Pre-Analysis Plan:
Mobile Money and Women's Empowerment – A Lab-in-the-Field Experiment in Tanzania

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1 Introduction

Digital financial services (DFS), and in particular mobile money, have shown strong potential to empower women economically by increasing their financial control and autonomy. Prior research highlights a range of positive impacts from DFS, including improved household welfare, increased savings, and reduced vulnerability to shocks (de Mel et al., 2022; Lee et al., 2021; Bastian, 2018; Munyegera and Matsumoto, 2016; Riley, 2019). Critically, mobile money has been linked to gains in women's empowerment through enhanced income privacy and control over resources (Riley, 2024; Heath and Riley, 2024; Aker et al., 2016; Suri and Jack, 2016).

While a number of studies suggest that mobile money increases women's empowerment, the mechanisms driving these effects are not well understood. Existing literature suggests at least three key channels[1]: (1) *privacy*, whereby mobile money allows women to conceal income from partners (Ashraf, 2009; Jakiela and Ozier, 2016; Boltz et al., 2019; Castilla, 2019); (2) *earmarking*, where digital formats may shape psychological ownership of funds (Shah et al., 2016; Lee et al., 2024); and (3) *transaction costs*, which can affect intra-household bargaining by limiting access to funds (Schaner, 2017).

This study seeks to causally identify these mechanisms using a lab-in-the-field experiment[2] with a target sample of 200-250 married women in Tanzania. We aim to answer three key questions: (1) Does privacy affect women's choice of payment modality between cash and mobile money? (2) Does earmarking, as induced by digital accounts or labeled cash, affect women's willingness to invest in a risky business investment? (3) Do earmarking and transaction costs influence women's willingness to incur a cost to retain control over funds?

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[1] While other mechanisms, such as increased transparency through mobile money transactions providing a record, could also be at play, we do not think they are significant drivers in this context, given the evidence from the prior study (Heath and Riley, 2024) and supporting survey data.

[2] In addition to the lab games, we will incorporate survey data to strengthen the descriptive foundation of the study. The survey includes information on women's empowerment, mobile money usage and perceptions, and the resources used for various anticipated and unanticipated household expenses.

2   Study Context and Design

This study builds on Heath and Riley (2024), which experimentally shifted loan repayment methods from cash to mobile money for microfinance clients in Tanzania. Their findings demonstrated substantial gains in women's empowerment and financial control from increased mobile money usage. However, their study could not precisely disentangle the potential channels through which mobile money operates.

Our lab-in-the-field experiment targets 200–250 married women drawn from the original Heath and Riley sample. The experiment includes three games designed to capture different dimensions of financial control and allocation behavior.

Through these games, we seek to uncover the mechanisms through which mobile money empowers women—specifically, privacy, earmarking, and transaction costs. Each game is designed to isolate one or more of these channels, and the observed behavioral patterns across treatment arms and conditions will help us identify the relative importance of these mechanisms.

- **Game 1: Mobile Money Preference.** Participants choose between fixed cash amounts and increasing mobile money amounts to elicit their willingness to accept (WTA) mobile money.[3] This captures the subjective value of mobile money relative to cash under both public and private conditions.

  This game helps us understand whether public visibility changes how women value mobile money, providing insight into the underlying mechanisms:

  - *An increase in WTA in the public condition* would suggest that mobile money enables women to better control funds through features like earmarking or transaction costs, which may deter external claims—especially when decisions are observable to others.

  - *No change in WTA in the public condition* would suggest that privacy is not the main determining factor behind women's valuation of mobile money, as removing privacy does not substantially alter their preferences.

  - *A decrease in WTA in the public condition* would imply that mobile money's primary benefit lies in the privacy it affords. When that privacy is removed under public conditions, women's preferences shift away from mobile money.

- **Game 2: Investment Game.** This game is a modified version of (Jakiela and Ozier, 2016), where participants are randomly assigned high or low endowments and decide how much to invest in a risky lottery. Each participant plays once in a *public* and once in a *private* condition (with the order randomized). Participants are randomly assigned to one of the following treatment arms:

  - Cash

  - Earmarked cash

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[3]On average, participants prefer cash to mobile money when the amounts offered are equal, likely due to mobile money transaction costs, such as withdrawal fees.

- Mobile money

We will examine changes in the amount invested in the risky investment across these conditions.

This game allows us to examine how visibility and the form of funds affect women's willingness to invest, which we interpret as a proxy for financial control and susceptibility to social pressure. The results will illuminate the following:

- Lower investment in the public condition (relative to private) would suggest that sharing pressure reduces women's willingness to invest in potentially profitable opportunities when the income from those opportunities could be known by others, consistent with (Jakiela and Ozier, 2016).

- In the *private* condition, where privacy is preserved across all arms, mobile money provides two additional features relative to cash: earmarking and transaction costs. If investment under mobile money is higher than under cash, it suggests that these features enhance perceived control or reduce external claims. If investment is similar or lower, it implies that privacy is the key driver of financial control, and that earmarking and transaction costs either have limited effects or offsetting influences.

  * Comparing mobile money to earmarked cash in the *private* setting helps isolate the role of transaction costs, since both formats preserve privacy and earmarking. A larger increase in investment under mobile money relative to earmarked cash would then indicate that transaction costs play an active role in enabling women to retain control over funds—for example, by reducing pressure to share. Conversely, if investment under mobile money is similar to or lower than in the other arms, it would suggest that mobile money's primary value lies in providing privacy, which is already ensured in this condition, and that any additional benefits from earmarking or transaction frictions are limited or offsetting.

- In the *public* condition—where investment decisions are visible to others—if mobile money and earmarked cash still lead to higher investment compared to regular cash, this would suggest that these formats help women resist social pressure to share, likely through earmarking, or transaction costs. Their effectiveness in a public setting would indicate that these features provide protection beyond just privacy. However, if the investment advantage of mobile money disappears when decisions are public, this would point to privacy as the primary mechanism: once compromised, the benefits of mobile money are no longer realized, suggesting that other features like earmarking or transaction costs play a more limited role in shaping behavior.

  * Comparing mobile money and earmarked cash in the public condition allows us to assess whether mobile money's additional features—like higher transaction costs —offer stronger protection than earmarking alone.

- **Game 3: Willingness to Pay for Financial Control.** In this game, women make a series of choices between keeping money for themselves or giving it to their husbands. The amount offered to the husband increases across eight rounds. If the woman keeps the money, the husband is not informed of the transaction, maintaining full privacy.

  We interpret this game as a measure of willingness to pay (WTP) for financial control. Participants are randomly assigned to one of three payout methods:

    - Cash
    - Earmarked cash
    - Mobile money

  Observed differences in WTP across arms help uncover the mechanisms behind financial control:

    - Lower WTP under mobile money and earmarked cash (compared to cash) could indicate that these methods provide sufficient control through features like labeling, making it less necessary to sacrifice income to retain control.
    - If WTP is lower under mobile money than earmarked cash, that would indicate mobile money provides additional control benefits—like transaction traceability or stronger enforcement. Conversely, similar WTP under both arms would imply that earmarking accounts for most of the observed benefits.

3   Outcomes

Mobile Money Preference (Game 1)

1. **Binary MM choice at each offer:** Indicator $\text{ChooseMM}_{i\ell} = 1$ if participant chooses MM at offer level $\ell \in \{2000, 2200, 2640, 3080, 3520\}$.

Investment Behavior and Concealment (Game 2

2. **Invest only up to low endowment:** $Y_{ig} = 1$ if investment $\leq$ low endowment (2,600 TZS); 0 otherwise.

  We will also examine the following secondary outcomes:

3. **Investment amount :** Continuous shillings (0–6,500 TZS) invested in the risky lottery in each round.

4. **Public–private investment gap:** (i) binary $1\{\text{Invest}_{\text{pub}} < \text{Invest}_{\text{priv}}\}$; (ii) continuous difference $\text{Invest}_{\text{priv}} - \text{Invest}_{\text{pub}}$.

Willingness to Pay for Financial Control (Game 3)

5. **Binary self–spouse choice at each offer :** Indicator $\text{ChooseSelf}_{i\ell} = 1$ if woman keeps 8,000 for herself vs. giving ℓ to husband where
$\ell \in \{7200, 8000, 8800, 10000, 14000, 16000, 24000, 32000\}$.

While our primary analysis focuses on these outcomes for the sample of women, the games were also conducted with a sub-sample of men. We will report the corresponding results for men as well, with the exception of Game 3, which was administered exclusively to women.

We also leverage variation from the original RCT to examine whether prior exposure to mobile money moderates treatment effects in the games. Additionally, we explore heterogeneity by baseline levels of empowerment and mobile money usage to assess how treatment effects vary across these dimensions.

4 Empirical Strategy

All regressions will control for covariates selected using LASSO based on baseline characteristics. Standard errors will be clustered at the individual level in game 2 where we have multiple observations per person, and robust in other specifications.

Game 1: Mobile Money Preference

$$\text{ChooseMM}_i = \beta_0 + \beta_1 \text{Public}_i + \gamma' X_i + \varepsilon_i. \tag{1}$$

In this and all subsequent regressions:

- ChooseMM_i is a binary variable equal to 1 if participant i chose to receive the payment via mobile money, and 0 if they chose to receive it in cash.

- Public_i is an indicator for the woman being randomly assigned to the public announcement group.

Game 2: Investment Game

Main (game-level) specification

$$\begin{aligned} Y_{ig} = {} & \delta_0 + \delta_1 \text{Public}_{ig} + \delta_2 \text{MM}_{ig} + \delta_3 (\text{Public}_{ig} \times \text{MM}_{ig}) \\ & + \delta_4 \text{CashEar}_{ig} + \delta_5 (\text{Public}_{ig} \times \text{CashEar}_{ig}) + \gamma' X_{ig} + \varepsilon_{ig}. \end{aligned} \tag{2}$$

- The outcome variable Y_{ig} is defined either as the investment amount of individual i in game g, or as a binary indicator equal to 1 if the investment is less than or equal to the low endowment amount.

- Public_{ig} is an indicator equal to 1 if the game was implemented under the public condition, where participants' decisions were publicly announced.

- MM_i is an indicator for the woman being randomly assigned to have any payments from the game made through mobile money.

- CashEar_i is an indicator for the woman being randomly assigned to have any payment from the game made through earmarked cash (i.e., cash placed in a labeled envelope).

Secondary (individual-level) specification

$$Y_i = \delta_0 + \delta_1 \text{MM}_i + \delta_2 \text{CashEar}_i + \gamma' X_i + \varepsilon_i,$$

where Y_i is defined as either the difference between investment in public and private games (the public–private gap) or a binary indicator equal to 1 if the participant invests less in the public condition.

Game 3: Willingness to Pay for Financial Control

$$\text{ChooseSelf}_i = \theta_0 + \theta_1 \text{MM}_i + \theta_2 \text{CashEar}_i + \gamma' X_i + \varepsilon_i.$$

- ChooseSelf_i is a binary indicator equal to 1 if the participant chose to keep the money for herself (as opposed to allocating it to her spouse), and 0 otherwise.

Variable definitions for MM_i and CashEar_i are the same as before.

5 Robustness Checks

- Enumerator FE and enumerator-gender controls
- Controlling for the original treatment status in Heath and Riley (2024)

6 References

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