.02	291.32	256.50	0.29	0.58	0.61	0.56	0.37
Business sales value	788.65	834.70	792.89	873.80	718.57	782.49	0.46	0.97	0.44	0.67	0.69
Inventory value	685.95	974.06	864.99	1014.74	704.83	976.14	0.85	0.08	0.12	0.16	0.25
Business experience (yrs)	7.46	5.99	7.48	6.68	6.50	5.61	0.08	0.97	0.10	0.13	0.36
Has employees	0.34	0.48	0.33	0.47	0.34	0.47	0.93	0.75	0.80	0.95	0.80
Retail	0.61	0.49	0.63	0.48	0.68	0.47	0.20	0.75	0.24	0.36	0.36
Food Vendor	0.19	0.39	0.15	0.36	0.16	0.37	0.48	0.31	0.77	0.59	0.33
Services	0.15	0.36	0.20	0.40	0.14	0.35	0.80	0.20	0.12	0.25	0.56
Used MM	0.98	0.14	0.94	0.24	0.96	0.20	0.20	0.07	0.39	0.12	0.04
MM Use index	0.01	1.00	0.03	1.12	-0.05	0.87	0.60	0.83	0.46	0.74	0.87
Empowerment Index	-0.03	1.02	0.02	1.03	0.01	0.96	0.69	0.64	0.88	0.88	0.61
HH total monthly income	663.96	479.80	634.08	527.75	587.15	464.09	0.20	0.63	0.44	0.43	0.32
Total monthly consumption	415.65	235.45	412.09	275.73	390.04	252.63	0.43	0.91	0.52	0.71	0.59
Total savings value	418.69	786.90	342.46	491.08	361.36	605.55	0.38	0.18	0.73	0.41	0.22
Saves with MM	0.16	0.37	0.16	0.36	0.13	0.34	0.47	0.91	0.58	0.75	0.62
Saving value MM	17.04	55.42	19.24	69.62	11.79	45.13	0.23	0.68	0.16	0.28	0.71
Net loans value	1123.62	756.38	1102.62	682.53	1093.23	708.42	0.74	0.80	0.91	0.94	0.74
Principal outstanding	881.49	467.73	827.23	483.02	888.92	534.47	0.90	0.31	0.30	0.47	0.64
Disbursed amount	1219.37	537.64	1156.01	596.90	1228.24	602.36	0.90	0.31	0.31	0.48	0.64
Obs	249.00		249.00		252.00						

Table A7: Attrition by treatment and baseline characteristics

	(1) 9-month	(2) 3-year	(3) 9-month	(4) 3-year
Treated	0.012	0.002		
	(0.013)	(0.021)		
Age			-0.001	-0.002*
			(0.001)	(0.001)
Completed Primary Education			-0.006	0.025
			(0.032)	(0.034)
Completed Secondary Education			-0.024	0.009
			(0.018)	(0.029)
Married			-0.011	-0.034
			(0.019)	(0.029)
HH size			-0.007	-0.013**
			(0.005)	(0.007)
Children under 12			0.004	0.018
			(0.010)	(0.014)
Last 30 days profit			-0.008	0.039
			(0.028)	(0.069)
Business experience (yr)			-0.001	-0.000
			(0.001)	(0.002)
Inventory value			-0.012***	0.013
			(0.005)	(0.014)
Asset value			0.001	-0.012
			(0.004)	(0.010)
Has employees			-0.007	-0.000
			(0.015)	(0.023)
Mobile money use index			-0.007	-0.010
			(0.007)	(0.014)
Used MM			0.013	-0.025
			(0.035)	(0.055)
Willing make loan repayments MM			-0.020	-0.005
			(0.013)	(0.021)
Empowerment index			0.001	-0.003
			(0.007)	(0.011)
Social cohesion index			-0.005	0.004
			(0.006)	(0.010)
HH total monthly income			0.023	0.009
			(0.018)	(0.041)
HH food consumption			-0.038	-0.048
			(0.031)	(0.058)
Saves with MM			0.043*	0.069*
			(0.025)	(0.041)
Net loans value			-0.014	-0.009
			(0.009)	(0.017)
Observations	750	750	750	750
Control Mean	0.028	0.084	0.028	0.084

The dependent variable is an indicator for not completing the follow-up survey. All regressions include stratification fixed effects. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. All values in USD PPP and winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A8: Takeup by treatment status (first 9-months)

	(1) Any payment	(2) At least 10	(3) Number payments	(4) Share payments
Treated	0.635***	0.423***	7.993***	0.320***
	(0.032)	(0.033)	(0.603)	(0.023)
Observations	750	750	750	750
Control Mean	0.020	0.000	0.040	0.001

All regressions control for stratification fixed effects. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Any payment is any loan repayment made using mobile money (pre-specified). At least 10 is 10 or more loan repayments made using mobile money (pre-specified). Number of payments is the number of loan repayments made using mobile money, out on 23 on average. Share of payments is number of payments made using mobile money as a proportion of all loan repayment made during the study. All outcomes use administrative data and are definied over the first 9 months of the study. Control mean is the mean of the outcome in the control group during the followup round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A9: Takeup by baseline characteristics in the treatment group

	(1) Any payment	(2) At least 10	(3) Number payments	(4) Share payments
Age	0.000	-0.001	-0.080	-0.001
	(0.003)	(0.003)	(0.049)	(0.002)
Completed Primary Education	-0.044	-0.038	0.229	-0.008
	(0.083)	(0.090)	(1.399)	(0.055)
Completed Secondary Education	-0.059	-0.040	-0.862	-0.029
	(0.054)	(0.054)	(0.893)	(0.034)
Married	-0.033	-0.009	-0.274	-0.006
	(0.051)	(0.051)	(0.917)	(0.033)
HH size	0.026*	0.010	0.097	0.009
	(0.013)	(0.016)	(0.276)	(0.011)
Children under 12	-0.077**	-0.045	-0.653	-0.034
	(0.031)	(0.033)	(0.511)	(0.021)
Last 30 days profit	0.101	-0.094	-0.627	0.005
	(0.098)	(0.104)	(2.000)	(0.073)
Inventory value	0.017	0.040*	0.376	0.027*
	(0.023)	(0.022)	(0.457)	(0.016)
Asset value	0.033	0.059***	1.001***	0.037***
	(0.022)	(0.021)	(0.321)	(0.013)
Used MM	0.223**	0.115	1.723	0.104*
	(0.103)	(0.089)	(1.472)	(0.062)
Mobile money use index	-0.028	-0.001	0.072	-0.001
	(0.024)	(0.026)	(0.474)	(0.018)
Willing make loan repayments MM	-0.022	-0.037	-0.500	-0.018
	(0.044)	(0.049)	(0.778)	(0.031)
Financial control index	-0.042*	-0.031	-0.205	-0.013
	(0.023)	(0.025)	(0.457)	(0.017)
HH decision index	-0.038*	-0.065***	-0.563	-0.033**
	(0.022)	(0.023)	(0.376)	(0.015)
HH food consumption	-0.044	-0.009	0.919	0.011
	(0.119)	(0.145)	(3.081)	(0.110)
Disbursed amount	0.012	0.004	-1.229	-0.014
	(0.042)	(0.046)	(0.756)	(0.029)
Observations	501	501	501	501

All regressions control for stratification fixed effects. Any payment is any loan repayment made using mobile money. At least 10 is 10 or more loan repayments made using mobile money. Number of payments is the number of loan repayments made using mobile money. Share payments is the proportion of all loan repayments made using mobile money Control mean is the mean of the outcome in the control group at endline. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A10: Impact of treatment on using mobile money for microfinance loan repayment - 3 year followup

	(1)	(2)	(3)	(4)	(5)	(6)
	Index	Repaid mobile money	Confidence repay mobile money	Current payment mobile money	Number payment mobile money	Training payment mobile money
Treated	0.506***	0.515***	0.285***	0.202***	3.552***	0.212***
	(0.086)	(0.036)	(0.099)	(0.051)	(0.690)	(0.036)
Observations	686	686	686	254	254	635
Control Mean	0.00	0.14	3.35	0.12	1.50	0.67

All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index of columns (2)-(3). Column (2) is whether the woman reports ever having made a microfinance loan repayment using mobile money. Column (3) is the woman's confidence in making loan repayments using mobile money. Columns (4) and (5) are only for current microfinance clients. Column (4) is a dummy for the current installment being made with mobile money. Column (5) is the number of repayments made with mobile money in the current loan cycle, out of 13 on average. Column (6) is whether the woman reports receiving any training on how to make loan repayments using mobile money. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A11: Impact of treatment on mobile money use, empowerment and business profits

	(1) Mobile money use index	(2) Empowerment index	(3) Business profits
Panel A: 9 months			
Treated	0.374	0.215	4.437
	(0.097)	(0.085)	(26.941)
	[0.000]***	[0.012]**	[0.869]
	{0.001}***	{0.013}**	{0.408}
Observations	723	723	723
Control Mean	-0.00	-0.00	307.25
Panel B: 3 years			
Treated	0.369	0.217	46.998
	(0.089)	(0.084)	(20.496)
	[0.000]***	[0.010]***	[0.022]**
	{0.001}***	{0.010}***	{0.015}**
Observations	686	686	686
Control Mean	-0.00	0.00	213.98

All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. Mobile money use index is an index of 8 dimensions of mobile money use excluding loan repayment. Women's empowerment is an index capturing four domains: financial control, household decision making, needing spouse permission, and business decision making. Business profits is from the last 30 days in USD PPP. Monetary values winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust p-value in square brackets. False discovery rate (FDR) adjusted p-values, also known as q-values, are shown in curly brackets and are calculated following Benjamini et al. (2006). *** $q < 0.01$, ** $q < 0.05$, * $q < 0.1$

Table A12: Impact of treatment on mobile money use, empowerment and business profits - robustness to excluding control variables

	(1) Mobile money use index	(2) Empowerment index	(3) Business profits
Panel A: 9 months			
Treated	0.374	0.259	4.437
	(0.098)	(0.096)	(27.239)
	[0.000]***	[0.007]***	[0.871]
	{0.001}***	{0.008}***	{0.410}
Observations	723	723	723
Control Mean	-0.00	-0.00	307.25
Panel B: 3 years			
Treated	0.369	0.235	46.998
	(0.090)	(0.088)	(20.731)
	[0.000]***	[0.008]***	[0.025]**
	{0.001}***	{0.009}***	{0.013}**
Observations	686	686	686
Control Mean	-0.00	0.00	213.98

All regressions include stratification fixed effects and use of mobile money at baseline. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. Mobile money use index is an index of 8 dimensions of mobile money use excluding loan repayment. Women's empowerment is an index capturing four domains: financial control, household decision making, needing spouse permission, and business decision making. Business profits is from the last 30 days in USD PPP. Monetary values winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust p-value in square brackets. False discovery rate (FDR) adjusted p-values, also known as q-values, are shown in curly brackets and are calculated following Benjamini et al. (2006).

Table A13: Impact of treatment on mobile money use, empowerment and business profits by sub-treatment

	(1) Mobile money use index	(2) Empowerment index	(3) Business profits
Panel A: 9 months			
MM Weekly	0.381***	0.242**	-2.255
	(0.112)	(0.095)	(29.776)
MM Biweekly	0.367***	0.188*	11.264
	(0.110)	(0.101)	(32.011)
P-value Biweekly=Weekly	0.90	0.58	0.65
Control Mean	-0.00	-0.00	307.25
Observations	723	723	723
Panel B: 3 year			
MM Weekly	0.447***	0.207**	57.574**
	(0.100)	(0.091)	(27.474)
MM Biweekly	0.287***	0.226**	35.895*
	(0.107)	(0.095)	(21.325)
P-value Biweekly=Weekly	0.14	0.82	0.43
Control Mean	-0.00	0.00	213.98
Observations	686	686	686

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline and control variables selected by LASSO. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Mobile money use index is an index of 8 dimensions of mobile money use excluding loan repayment. Women's empowerment is an index capturing four domains of women's empowerment: financial control, household decision making, requiring the spouse's permission to do certain activities and business decision making. Business profits is from the last 30 days in USD PPP. Monetary values winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A14: Instrumental variable regression of the impact of any loan repayment with mobile money on mobile money use, empowerment and business profits

	(1) Mobile money use index	(2) Empowerment index	(3) Business profits
Panel A: 9 months			
Any MM loan repayment	0.580***	0.402***	6.837
	(0.147)	(0.144)	(41.487)
Observations	723	723	723
Control Mean	-0.00	-0.00	307.25
Panel B: 3 year			
Any MM loan repayment	0.564***	0.359***	71.473**
	(0.130)	(0.131)	(30.916)
Observations	686	686	686
Control Mean	-0.00	0.00	213.98

Instrumental variable regression where any use of mobile money for loan repayment is instrumented by treatment assignment. Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline and control variables selected by LASSO. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. Any MM loan repayment is an indicator for making at least one loan repayment using mobile money. The instrument is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Mobile money use index is an index of 8 dimensions of mobile money use excluding loan repayment. Women's empowerment is an index capturing four domains of women's empowerment: financial control, household decision making, requiring the spouse's permission to do certain activities and business decision making. Business profits is from the last 30 days in USD PPP. Monetary values winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A15: Impact of treatment on the value of mobile money transactions

	(1) Total value	(2) Money sent	(3) Money received	(4) Savings/ deposits	(5) Airtime	(6) Bill payment	(7) Purchase goods	(8) Payments customers	(9) Purchase supplier	(10) School fees	(11) Receive wage
Panel A: 9 months											
Treated	35.294**	3.710	1.454	12.048*	-0.025	0.242	-4.202	9.034**	1.803	9.803**	1.011
	(16.722)	(7.119)	(7.667)	(6.324)	(0.487)	(0.927)	(2.808)	(3.844)	(4.742)	(4.136)	(1.003)
Observations	723	723	723	723	723	723	723	656	656	723	723
Control Mean	110.64	27.32	48.14	13.52	1.55	4.26	7.06	3.62	5.48	0.70	0.00
Panel B: 3 year											
Treated	112.879***	17.944**	30.515**	21.349***	0.375	-0.920*	8.938	16.074*	6.790**	4.432**	10.739**
	(24.741)	(7.180)	(13.102)	(7.577)	(0.314)	(0.549)	(5.908)	(9.249)	(3.128)	(1.836)	(4.414)
Observations	686	686	686	686	686	686	686	553	553	686	686
Control Mean	124.53	23.61	56.95	21.82	1.33	3.34	2.79	11.74	3.11	0.49	2.22

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. All outcomes refer to the USD PPP value of mobile money transactions in the last 30 days for that purpose. Money sent/received are remittances. Savings/deposits are deposits to the mobile money account (excluding loan repayment). Purchase goods/supplier and payments customers refer to business-related transactions. Monetary values winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A16: Impact of treatment on Mobile Money Comfort

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Index	Leave 30,000	Leave month	Complete transaction	Correct error	Reverse transaction	Send money	Check balance	Ease transact	Makes transactions herself
Panel A: 9 months										
Treated	0.165*	0.239	0.052	0.171	0.203	0.239*	0.221*	0.116	0.060	0.060**
	(0.086)	(0.233)	(0.044)	(0.112)	(0.142)	(0.133)	(0.114)	(0.104)	(0.084)	(0.029)
Observations	723	723	723	723	723	723	723	723	723	723
Control Mean	0.00	6.17	0.29	3.95	3.42	3.45	4.00	4.20	4.38	0.76
Panel B: 3 year										
Treated	0.070	-0.001	-0.035	-0.040	0.200	0.234	0.018	-0.006	0.078	0.062**
	(0.079)	(0.247)	(0.041)	(0.122)	(0.162)	(0.152)	(0.122)	(0.145)	(0.120)	(0.030)
Observations	686	686	686	686	686	686	686	686	686	686
Control Mean	0.00	6.70	0.36	4.10	3.13	2.93	4.07	4.08	4.36	0.74

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index composed of the components of columns (2)–(10). All variables are coded such that higher is more comfortable. Column (2) is a 1–10 scale of whether the woman would be comfortable having 30,000 TSH in her mobile money account. Column (3) is a dummy for whether the woman would be happy leaving money on her mobile for a month or longer. Columns (4)–(9) ask comfort (1–5) with different mobile money actions. Column (10) is a dummy for whether the woman makes mobile money transactions herself. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A17: Impact of treatment on Mobile Money Preference

	(1) Index	(2) Selects MM incentive	(3) Easier save MM	(4) Prefers MM loan repay
Panel A: 9 months				
Treated	-0.168**	-0.002	-0.117	-0.127***
	(0.083)	(0.027)	(0.140)	(0.045)
Observations	723	723	723	723
Control Mean	0.00	0.15	3.90	0.51
Panel B: 3 year				
Treated	-0.059	-0.043	-0.077	-0.002
	(0.081)	(0.030)	(0.152)	(0.042)
Observations	686	686	686	686
Control Mean	0.00	0.27	3.50	0.38

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index composed of the components of columns (2)–(4). Column (2) is a dummy for whether when offered 20,000 TSH as cash or mobile money the woman selects mobile money. Column (3) is agreement (1–5) that it is easier to save with mobile money. Column (4) is whether the woman would prefer to make loan repayments using mobile money instead of cash. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A18: Impact of treatment on Mobile Money Trust

	(1) Index	(2) MM safe	(3) Trust MNO	(4) Trust own agent	(5) Trust agents	(6) Fraud unlikely	(7) Not worried fraud	(8) Deal fraud	(9) Cost fair
Panel A: 9 months									
Treated	0.027	0.046	-0.157	-0.181	0.110	0.373	0.174	-0.234	-0.157
	(0.090)	(0.089)	(0.097)	(0.217)	(0.159)	(0.261)	(0.303)	(0.325)	(0.145)
Observations	694	694	694	393	393	694	694	694	691
Control Mean	0.00	4.40	4.38	3.04	3.84	5.71	5.96	6.56	3.52
Panel B: 3 year									
Treated	-0.004	-0.070	-0.044	-0.113	-0.104	0.388	0.003	0.406	-0.199
	(0.097)	(0.180)	(0.120)	(0.211)	(0.142)	(0.389)	(0.342)	(0.364)	(0.156)
Observations	659	659	659	375	375	659	659	659	656
Control Mean	-0.00	3.56	4.08	3.04	3.87	4.83	5.22	6.23	2.90

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index composed of the components of columns (2)–(9). Questions are coded so higher values correspond to greater trust. Columns (2)–(5) are statements (1–5) on safety and trust in mobile money operators/agents. Columns (6)–(8) measure fraud beliefs/concerns (1–10). Column (9) is a 1–5 scale of whether costs are fair. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A19: Impact of treatment on Mobile Money Problems - 9 months

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Index	System Down	Unclear Transaction	Delay Transaction	Difficulty Contact	Wrong Number	Transaction Often Fails	Agent Absent	Agent No Float	Agent System Down	Agent Overcharge
Treated	0.095	0.052	0.039	0.046	0.019	0.013	0.075	0.009	0.068	-0.039	0.020
	(0.093)	(0.043)	(0.031)	(0.040)	(0.032)	(0.019)	(0.068)	(0.035)	(0.041)	(0.032)	(0.018)
Observations	645	521	521	521	521	521	645	521	521	521	521
Control Mean	-0.00	0.19	0.11	0.17	0.12	0.03	1.31	0.16	0.18	0.15	0.03

All regression include stratification fixed effects, use of mobile money at baseline and control variables selected by LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index composed of the components of columns (2)-(11). Columns (2)-(6) are dummy variables capturing if the woman experienced that problem when making a transaction. Column (7) is a 1-5 scale for how much the woman agrees that transactions often fail, where higher is disagrees. Columns (8)-(11) are dummy variables capturing problems experienced with mobile money agrents. Control mean is the mean of the outcome in the control group at endline. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A20: Impact of treatment on Empowerment

	(1) Empowerment index	(2) Financial Control index	(3) Permission index	(4) HH decision index	(5) Bus decision index
Panel A: 9 months					
Treated	0.215**	0.371***	0.014	0.216**	-0.055
	(0.085)	(0.102)	(0.120)	(0.090)	(0.078)
Observations	723	723	487	723	723
Control Mean	-0.00	0.00	-0.00	-0.00	-0.00
Panel B: 3 year					
Treated	0.217***	0.389***	-0.044	0.175**	-0.033
	(0.084)	(0.095)	(0.113)	(0.077)	(0.075)
Observations	686	686	407	686	686
Control Mean	0.00	-0.00	-0.00	-0.00	-0.00

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is composed of the elements of columns (2)-(5). Financial control is an index capturing (less) pressure to share money with the spouse and willingness to pay to control money. Permission is an index capturing whether the woman requires the spouse permission to do different activities (married women only). HH decision is an index capturing who makes decisions in the household across 8 domains. Bus decision is an index capturing who makes the decisions in the woman's business across 4 domains. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A21: Impact of treatment on business decisions

	(1) Index	(2) Loan	(3) Purchases	(4) Pricing	(5) Employees
Panel A: 9 months					
Treated	-0.055	-0.022	0.005	-0.022	-0.004
	(0.078)	(0.036)	(0.039)	(0.025)	(0.040)
Observations	723	723	723	723	723
Control Mean	-0.00	0.40	0.76	0.89	0.76
Panel B: 3 year					
Treated	-0.033	-0.039	0.010	-0.003	0.022
	(0.075)	(0.038)	(0.031)	(0.030)	(0.030)
Observations	686	686	686	686	686
Control Mean	-0.00	0.48	0.79	0.86	0.80

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index of columns (2)–(5). Columns (2)–(5) are dummy variables for whether the woman makes different decisions in her business alone. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A22: Impact of treatment on spousal permission

	(1) Index	(2) Bank account	(3) Take loan	(4) Visit market	(5) Visit friend locally	(6) Visit friend far	(7) Work
Panel A: 9 months							
Treated	0.014	-0.025	-0.029	-0.026	0.026	0.017	0.105*
	(0.120)	(0.057)	(0.047)	(0.043)	(0.052)	(0.049)	(0.053)
Observations	487	487	487	487	487	487	487
Control Mean	-0.00	0.43	0.22	0.16	0.25	0.60	0.51
Panel B: 3 year							
Treated	-0.044	-0.072	0.014	-0.070	-0.029	0.056	-0.011
	(0.113)	(0.053)	(0.049)	(0.046)	(0.055)	(0.054)	(0.054)
Observations	407	407	407	407	407	407	407
Control Mean	-0.00	0.43	0.25	0.34	0.45	0.68	0.69

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index of columns (2)–(7). Each column shows a regression of a dummy variable for whether the woman requires her husband's permission to do that activity. Regressions restricted to married women only. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A23: Impact of treatment on Norms - 3 year followup

	(1) Index	(2) Decisions man own	(3) Decisions man community	(4) IGA own	(5) IGA community	(6) Earn more own	(7) Earn more community
Treated	-0.158*	0.068	-0.192	-0.046	-0.247***	-0.180	-0.180
	(0.082)	(0.086)	(0.121)	(0.046)	(0.087)	(0.139)	(0.160)
Observations	686	686	686	686	686	686	686
Control Mean	0.00	1.30	1.83	1.14	1.51	2.54	3.09

All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Questions asked at the 3 year followup only. Column (1) is an index of columns (2)-(7). Columns (2)-(7) are out of 5 where higher values indicate worse gender norms. Column (2) is own views and columns (3) views about the community opinion on whether the important decisions in the family should be made by the man. Column (4) is own views and column (5) views about the community opinion on whether a woman should not have her own income generating activity. Column (6) is own views and column (7) views on the community opinion about whether it will cause problems if a woman earns more than her husband. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A24: Impact of treatment on Well-being

	(1) Index	(2) Happiness scale	(3) Discord with spouse (r)
Panel A: 9 months			
Treated	0.007	-0.206	0.064
	(0.091)	(0.187)	(0.063)
Observations	723	723	486
Control Mean	0.00	5.76	0.71
Panel B: 3 year			
Treated	0.014	-0.113	0.004
	(0.091)	(0.270)	(0.039)
Observations	686	686	407
Control Mean	0.00	6.02	0.81

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index of columns (2)-(3). Column (2) is a 1–10 scale for the woman's happiness. Column (3) is a dummy for any major argument with the spouse in the last 30 days - (r) indicates reversed so that higher values mean less discord. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A25: Impact of treatment on Other Business Outcomes

	(1) Business Sales	(2) Business Expenses	(3) Profit (calculated)	(4) Business Capital
Panel A: 9 months				
Treated	77.324	37.782	37.041	-113.465
	(101.429)	(78.922)	(63.688)	(106.052)
Observations	723	723	723	723
Control Mean	869.40	605.55	263.86	910.59
Panel B: 3 year				
Treated	198.486**	63.704	128.074**	46.128
	(88.306)	(63.388)	(52.734)	(117.048)
Observations	686	686	686	686
Control Mean	625.71	378.88	246.83	773.81

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Values in USD PPP. Columns (1) and (2) refer to the last 30 days. Column (3) is a stock measure of business capital. Monetary values winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A26: Impact of treatment on Labour and Operating Outcomes

	(1) Business hours	(2) Has employees	(3) Last 30 days operating	(4) Business operating
Panel A: 9 months				
Treated	6.567	0.002	0.645	0.041
	(10.885)	(0.044)	(0.890)	(0.026)
Observations	723	723	723	723
Control Mean	173.36	0.33	19.46	0.89
Panel B: 3 year				
Treated	17.052	-0.041	0.333	0.001
	(12.081)	(0.035)	(0.957)	(0.032)
Observations	686	686	686	686
Control Mean	158.46	0.23	17.51	0.81

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is the number of hours worked in the business in the last 30 days by anyone (owner and/or employees). Column (2) is a dummy for whether the business has any employees. Column (3) is the number of days in the last 30 that the business was operating. Column (4) is whether the business is still operating (not pre-specified). Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A27: Impact of treatment on mobile money payments to customers and suppliers

	(1) Price same mobile customers	(2) Price same mobile suppliers	(3) Value sales mobile	(4) Value purchases mobile	(5) Transport expenses	(6) Digital reordering
Panel A: 9 months						
Treated	0.031	0.020	9.034**	1.803	2.420	
	(0.022)	(0.013)	(3.844)	(4.742)	(3.643)	
Observations	656	656	656	656	664	
Control Mean	0.06	0.03	3.62	5.48	30.53	
Panel B: 3 year						
Treated	0.026	0.099***	16.074*	6.790**	-5.612*	0.114***
	(0.029)	(0.023)	(9.249)	(3.128)	(3.162)	(0.031)
Observations	553	553	553	553	553	553
Control Mean	0.09	0.04	11.74	3.11	26.10	0.13

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Price same mobile customers/suppliers are dummies for whether the business both allows mobile money payments and charges the same or a lower price for mobile payments. Value sales/purchases mobile are the monetary values of monthly sales/inventory purchases through the mobile money account. Transport expenses are the monthly spending on transport related to business activities. Digital reordering is calling suppliers and having items delivered as the main method of purchasing stock and/or materials. These outcomes were not pre-specified in the pre-analysis plan. Outcomes defined for operating businesses only. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A28: Impact of treatment on business losses

	(1) Index	(2) Run out stock	(3) Sales lost stockout	(4) Lose sale no change	(5) Sales lost no change	(6) Closed bus 30 days	(7) Sales lost closed
Panel A: 9 months							
Treated	-0.008	-0.024	-0.628	0.010	1.259	-0.005	-1.393
	(0.083)	(0.036)	(5.886)	(0.023)	(0.830)	(0.025)	(5.120)
Observations	664	664	664	664	664	656	651
Control Mean	0.00	0.20	19.62	0.10	0.97	0.08	11.76
Panel B: 3 year							
Treated	-0.321***	-0.110**	-8.034*	-0.059*	0.163	-0.113***	-12.939**
	(0.066)	(0.046)	(4.324)	(0.031)	(0.909)	(0.029)	(5.174)
Observations	553	521	521	521	521	553	553
Control Mean	0.00	0.37	20.90	0.15	1.65	0.17	16.40

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index of columns (2)-(6). Column (2) indicates stockouts in the last 30 days. Column (3) is the value of sales lost due to stockouts. Column (4) indicates losing a sale due to lack of change. Column (5) is the value of lost sales due to lack of change. Column (6) indicates business closure in the last 30 days during a time that the business would usually be open due to lack of change, needing to get money from the bank, needing to purchase stock or running out of stock. Outcomes defined for operating businesses only. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A29: Impact of treatment on Savings

	(1) Total	(2) Bank	(3) MM account	(4) Friends	(5) Home	(6) VSLA
Panel A: 9 months						
Treated	65.367*	10.563	15.579**	9.288	10.490	14.064
	(38.076)	(33.059)	(6.222)	(7.050)	(10.065)	(11.751)
Observations	723	723	723	723	723	723
Control Mean	352.46	239.95	11.83	11.42	53.84	35.41
Panel B: 3 year						
Treated	90.319*	64.712	23.371**	-5.341	5.950	3.603
	(51.362)	(47.212)	(9.996)	(4.504)	(12.474)	(23.227)
Observations	686	686	686	686	686	686
Control Mean	332.04	142.36	31.69	5.91	55.29	96.78

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is total savings (sum of columns (2)-(6)). Values in USD PPP. Column (2) is savings in a bank account. Column (3) is savings in the mobile money account. Column (4) is savings with friends. Column (5) is savings kept at home. Column (6) is savings with a saving group (VSLA). Monetary values winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A30: Impact of treatment on household outcomes

	(1) Total consumption	(2) Total income	(3) Spouse total income	(4) Woman's work income
Panel A: 9 months				
Treated	3.057	26.230	29.415	4.604
	(16.451)	(52.626)	(45.866)	(7.268)
Observations	723	723	487	723
Control Mean	571.49	624.34	439.72	22.74
Panel B: 3 year				
Treated	21.956	46.540	15.372	-24.997
	(30.069)	(39.326)	(48.624)	(18.056)
Observations	686	686	407	686
Control Mean	547.49	483.75	306.18	93.86

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is household total consumption scaled to the last 30 days. Column (2) is total household monthly income. Column (3) is the spouse's income in the last 30 days (married households only - 67% of women were married at 9 months and 59% after 3 years). Column (4) is the woman's income from wage work in the last 30 days. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A31: Impact of treatment on expenditures

	(1) Food home	(2) Food outside	(3) Housing, utilities	(4) Personal care	(5) Clothing women	(6) Clothing men	(7) Clothing girls	(8) Clothing boys	(9) School fees (boys)	(10) School fees (girls)	(11) School supplies (boys)	(12) School supplies (girls)
Panel A: 9 months												
Treated	-8.176	-4.949	-0.133	-0.305	0.661	0.116	1.499***	1.125**	5.389*	6.615**	3.989***	-0.020
	(12.663)	(3.561)	(6.525)	(0.860)	(0.591)	(0.395)	(0.493)	(0.546)	(2.796)	(2.955)	(1.212)	(1.112)
Observations	723	723	723	722	723	723	723	723	723	723	723	723
Control Mean	270.01	33.16	116.45	14.83	7.59	1.94	7.11	6.58	28.53	28.97	9.13	10.30
Panel B: 3 year												
Treated	-0.090	3.530	9.726	-0.548	1.425*	0.825	1.232	1.023	-6.505	9.641***	0.497	0.661
	(11.076)	(2.295)	(17.681)	(1.100)	(0.791)	(0.569)	(0.858)	(0.689)	(6.315)	(3.735)	(0.613)	(0.443)
Observations	686	686	686	686	686	686	686	686	686	686	686	686
Control Mean	250.90	35.17	132.08	15.55	8.25	2.54	8.18	6.80	25.39	15.16	3.98	3.70

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. All values are in USD PPP and scaled to the last 30 days. Food at home/outside are based on weekly recall and scaled to 30 days; housing/utilities and personal care are monthly recall; remaining categories are 6-month recall and scaled to 30 days. Not all expenditure categories are shown. Not pre-specified. Monetary values winsorized at the 1% level. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A32: Impact of treatment on expenditure shares

	(1) Food home	(2) Food outside	(3) Housing, utilities	(4) Personal care	(5) Clothing women	(6) Clothing men	(7) Clothing girls	(8) Clothing boys	(9) School fees (boys)	(10) School fees (girls)	(11) School supplies (boys)	(12) School supplies (girls)
Panel A: 9 months												
Treated	-0.005	-0.013**	0.003	-0.001	0.001	0.000	0.002*	0.002	0.009**	0.008*	0.007***	-0.001
	(0.016)	(0.006)	(0.009)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.005)	(0.004)	(0.002)	(0.002)
Observations	723	723	723	722	723	723	723	723	723	723	723	723
Control Mean	0.45	0.06	0.21	0.03	0.01	0.00	0.01	0.01	0.05	0.05	0.02	0.02
Panel B: 3 year												
Treated	-0.008	0.005	-0.006	-0.001	0.001	0.001	0.002	0.001	-0.005	0.009**	0.001	0.001
	(0.013)	(0.004)	(0.011)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.006)	(0.004)	(0.001)	(0.001)
Observations	686	686	686	686	686	686	686	686	686	686	686	686
Control Mean	0.49	0.07	0.22	0.03	0.02	0.00	0.02	0.01	0.03	0.02	0.01	0.01

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Regressions also control for total expenditure and household composition at baseline. Excluded categories represent approximately 7% of expenditure. All columns report expenditure shares on a monthly basis. Not pre-specified. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A33: Impact of treatment on school attendance and shocks

	(1) Age 6-12 in school	(2) Age 13-18 in school	(3) Adverse shock effect
Treated	-0.003	0.072*	-0.062
	(0.003)	(0.042)	(0.041)
Observations	364	436	686
Control Mean	0.99	0.82	0.46

All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Columns (1) and (2) are dummy variables for whether all children of those age groups are attending school, conditional on having children of that age. Column (3) is a dummy variable for whether any adverse effect occurred as a result of being unable to mitigate a shock. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A34: Impact of treatment on BRAC administrative outcomes

	(1) Principal outstanding	(2) Disbursed amount	(3) Saving amount	(4) Overdue amount	(5) Days late	(6) Default	(7) No Loan
Panel A: 9 months							
Treated	50.720	18.075	6.552	-5.245	-8.670	0.006	0.017
	(55.655)	(71.452)	(7.521)	(10.256)	(5.951)	(0.019)	(0.041)
Observations	750	750	750	750	750	750	750
Control Mean	584.15	973.83	101.33	22.22	13.24	0.04	0.40
Panel B: 3 year							
Treated	126.957**	141.810	17.122*	16.147	1.467	-0.003	-0.036
	(55.363)	(90.621)	(9.044)	(14.372)	(5.735)	(0.017)	(0.039)
Observations	750	750	750	750	750	750	750
Control Mean	279.87	555.12	59.80	30.34	13.36	0.05	0.72

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO.. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Administrative outcomes are from February 2023 (9 month) and May 2025 (3 year). Column (1) is remaining principal on a current loan. Column (2) is the most recently disbursed loan amount. Column (3) is required savings with BRAC (10% of disbursed amount). Column (4) is overdue amount (late payments). Column (5) is days late on a repayment. Column (6) indicates whether the loan is in default (any days late). Column (7) indicates whether the woman no longer has an active loan from BRAC. Variables are zero for women without an active loan. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A35: Impact of treatment on BRAC administrative outcomes - all women in study groups

	(1) Principle outstanding	(2) Disbursed amount	(3) Saving amount	(4) Overdue amount	(5) Days late	(6) Default	(7) No Loan
Panel A: 9 months							
Treated	11.459	21.702	2.540	-1.715	-3.763	0.004	0.000
	(28.209)	(41.656)	(4.203)	(6.621)	(3.856)	(0.012)	(0.026)
Observations	3460	3460	3460	3460	3460	3460	3460
Control Mean	472.46	839.46	85.99	24.17	13.94	0.05	0.48
Panel B: 3 year							
Treated	35.161*	12.974	1.635	1.889	-0.889	-0.008	-0.003
	(20.549)	(35.331)	(3.674)	(6.660)	(2.260)	(0.007)	(0.017)
Observations	3460	3460	3460	3460	3460	3460	3460
Control Mean	164.52	321.01	34.69	20.62	8.28	0.03	0.84

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects and the baseline value of the outcome. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Administrative outcomes are from the relevant BRAC administrative extract. Column (1) is remaining principal on a current loan. Column (2) is the most recently disbursed loan amount. Column (3) is required savings with BRAC (10% of disbursed amount). Column (4) is overdue amount. Column (5) is days late. Column (6) is default (any days late). Column (7) indicates no longer having an active loan. Sample includes only women present in the group at baseline (new joiners excluded). Sample composition differs from the study sample because women in default at baseline were excluded from the study sample but are included here. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A36: Impact of treatment on Loans

	(1) Loan last 6 months	(2) Loans outstanding	(3) BRAC loans outstanding
Panel A: 9 months			
Treated	0.078	82.583	61.036
	(0.056)	(58.340)	(56.227)
Observations	723	723	723
Control Mean	0.57	485.59	465.10
Panel B: 3 year			
Treated	0.001	78.460	72.601
	(0.036)	(55.431)	(52.486)
Observations	686	686	686
Control Mean	0.32	267.26	232.87

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is a dummy for whether the woman took out a loan in the last 6 months. Column (2) is the value of all outstanding loans. Column (3) is the value of outstanding loans from BRAC. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A37: Impact of treatment on Social Cohesion

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Index	Talk once week	Ask financial help	Give financial help	Discuss business	Discuss personal	Visit house	Trust group members
Panel A: 9 months								
Treated	0.106	0.042**	0.008	0.031**	0.025*	0.005	0.032**	-0.167*
	(0.102)	(0.021)	(0.012)	(0.015)	(0.015)	(0.007)	(0.014)	(0.101)
Observations	723	719	719	719	719	719	719	723
Control Mean	-0.00	0.20	0.12	0.12	0.13	0.05	0.09	4.11
Panel B: 3 year								
Treated	-0.014	0.032	0.009	-0.010	0.006	-0.004	-0.017	0.006
	(0.117)	(0.031)	(0.021)	(0.029)	(0.035)	(0.015)	(0.036)	(0.107)
Observations	254	254	254	254	254	254	254	254
Control Mean	0.00	0.28	0.17	0.23	0.22	0.08	0.21	4.10

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. All regressions also control for group size. Column (1) is an index of columns (2)-(8). Column (2) is the share of group members the woman talked to outside the group meeting in the past week. Columns (3) and (4) are the shares she would ask for and give financial help to. Columns (5) and (6) are the shares she talked to about business and personal matters in the last 30 days. Column (7) is the share who visited the woman's home in the last 30 days. Column (8) is a 1–5 trust scale. At the 3 year followup, questions on social interaction and trust were only asked of women currently in microfinance groups. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A38: Impact of treatment on BRAC and meeting experience

	(1)	(2)	(3)	(4)	(5)
	Index	Trust in BRAC officer	Trust in BRAC microfinance	Prefers weekly meeting	Meeting time
Panel A: 9 months					
Treated	-0.049	-0.004	-0.037	-0.104**	-9.914*
	(0.088)	(0.074)	(0.043)	(0.041)	(5.532)
Observations	723	723	723	723	723
Control Mean	0.00	4.53	4.83	0.80	133.35
Panel B: 3 year					
Treated	0.144	0.134	0.006	0.022	4.681
	(0.132)	(0.105)	(0.029)	(0.036)	(16.810)
Observations	254	254	254	254	254
Control Mean	-0.00	4.53	4.94	0.04	131.12

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Column (1) is an index composed of columns (2)-(3). Columns (2) and (3) are 1–5 scales where 5 is the highest level of trust. Column (4) indicates whether the woman would prefer weekly group meetings over bi-weekly or monthly meetings. Column (5) is meeting time in minutes (not pre-specified). Note that at the 3-year followup these questions were only asked to current BRAC microfinance clients. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A39: Impact of treatment on mobile money sharing expectations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Index	Spouse asks mobile money	Family asks mobile money	Spouse asks mobile money business	Spouse expect share mobile money	Easier say no spouse	Easier say no family
Treated	0.181*	-0.045	-0.016	0.000	-0.285**	0.178	0.258*
	(0.099)	(0.043)	(0.041)	(.)	(0.130)	(0.184)	(0.147)
Observations	654	383	654	210	383	383	654
Control Mean	-0.00	0.21	0.35	0.00	2.54	3.31	3.28

All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Questions asked at the 3 year followup only. Column (1) is an index of columns (2)-(6) - higher values indicate that mobile money is more strongly earmarked. Columns (2) and (3) are dummy variables for whether the spouse or other family members ever ask the woman to send them mobile money when they know she has it. Column (4) is a dummy for whether the spouse would ask the woman to send mobile money if he needed it for his business and knew she had it. Column (5) is 1-5 scale of how strongly the woman agrees with the statement that when she has money saved as mobile money and her spouse asks for it, he would expect her to give some to him (higher values indicate stronger agreement). Columns (6) and (7) are 1-5 scales of how strongly the woman agrees that it is easier to say no to requests for money from my spouse/family when I keep my money on a mobile money account (higher values indicate stronger agreement). Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A40: Impact of treatment on spousal sharing expectations for cash

	(1)	(2)	(3)	(4)
	Index	Spouse asks cash	Spouse asks cash business	Spouse expect share cash
Treated	-0.244***	-0.040	-0.072	-0.391**
	(0.094)	(0.044)	(0.066)	(0.180)
Observations	407	407	210	383
Control Mean	-0.00	0.34	0.26	3.20

All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Questions asked at the 3 year followup only. Column (1) is an index of columns (2)-(4). Higher values denote more sharing expectations from the spouse. Column (2) is a dummy variable for whether the spouse asks for cash for personal or business expenses when he knows she has some. Column (3) is a dummy variable for whether the spouse takes the woman's cash to cover his business expenses (conditional on the spouse having a business). Column (4) is whether the spouse would expect the woman to share cash savings if he asked, on a 1-5 scale where 5 is strongly agree. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A41: Impact of treatment on Saving Autonomy

	(1)	(2)	(3)
	Index	Save purpose	Discuss savings spouse
Treated	0.217**	0.210***	0.003
	(0.085)	(0.075)	(0.125)
Observations	686	686	407
Control Mean	-0.00	2.23	2.31

All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Questions asked at the 3 year followup only. Column (1) is an index of columns (2) and (3). Column (2) is a 1-3 scale in response to the question of whether in the last 12 months the woman has saved someonewhere for her own purpose, where 3 is yes, 2 is no but she could if she wanted, and 1 is no and she couldn't even if she wanted. Column (3) is a dummy variable for whether the woman discusses how much she has saved with her spouse. Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A42: Impact of treatment on mobile money privacy

	(1)	(2)	(3)	(4)	(5)	(6)
	Index	Anyone access	Anyone know PIN	Anyone show balance	Private safe	Known only me
Treated	0.005	0.018	0.046	-0.018	0.027	-0.129
	(0.086)	(0.039)	(0.043)	(0.021)	(0.145)	(0.155)
Observations	654	654	654	654	654	654
Control Mean	-0.00	0.25	0.45	0.09	3.83	3.58

All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Questions asked at the 3 year followup only. Column (1) is an index of columns (2)-(6) - higher values indicate that mobile money is more private. Anyone access is a dummy equal to one if the woman responded yes to the question "Does anyone else have access to your mobile money account?". Anyone know PIN is a dummy variable equal to one if the woman responded yes to the question "Does anyone else know your mobile money PIN?". Anyone show balance is a dummy variable equal to one if the woman responded yes to the question "Do you have to show anyone else your mobile money account balance if asked?". Private save is a 1-5 response where 5 is strongly agree to the question "My mobile money account is a private place for me to save money". Known only me is a 1-5 response where 5 is strongly agree to the question "My mobile money account is private and known only to me.". Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A43: Heterogeneous treatment effects by privacy and transaction costs

	(1) Mobile money use index	(2) Mobile money comfort index	(3) Financial control index	(4) HH decision index
Panel A: 9 months				
Treated	0.504***	0.167	0.369***	0.189*
	(0.129)	(0.120)	(0.128)	(0.101)
Others know PIN * Treated	-0.286*	-0.008	0.023	0.059
	(0.169)	(0.170)	(0.180)	(0.147)
Treated	0.336**	0.138	0.339***	0.193*
	(0.131)	(0.108)	(0.128)	(0.102)
Spouse same network * Treated	0.072	0.066	0.086	0.052
	(0.168)	(0.150)	(0.141)	(0.153)
Control Mean	-0.00	0.00	0.00	-0.00
Observations	723	723	723	723
Panel B: 3 year				
Treated	0.469***	0.076	0.391***	0.114
	(0.113)	(0.109)	(0.139)	(0.099)
Others know PIN * Treated	-0.219	-0.015	0.009	0.132
	(0.167)	(0.143)	(0.180)	(0.146)
Treated	0.327***	0.032	0.359***	0.102
	(0.121)	(0.100)	(0.121)	(0.096)
Spouse same network * Treated	0.092	0.089	0.084	0.150
	(0.167)	(0.144)	(0.156)	(0.154)
Control Mean	-0.00	0.00	-0.00	-0.00
Observations	686	686	686	686

Panel A reports results from the endline survey 9 months after the intervention began. Panel B reports results from the follow-up survey conducted 3 years after the intervention began. All regressions include stratification fixed effects, use of mobile money at baseline, the baseline value of the outcome (if available) and control variables selected by PDS-LASSO. Treated is an indicator for the woman's group being randomly assigned to mobile money repayment treatment. Others know PIN is a dummy variable for other people knowing the PIN code for the woman's mobile money account. Spouse same network is a dummy variable for the woman's spouse having the same primary mobile network provider as the woman. Regression also controls for the heterogeneity variable (output not shown). Control mean is the mean of the outcome in the control group during that endline round. Heteroskedasticity-robust standard errors clustered at microfinance group level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

B PAP deviations

B.1 Outcome definitions

There are no deviations from the pre-specified primary outcomes. Deviations from the pre-specified secondary outcomes are shown in Table B1. In addition, the pre-analysis plan did not specify looking at expenditures beyond food expenditure. The paper expands the categories of expenditure examined to include all major categories of household expenditure.

B.2 Analysis

Members of groups assigned to treatment arm two were meant to have the option of skipping every other group meeting if they made their repayment using mobile money. However, after randomisation it was decided to not implement this option. As a result, treatment arm two is identical to treatment arm one, and so both treatments are pooled together for all the analysis. Table A13 shows treatment effects on the primary outcomes by the two original treatment assignments and Table A6 shows that the original randomisation was balanced.

Lasso controls were selected for each outcome shown, rather than by family of outcome, as pre-specified.

We pre-defined 6 dimensions of heterogeneity to examine treatment effects by: whether the woman was above the median in profits, a mobile money use index, a group social cohesion index, an empowerment index, a business management index and a psychological score index. We do not report heterogeneity by social cohesion, business management or the psychological score for brevity. We do not see significant heterogeneity by these dimensions.

Table B1: Deviations from pre-specified outcomes

Outcome family	Deviation	Reason
Deviations		
2a) Mobile Money Comfort Index	Components "vi. Has a mobile money account registered in own name" and "vii. Has a regular mobile money agent that she uses" excluded from index	No or negative correlations in group group with other components.
3b) Permission index	Component "Must ask spouse permission to take a loan" not included. Components "Must ask spouse permission to send money to a friend or family member" and "Must ask spouse permission to visit the market" included.	The permission questions were changed in the survey and not updated in the pap. The loan question was not asked, and the question about visiting the market and sending money asked instead.
4. Social Cohesion Index	"(c) Prefers weekly group meetings" excluded from index.	Negatively correlated with other components.
5 BRAC Sentiment and repayment index	"c) late loan repayment" excluded from index	shown separately with additional admin data outcomes.
Results not reported		
3.c)i. Asset value	Not reported separately.	Reported as part of business capital.
3.c)ii.Inventory value	Not reported separately.	Reported as part of business capital.
3d)ii. Hours spent by employees last 30 days	Not reported separately.	Reported as part of business hours.
3d)iii. Hours owner spent working in business last week	Not reported separately.	Reported as part of business hours.
3e) Business mis-management index	Not reported.	No significant effects on index or components.
6a)i. Household income from work	Not reported separately.	Reported as part of total income.
6a)ii. Household income from non-work	Not reported separately.	Reported as part of total income.
6a)iii. Household income from remittances	Not reported separately.	Reported as part of total income.
6a)iv. Spouse income from work	Not reported separately.	Reported as part of spouse total income.
6a)v. Spouse income from business	Not reported separately.	Reported as part of spouse total income.
6b) Household food consumption	Not reported in aggregate.	Shown as household food at home and food outside.
7. Time use	Not reported	No significant effects.
8b) Financial security index	Not reported.	No significant effects on index or components.
9.c) Gave a loan in the last 6 months	Not reported.	Question was cut from survey.
9.d) Loans given (value outstanding)	Not reported.	Question was cut from survey.
9.e) Allows customers to pay for goods on credit	Not reported.	Question was cut from survey.