Pre-analysis plan: Revitalizing rural Malawi: Experimental evaluation of the economic impacts of capital injections to village savings and loans associations

Kalle Hirvonen [a], Joachim De Weerdt [a], Chikumbutso Mtemwa [b], Lonester Sibande [b], Edwin Siyame [a], Elizabeth Venable [b]

[a] International Food Policy Research Institute (IFPRI), [b] Feed the Future Malawi Growth Poles Project

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Abstract

This trial tests an innovative intervention to boost the lending capacity of village savings and loans associations (VSLAs) in rural Malawi. Our pre-analysis plan describes a cluster randomized control trial (RCT) in which VSLAs in treated communities will receive between $350 and $590 USD capital injection to boost the groups' lending capacity, depending on the group size. Outcomes are assessed in five domains: financial inclusion, livelihoods, welfare, food security, and gender. The trial is designed to document spillover effects in local labor markets.

Keywords: Savings; Livelihoods; Labor markets; Poverty reduction

JEL codes: D14, O12, O17, J46.

Study pre-registration: https://www.socialscienceregistry.org/trials/14464

Contents

Timeline

The study begins in 2024 and ends in 2027. The baseline survey took place in October-November 2024, after which the study clusters were randomized by the research team into one treatment and one control arm. The program implementation is scheduled to take place in December 2024. Monthly phone surveys will be conducted between December 2024 and September 2026. The endline survey is scheduled for October-November 2026. We plan to complete the research paper within 9 months of the completion of the endline survey.

1. Introduction

Financial tools to raise capital for investment opportunities and to manage risk are often not accessible to the poor (Collins 2009, Demirgüç-Kunt and Klapper 2012). Formal banking services seldom reach this population, and the high interest rates charged by informal providers make them unappealing (Demirgüç-Kunt and Klapper 2012, Banerjee and Duflo 2007). Meanwhile, rigorous evaluations of microcredit – the provision of small loans to small-scale entrepreneurs – limited transformational impacts for the average borrower and low take-up rates (Banerjee, Karlan, and Zinman 2015, Meager 2019). Moreover, microfinance institutions have a limited reach in rural areas (Beaman, Karlan, and Thuysbaert 2014), where the majority of people in extreme poverty reside (Castañeda et al. 2018).

When established financial services are unavailable, households often rely on their networks to raise capital for investments and cope with shocks (Karlan, Ratan, and Zinman 2014, Collins 2009, Banerjee and Duflo 2007). One such network is the village savings and loan association (VSLA), a community-based group that provides loans to its members. VSLAs primarily offer loans for income-generating activities and charge interest to raise capital for the group. Operating on a savings and loan cycle, VSLAs distribute accumulated savings and interest payments among members at the end of each cycle. Formalized by CARE International, VSLAs are now promoted by several international and national NGOs and are often a central component of popular graduation model programs (Banerjee, Duflo, and Sharma 2021, Banerjee et al. 2022, Leight et al. 2023). Today, VSLAs operate in 77 countries, and have over 20 million active members.[1]

This trial evaluates an innovative intervention to boost the lending capacity VSLAs in rural Malawi. VSLAs in Malawi are widespread, boasting more than 400,000 individuals belonging to one of the 55,000+ groups operating in the country with a total accumulated savings reaching nearly eight million USD (Krause 2022). We conduct a cluster randomized control trial (RCT) in which communities will be randomized into two equal-sized treatment and control groups. VSLAs in the treatment communities will receive between $350 and $590 USD capital injection to boost the groups' lending capacity, depending on the group size. Per person transfer amounts to 40,000

[1] See https://www.vsla.net/.

Malawian kwacha (MWK), which is equivalent to US$ 24 at the official exchange rate and US$ 79 in purchasing power parity terms (PPP)[2].

Cluster randomized control trials assessing the economic impacts of interventions that promote the formation of VSLAs generally find that that these groups improve financial inclusion and increase total savings amounts (Marguerie and Premand 2023, Ksoll et al. 2016, Karlan et al. 2017, Beaman, Karlan, and Thuysbaert 2014). However, the impacts on household welfare outcomes, such as per capita consumption or food security have been modest and often statistically not different from zero. In addition, only one study reports improvements in key business outcomes, such as profits (Karlan et al. 2017). One reason for the lack of transformative VSLA impacts could be due to the limited capital circulating within these groups. At about $20 in PPP terms (Beaman, Karlan, and Thuysbaert 2014, Karlan et al. 2017), the average loan sizes may not be sufficient to unlock larger business investments needed to break the cycle of poverty. [3]

The intervention evaluated in this trial addresses this constraint by injecting $79 PPP per member into rural Malawian VSLAs, aiming to expand loan availability and average loan sizes. The intervention is funded by the USAID and implemented by the Women's Legal Resources Centre (WOLREC), a Malawi-based NGO, in collaboration with Palladium International. To qualify for the capital injection, VSLAs must adhere to specific criteria, including a 4-month loan term and a nominal interest rate not exceeding 10 percent (equivalent to approximately 33 percent on an annualized basis).[4] The VSLAs will be equipped with local bank accounts to improve security and establish a connection to formal financial services. Moreover, the VSLA members will receive training in financial literacy, as well as in business and VSLA management. A small-scale pilot survey conducted with 12 VSLAs that had received capital injections documented positive changes in household welfare, assets and earnings during a period characterized by multiple shocks in Malawi, such as the COVID-19 pandemic, Tropical Storm Ana, and the 2022 price shocks (Venable et al. 2023). Beneficiary households

[2] The latest available PPP estimate (for private consumption) provided by the World Bank is from 2022, with a value of 390.79. According to consumer price index estimates from the International Monetary Fund, prices increased by 29 percent between June 2023 and August 2024. This means that MWK 40,000 in 2024 translate to approximately MWK 31,000 in 2023 prices. Applying the PPP exchange rate to this amount results in around $79 in PPP terms.

[3] See Appendix A for a more detailed literature review of this literature.

[4] The 2023 inflation rate in Malawi was 29 percent according to the consumer price index published by the International Monetary Fund.

primarily used the capital injection loans toward livelihood activities, as opposed to meeting short-term consumption needs (Venable et al. 2023).

We will assess the impact of capital injections by comparing outcomes between households in treatment communities that belong to VSLAs and households in control communities that also belong to VSLA groups. The primary and secondary outcomes can be grouped into five impact domains: financial inclusion, livelihoods, welfare, food security, and gender.

In addition to assessing the intervention's direct benefits on VSLA members, we will also measure local spillover effects pertaining to non-VSLA members. Quantifying local spillover effects is particularly important to address questions of inclusivity, because the very poorest households often do not take part in savings groups (Lønborg and Rasmussen 2014). Our spillover analysis focuses on local labor markets, more specifically on the intervention's impacts on casual labor, locally known as *ganyu*. The ganyu labor markets are highly localized, primarily operating within villages (Van Cappellen and Oliveres-Mallo 2024). Informed by the pilot study (Venable et al. 2023) and research carried out in neighboring Zambia (Fink, Jack, and Masiye 2020), we expect that the intervention will lead beneficiary households to re-allocate family labor, by reducing their own ganyu supply and possibly even beginning to hiring ganyu for agricultural or non-agricultural activities. To assess these spillover effects, we will draw a random sample of non-VSLA households residing in control and treatment localities.

2. Research design

2.1 VSLAs

VSLAs typically consist of 10 to 30 self-selected individuals, mostly women, who meet regularly to pool savings and provide loans from these pooled funds. Members purchase shares, usually between one and five at each meeting, with the share price determined at the beginning of the annual cycle and remaining constant throughout. These pooled savings create a loan fund, allowing members to borrow up to three times the amount of their savings for a maximum of three months, with repayment terms decided by the group. At the end of each annual cycle, all loans are repaid, and the total fund, including all interest from the loans, is distributed among the members based on their contributions. The money from this so-called share-out can be reinvested in the group to increase loan sizes in the next annual cycle.

2.2 Interventions

The capital injection model intervention is a component of a broader USAID Growth Poles initiative focused on specific anchor firms. These firms are expected to serve as catalysts for economic development, aiming to mobilize investments and result in positive impacts for nearby communities. The VSLA capital injections are intended to help households in nearby communities to tap into the new economic opportunities created by the Growth Pole initiative. In total, there are more than 15 growth poles (or anchor firms) in which USAID investments take place. The capital injections that are part of this trial take place in communities that are in the vicinity of four growth poles: Ilovo Dwangwa in Nkhotakota district located in the Central region of Malawi; Tropha in Rumphi and Mzimba districts in Northern region; and Pyxus in Dowa and Kasungu districts in the Central region; and African Parks in Nkhotakota district.

The VSLA capital injection intervention is implemented by Women's Legal Resources Centre (WOLREC), a Malawi-based NGO, in collaboration with Palladium International, a global consulting firm with an operational presence in Malawi. The intervention grants a sum of $79 PPP per member in the VSLA group to expand their loan sizes. To qualify for the capital injection, VSLAs must adhere to specific criteria, including a 4-month loan term and an interest rate of at most 10 percent (equivalent to approximately 33 percent on an annualized basis). This capital injection program complements the regular VSLA group loans, which the groups will continue to provide under their original terms, typically characterized by higher annualized interest rates than what is offered through the capital injection scheme. In addition, the groups will be equipped with local bank accounts to enhance security and establish a connection to formal financial services. Moreover, VSLA members will receive training in financial literacy, as well as in business and VSLA management. The training package also includes Gender Action Learning Systems (GALS) trainings that aim to empower women to contribute to planning and decision-making within their households.

The capital injections and training will be rolled out between December 2024, i.e., shortly after the baseline survey.

2.3 Identification strategy

We evaluate the economic impacts of the capital injections using a cluster RCT design, where the cluster is defined as the Group Village Headman (GVH), the second-lowest administrative unit in Malawi. The implementation partner will generate a list of 150 eligible GVHs. Using this list, 75 GVHs

were randomized into treatment and 75 GVHs to control before the intervention begins. The randomization was conducted by the research team using Stata. The randomization will be stratified at the growth pole level so that each of the four growth pole areas has an equal number of treatment and control GVHs. Other stratification variables include the following two binary variables, constructed at the GVH level using baseline household survey data: above-median share of households with small land sizes and above-median distance to the district capital.

The capital injection will then be provided into all eligible VSLAs in the GVHs selected into treatment. The eligibility is determined based on a VSLA mapping exercise at the onset of the project. A VSLA is eligible to receive a capital injection if it has been in operation for at least 12 months prior to the mapping visit. In each GVH, there are also households that do not belong to a VSLA. We call these 'non-VSLA households' and sample these households to measure local spillover effects.

2.4 Study arms

The study has two arms:

- **T1** – VSLA households in treatment GVHs: Households belonging to a VSLA group that is eligible and receives the capital injection.
- **C1** – VSLA households in non-treatment GVHs: Households belonging to an eligible VSLA group, but no capital injection takes place in the GVH.

To measure the direct impacts of the program, we will compare the outcomes between households belonging to eligible VSLAs in treated communities (**T1**) and households belonging to eligible VSLAs in non-treated communities (**C1**).

To measure the local spillover effects, we will compare the outcomes between households that are not part of eligible VSLAs in treated communities (**T2**) and households not part of eligible VSLAs in non-treated communities (**C2**):

- **T2** – Non-VSLA households in treatment GVHs: Households residing in GVHs in which capital injections are taking place, but they do not belong to a VSLA.
- **C2** – Non-VSLA households in non-treatment GVHs: Households residing in GVHs in which capital injections are not taking place and they do not belong to a VSLA.

Both control and treatment clusters follow the same eligibility criteria, thus creating *ex ante* comparable groups of eligible and ineligible households.[5]

2.5 Ethical considerations and IRB protocols

The ethical rationale for this trial and its design is threefold. First, we believe there is a strong case for policy equipoise (MacKay 2024). There is uncertainty about the net benefits of the treatment arm (capital injections into VSLAs) relative to the control arm (no intervention). Given that we are not aware of earlier studies assessing the impact of capital injections into VSLAs, the benefits of this intervention compared to no intervention are uncertain. Second, and relatedly, the random allocation permits us to rigorously assess the intervention's impact, and the information generated in this trial forms a public good that policymakers in Malawi and elsewhere can use in designing poverty alleviation strategies. Second, due to funding constraints, the capital injection intervention cannot be rolled out to all GVHs, and random allocation becomes a fair method of distributing scarce resources.

Ethical approvals from institutional review boards (IRB) were received from the International Food Policy Research Institute (IFPRI) and from Malawi's National Commission for Science and Technology.

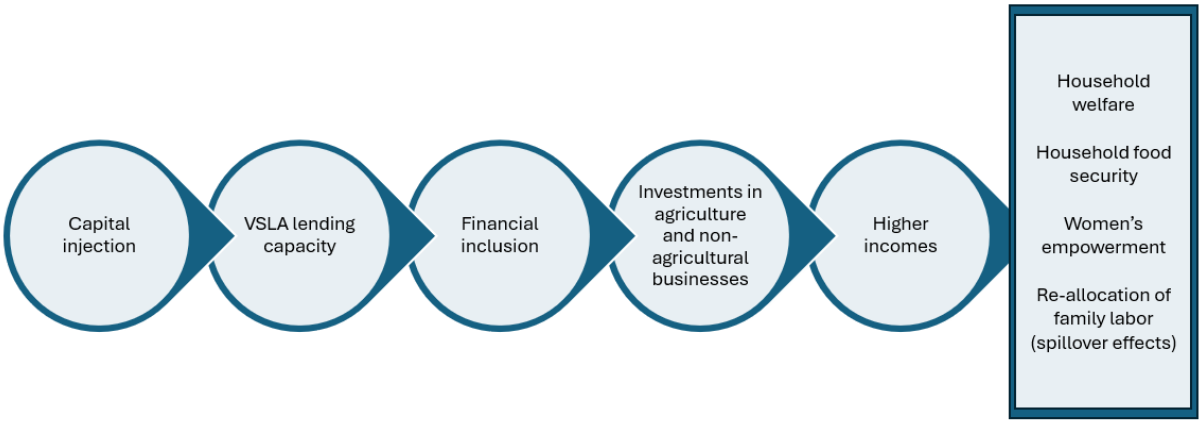
2.6 Theory of change

Figure 1 provides an overview of the project's theory of change. The capital injections increase the lending capacity of the VSLA. This improves the financial inclusion (improved access and larger loans) of the VSLA members, permitting them to expand their existing non-agricultural businesses, initiate new ones, or invest in farm activities such as purchasing crop inputs (fertilizers, seeds), or invest in livestock-related activities. These investments are expected to increase average incomes, resulting in improvements in household welfare and food security outcomes. Considering the VSLA members are mostly women, we also hypothesize that women's control over resources within their households will improve. Finally, this increased economic activity is hypothesized to create spillover effects to local labor markets that affect non-VSLA members. For example, VSLA members benefiting

[5] Several recent experimental papers studying the effects of cash transfers and related interventions have used the same approach to quantify local spillover effects (Angelucci and De Giorgi 2009, Banerjee et al. 2015, Haushofer and Shapiro 2016, Sedlmayr, Shah, and Sulaiman 2020, Marguerie and Premand 2023).

from capital injections may re-allocate family labor away from ganyu with the most successful ones becoming net hirers of ganyu labor.

Figure 1. Theory of change



The RCT is designed to measure the impacts along this hypothesized theory of change. First, we will assess the degree to which the lending capacity of treated VSLAs has increased relative control VSLAs (Figure 1: the 2nd circle from the left). The data for this assessment will come from the VSLA module in the household questionnaire. Second, we will measure the impacts on financial inclusion (Figure 1: the 3rd circle from the left) by conducting baseline and endline survey with randomly selected VSLA groups in treatment and control communities. Third, we will estimate the impacts of the capital injection on various livelihood related outcomes such as business activities and incomes (Figure 1: the 4th and 5th circles from the left). Fourth, moving along the theory of change, we will assess the impact of the capital injections on household welfare (e.g., per capita consumption) and food security, and women's empowerment. Finally, we will measure spillover effects operating through local labor markets by sampling non-VSLA households residing in the same control and treatment communities.

2.7 Hypotheses and study outcomes

Direct effects

Building on the theory of change, we will test the program's impact on five domains: financial inclusion, household livelihoods, household welfare, household food security, and women's

empowerment. More specifically, we hypothesize that being part of a VSLA that receives a capital injection will:

D1) Improve household's financial inclusion.

D2) Increase household's net income from non-agricultural activities.

D3) Improve household welfare (measured using per capita consumption).

D4) Improve household food security.

D5) Improve women's empowerment within households.

Table 1 lists the primary and secondary outcomes under each domain.

Financial inclusion

Evaluations of VSLA promotion interventions have documented increases in total savings and improved credit access (Ksoll et al. 2016, Karlan et al. 2017, Beaman, Karlan, and Thuysbaert 2014). Therefore, in the financial inclusion domain, the primary outcome is household's total savings in informal or formal institutions, including VSLAs. As a secondary outcome we consider credit access from formal and informal sources. This is measured using a binary variable capturing households that had any loan in the past 12 months.

Moreover, capital injections are hypothesized to increase savings and loan sizes within VSLAs. To test this, we compare the annual share-outs received by VSLAs operating in treated and non-treated communities. Of particular interest is to assess whether the annual share-outs have increased more than the amount of capital injected into the VSLAs after two years.

Household livelihoods

The primary livelihood outcome is net income from non-agricultural activities during the last month of operation. As secondary outcomes, we include number of non-agricultural activities operated by the household, number of days of selling ganyu labor, whether the household hired ganyu labor and the expenditures associated with that, expenditure on agricultural inputs, and livestock assets using tropical livestock units (Jahnke 1982). With respect to ganyu labor, we expect that direct beneficiary households will sell less and hire more ganyu labor.

Household welfare

Our primary welfare measure is household per capita consumption. Following the guidelines outlined in Deaton and Grosh (2000) and Deaton and Zaidi (2002), this variable is constructed using data from detailed food and non-food consumption-expenditure modules administered at baseline and endline. As a secondary welfare outcome, we consider durable assets, measured in monetary terms.

Household food security

We measure impacts on household food security using the Reduced Coping Strategies Index or RCSI. The RCSI is a self-reported indicator with a 7-day recall measuring the frequency of certain harmful coping strategies households use against severe food shortages, such as the reduction of the number of meals or portion sizes (Maxwell et al. 2003). As a secondary food security outcome, we include the number of meals taken by the adults in the household in the previous day.

Women's empowerment

Previous research suggests that VSLA participation improves women's empowerment, particularly in relation to their decision making within households (Karlan et al. 2017). Guided by this earlier work, our primary outcome within this domain is an index measuring women's control over income. This index is one of the five domains in Women's Empowerment in Agriculture Index (WEAI) developed by Alkire et al. (2013) and it evaluates the degree to which an individual can benefit from their efforts.

The study measures a woman's control over income in households with both a male and female adult. Women are interviewed about their participation in income-generating activities and their decision-making power regarding how the income and outputs are used. A woman is considered to have adequate control if she participates in an activity and has significant influence on both income and output decisions (consumption vs. selling for agriculture).

Table 1. Primary and secondary outcomes

Outcome (Hypothesis)	Outcome Type
Domain: Financial inclusion (Hypothesis D1)	
Household total savings	**Primary**
Took a loan in the past 12 month (0/1)	Secondary
Annual share-out in the VSLA	Secondary
Domain: Livelihoods (Hypothesis D2)	
Number of non-agricultural businesses operated	Secondary
Net income from non-agricultural businesses	**Primary**
Number of days of selling ganyu labor *	Secondary
Hired ganyu labor (0/1) *	Secondary
Expenditure on hiring ganyu labor *	Secondary
Expenditure on agricultural inputs	Secondary
Livestock assets (Tropical Livestock Units)	Secondary
Domain: Welfare (Hypothesis D3)	
Household per capita consumption-expenditures	**Primary**
Value of durable assets	Secondary
Domain: Food security (Hypothesis D4)	
Food security (Reduced Coping Strategies Index) *	**Primary**
Number of meals by adults *	Secondary
Domain: Gender (Hypothesis D5)	
An indicator capturing women's control over income (based on A-WEAI questionnaire)	**Primary**

** These variables will be constructed and analyzed using data from high-frequency phone surveys conducted between the baseline and endline surveys. 0/1 = binary variable.*

Spillover effects

We hypothesize that potential spillover effects will operate through their impact on casual labor markets. These markets primarily operate within villages where better-off rural households hire people residing in the same village to work on their farm or non-agricultural businesses. Therefore, the primary outcome in the spillover analysis is non-VSLA households' participation in ganyu labor: the number of days these households sold ganyu. Since welfare effects depend on both price and quantity of labor supplied, we also measure the income received from selling ganyu labor during the same period.

Other potential spillover effects can be aspirational: neighbors' saving activity and business successes may spur households to join a VSLA and become an entrepreneur. To assess the degree of *VSLA replication* (Marguerie and Premand 2023, Karlan et al. 2017) among non-VSLA households at baseline, we will assess whether the non-VSLA households in the treatment GVHs are more likely to join a VSLA by the endline than non-VSLA households in control GVHs. We will also assess whether non-VSLA households are more likely to set up their own businesses.

The combined effect of these local spillover effects will be captured by measuring impacts on household per capita expenditures and food security (RCSI) and number of meals by adults. Table 2 lists all the outcomes considered in the spillover analysis.

Table 2. Outcomes considered in the spillover analysis

Outcome
Number of days of selling *ganyu* labor *
Income from selling *ganyu* labor *
Participation in a VSLA
Number of non-agricultural businesses operated
Household per capita consumption-expenditures
Food security (Reduced Coping Strategies Index) *
Number of meals by adults *

** These variables will be constructed and analyzed using data from high-frequency phone surveys conducted between the baseline and endline surveys.*

2.8 Sample and sampling

The target sample is 2,100 VSLA households in 150 GVHs for the primary sample and 750 non-VSLA households in the same 150 GVHs for the 'spillover' sample, amounting to 14 VSLA households and five non-VSLA households in each GVH. To account for attrition, we added one additional VSLA households and one additional non-VSLA in each GVHs, resulting in a total sample size of 3,150 households. At the endline, we will revisit the same households to measure the impact of the intervention on primary and secondary outcomes listed in Tables 1 and 2.

The eligibility criteria used in the household sampling are the following. To be included in the primary sample used to assess direct effects, the household must belong to an eligible VSLA during the

baseline visit. To be included in the secondary sample used to assess spillover effects, the household must not belong to an eligible VSLA during the baseline visit.

The implementation partner identified 150 GVHs eligible for capital injections and conducted mapping in each GVH to document all VSLAs operating there and the villages where these VSLAs are located. The sampling frame for VSLA households was based on mapping data collected by the implementation partners. We contacted the designated contact persons for all VSLAs operating in each GVH, listed all individuals participating in these VSLAs, and randomly selected 15 VSLA households to include in the sample. Non-VSLA households were selected from two randomly chosen villages within each GVH in which VSLAs were operational. A complete household listing was conducted in these villages, categorizing households into VSLA and non-VSLA groups, after which six non-VSLA households were randomly selected for inclusion in the sample. The survey team then administered the baseline survey questionnaire to the sampled households.

2.9 Surveys

We will conduct comprehensive in-person household surveys involving both VSLA and non-VSLA members. The baseline survey was carried out in October–November 2024, just before the intervention rollout, and an endline survey is planned for October–November 2026.

In addition to the baseline and endline in-person surveys, we will conduct high-frequency phone surveys to monitor labor allocation, labor earnings, and food security. These monthly phone surveys will be administered for roughly 40 percent of households in each primary study arm (T1, C1) and for all households in the spillover study arms (T2, C2), resulting in a total sample of 1,800 households (900 VSLA households and 900 non-VSLA households). The phone surveys will begin one month after the capital injections have been completed. Their primary purpose is two-fold. First, collecting data on labor allocation only at the endline would involve questions with long recall periods spanning several months, an approach associated with sizable measurement error (Arthi et al. 2018). Frequent phone surveys with shorter recall periods will result in more accurate data on labor-related activities and earnings. They also permit us to assess the degree to which seasonal patterns vary across treated and control households/communities. Second, building on Beaman, Karlan, and Thuysbaert (2014), we will use the phone survey data to assess whether treated households are better equipped to cope with the sharp seasonal fluctuations in income and prices that are common in Malawi. Since collecting accurate consumption over the phone is found to be infeasible (Abate et al. 2023), we will perform this resilience analysis using the food security indicators as the outcome variables.

We will use a 7-day recall period for all phone survey questions. Households will be contacted on a rolling basis between January 2025 and October 2026. Each household will be interviewed approximately once a month, resulting in roughly 22 monthly observations per household in total.

2.10 Statistical power

We performed power calculations using the Stata command *power twomeans*. The significance level was set at 5 percent, with a power of 80 percent. These calculations are only reported for the primary outcomes listed in Table 1 above. The spillover analysis focuses on ganyu labor markets, so we perform the power calculations using household's ganyu labor supply.

The parameters and the minimum detectable effect sizes (MDES) are provided in Table 3. The means, standard deviation (SD)[6], and intra-cluster correlations for each primary outcome have been estimated using secondary data sources. For total amount of savings, we use the endline data from Karlan et al. (2017) after restricting the data to VSLA households. For women's empowerment, we use data collected by IFPRI (2024). For all other outcomes, we use data from the Fifth Integrated Household Survey (IHS), a nationally representative survey conducted in 2019-2020. These MDES estimates are preliminary, and we will re-estimate them with the baseline data.

Overall, these preliminary MDESs are in line with previous studies assessing the impacts of VSLA promotion campaigns (Marguerie and Premand 2023, Karlan et al. 2017, Ksoll et al. 2016, Beaman, Karlan, and Thuysbaert 2014). For example, Marguerie and Premand (2023) report MDES between 0.15 and 0.23 SDs , a range that this very similar to those reported in Table 3.

Finally, a major methodological challenge in previous VSLA RCTs relates to low take-up (see Table A1 in the appendix). With the exception of one study (Marguerie and Premand 2023), less than 50 percent of the targeted households in treated communities joined a VSLA group (Karlan et al. 2017, Ksoll et al. 2016, Beaman, Karlan, and Thuysbaert 2014). In addition, a non-negligible share of control

[6] We stratify the randomization at the Growth Pole level. Such an administrative organization is not available in the IHS and the other sources, but we proxied for this using the indicator variable capturing either a study cluster in the case of Karlan et al. data or Traditional Authority (TA – the second lowest administrative unit in Malawi) in the case of IHS. More specifically, we used the predictive power to adjust the standard deviation for the reduced variance in outcomes controlling for TA fixed effects as well as the baseline controls introduced in Section 4.1: household size, and age and education level of the household head. We follow the guidance provided by McKenzie in point 4 in this recent blog post in adjusting for the reduced variance of the outcomes of interest conditional on controls:
https://blogs.worldbank.org/impactevaluations/six-questions-about-doing-power-calculations.

households joined a VSLA during the study period. Such partial compliance greatly reduces statistical power, reducing the effective MDESs (Duflo, Glennerster, and Kremer 2007).[7] Our study design bypasses this problem by leveraging existing VSLA groups in the communities. As such, we expect that very few VSLA groups will refuse to receive a capital injection, implying a near 100 percent compliance rate in the RCT.

[7] For example, a 50-% difference in the take-up rate between control and treated implies a four times larger minimum detectable effect size (MDES) than in the case of perfect compliance.

Table 3. Power calculations for the primary outcomes

	(1) Main analysis: Household total savings ($PPP)	(2) Net income from non-agricultural businesses ($PPP)	(3) (log) Household monthly per capita consumption expenditure ($PPP)	(4) Food security (RCSI) *	(5) Women's control over income index	(6) Spillover analysis: Number of days of selling ganyu labor *
Households per cluster	14	14	14	5	14	5
Number of clusters per arm	75	75	75	75	75	75
Number of clusters in total	150	150	150	150	150	150
Number of households per arm	1050	1050	1050	375	1050	375
Total number of households	2850	2850	2850	750	2850	750
Baseline mean	0.909	103.16	3.988	8.12	0.121	85.54
Standard deviation (SD)	1.225	163.39	0.628	8.66	0.326	74.66
Adjusted SD [1)]	1.161	158.35	0.479	8.11	N/A	70.64
Intra-cluster correlation (ICC)	0.108	0.018	0.125	0.13	0.05 [2)]	0.098
Minimum detectable effect size (MDES)	0.220	21.54	0.095	2.039	0.051	17.06
MDES relative to mean	0.242	0.209	0.024	0.251	0.425	0.199
MDES relative to SD	0.180	0.132	0.151	0.235	0.157	0.229

*Note: Baseline means, SDs and ICCs estimated using Malawi data from Karlan et al. (2017) in column (1), the IHS 2019-20 data in columns (2), (3), (4), (6) and IFPRI (2024) in column (5). [1)] Adjusted for the reduced variance in outcomes when controlling for household size, and age and education level of the household head and TA or cluster fixed effects. [2)] Assumed, not estimated from the data. * These variables will be constructed and analyzed using data from high-frequency phone surveys conducted between the baseline and endline surveys. RCSI = Reduced Coping Strategies Index.*

3. Data management plan

Confidentiality measures are implemented to safeguard data integrity throughout the survey process. Data will be recorded using Computer-Assisted Personal Interviewing (CAPI) methods, eliminating the existence of hard copy questionnaires. Both raw and analyzed data files are securely stored in password-protected and encrypted databases, with access restricted to the research team. Each household and VSLA is assigned a unique ID for identification purposes. Personal details such as name, contact information, and location of the respondent are maintained separately in a data file accessible only to key members of the research team: the Research Analyst and Principal Investigators. Prior to analysis, data sets are anonymized, removing personal identifiers, and will be accessible to the public post-evaluation. Personally Identifiable Information (PII) will be deleted one year after the conclusion of the evaluation and associated grant activities, scheduled to end in 2027.

4. Analyses

4.1 Direct effects

We will employ an analysis of covariance (ANCOVA) estimation approach (McKenzie 2012) to analyze the direct impacts on primary and secondary outcomes outlined above. The estimated equation can be expressed as follows:

$$Y_{igp,t=1} = \beta T_{gp} + X'_{igp,t=0}\vartheta + \delta Y_{igp,t=0} + \theta_{gp} + \varepsilon_{igp}, \quad (1)$$

where *Y* is the value of outcome indicator observed at endline (t=1) for household *i* residing in GVH *g* near growth pole *p*. Variable T_{gp} is a time-invariant indicator variable, obtaining value of 1 if the GVH is randomly assigned to receive capital injections, and zero otherwise. We control for baseline value of the outcome variable ($Y_{igp,t=0}$), rendering equation (1) to an ANCOVA specification. The term θ_{gp} captures strata fixed effects. The equation will be estimated with and without baseline controls ($X'_{igp,t=0}$) that include household size, and age and education level of the household head. To estimate these direct effects, the sample is restricted to households that belong to eligible VSLA groups, either in treated or non-treated GVHs.

In all regressions, our treatment variable is defined according to the initial treatment assignment, rather than actual compliance. Consequently, the impact estimates, captured by β, reflect intention-to-treat effects (ITT).

To assess impacts on food security and labor market participation, we use the high frequency phone survey data and the following specification:

$$(2) \quad Y_{igp,t=\{1,..,22\}} = \sum_{t=1}^{22} \zeta_t m_t + \beta T_{gp} + \sum_{t=1}^{22} \lambda_t \left(T_{gp} * m_t\right) + X'_{igp,t=0}\vartheta + \delta Y_{igp,t=0} + \theta_{gp} + \varepsilon_{igp},$$

where time-period *t* now refers to post-treatment calendar months (22 in total). Variable m_t is a binary variable for each calendar month with parameter ζ_t providing the estimate of the change in food security situation or labor market participation among the control households at time *t*. The corresponding effect in treated households is captured by ζ_t+λ_t, and hence λ_t quantifies the estimated difference between the treatment and control households. The baseline value ($Y_{igp,t=0}$) will be constructed using data from the in-person baseline survey. The results will be presented graphically using scatter plots with 95% confidence intervals, where the vertical axis measures the change in the outcome each month and the horizontal axis captures the calendar month.

All regressions will be conducted using the Ordinary Least Squares (OLS) method. To accommodate the randomized study design, standard errors will be clustered at the GVH level, following the recommendation by Abadie et al. (2022). Cluster-robust standard errors will be computed using Stata's *vce(cluster)* command, which adjusts the standard errors based on the Liang and Zeger (1986) approach. Statistical analyses will be carried out using Stata, version 18 or higher.

In addition to reporting standard p-values, we will also report p-values corrected for multiple hypothesis testing using sharpened FDR (false discovery rate) q-values (Anderson 2008). This correction will be applied separately within the primary outcomes and within the secondary outcomes.

4.2 Spillover effects

The study is specifically designed to capture within-GVH spillover effects. To quantify these effects, we re-estimate Equations (1), (2) and (3) but restrict the sample to households that did not belong to eligible VSLAs during the eligibility mapping conducted before the baseline survey.

We expect the between-GVH spillovers to be negligible in this context. First, the casual labor (ganyu) markets primarily operate at the village level with rural households rarely hiring labor from outside their village (Fink, Jack, and Masiye 2020, Van Cappellen and Oliveres-Mallo 2024). Second, we expect price effects to be negligible. Studies assessing the inflationary impacts of large-scale cash

transfers programs routinely fail to detect meaningful impacts, even when in programs characterized by high saturation and large transfer sizes (Cunha, De Giorgi, and Jayachandran 2018, Egger et al. 2022). Therefore, we do not expect that the improved loan access generated by capital injections will generate meaningful price effects that would create winners or losers in the local economies.

4.3 Missing data from item non-response

There will be no imputation for missing data due to item non-response at baseline or endline.

4.4 Heterogeneous effects

We will report heterogenous treatment effects along three pre-specified dimensions. These analyses should be considered to be exploratory because our sample may not be sufficiently powered to estimate interaction effects.

The first dimension of heterogeneity is household size. Households with fewer adults could be too labor constrained to start new livelihood activities. To explore this, we will use the baseline data to classify households as small or large using the median number of adults in the household.

A second dimension of heterogeneity is land size. Earlier analysis suggests that households with more than 0.25 hectares of cultivated land per person are likely to meet their basic needs from farming alone (Benson and de Weerdt 2023).[8]

Finally, we will use the listing data to categorize GVHs based on the presence of Growth Pole firms, considering their footprint in terms of economic interactions (e.g., number of employees and out-growers), and explore heterogeneity in this dimension. We hypothesize that a larger Growth Pole footprint is associated with more economic opportunities, and therefore, we expect the estimated impacts to be greater in GVHs where this footprint is larger.

4.5 Cost-effectiveness

To further support policymaking in this area, we will conduct a cost-effectiveness analysis. Intervention costs will be compiled using the 'ingredients method of costing' (Levin and McEwan 2001). Benefits will be assessed through treatment effects on household per capita consumption, a widely used welfare indicator that allows for broad comparability (Bossuroy et al. 2022) and serves

[8] According to the latest available IHS data, only 20 percent of households were above this threshold.

as a standard for defining poverty in poor countries where income data are challenging to measure accurately (Ravallion 2010).

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Administrative information

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Declaration of interest

Hirvonen, De Weerdt and Siyame declare no conflict of interest. Mtemwa, Sibande and Venable are members of the program implementation team (Feed the Future Malawi Growth Poles Project) that designed and implemented the VSLA capital injection intervention. Mtemwa, Sibande and Venable reviewed the protocol and provided inputs into description of the study design. However, the final decisions for content were made by the primary researchers from the evaluation team (Hirvonen, De Weerdt and Siyame).

Appendix A: Literature review of previous VSLA RCTs

Marguerie and Premand (2023) conducted a multi-arm randomized controlled trial (RCT) to test the direct and spillover impacts of various financial interventions in Côte d'Ivoire. The study featured four arms: the first treatment arm assisted households in forming VSLAs without additional cash payments to either households or VSLAs; the second treatment arm received a one-off cash transfer of $384 PPP; and the third treatment arm received a one-off cash transfer with a 50 percent repayment requirement. A total of 207 villages were included in the study out of which 53 villages received the VSLA intervention, 30 villages received the cash grant intervention, 64 villages the cash grant with repayment and 60 clusters served as a control group. In addition, all treatment arms received training on operating micro-enterprises. The impacts were compared against a control group that received no financial interventions or training. After about 2 years since the launch of the project, the VSLA intervention increased the value of productive assets and led to a re-allocation of savings to VSLAs when compared to the control group but did not increase the total savings amounts. Furthermore, the impacts of the VSLA on earnings, as well as household food security and other welfare outcomes, were muted. Regarding local spillovers, households that did not directly benefit from the VSLA intervention, but resided in communities where the intervention was implemented, were more likely to join and save in VSLAs. There is also evidence of increased economic activity among these households: the number of income-generating activities increased by more than 10 percent.

Ksoll et al. (2016) studied the impact of a randomized intervention that promoted the formation of VSLAs in rural villages of northern Malawi. This intervention did not include capital injections into the VSLAs or cash transfers to households. The study included both a treatment and a control group, each consisting of 23 villages. After 2 years, the intervention had improved access to credit and loans, which were mostly used to finance inputs in crop agriculture. It also led to an increase in total savings, household expenditures (based on a poverty scorecard method) and number of meals consumed by the household per day. However, there was no evidence of an increase in the number of income-generating activities; in fact, the results suggested the opposite. Agricultural investments increased as did income from small businesses (but only at the median). Many of these findings, however, are not robust to alternative estimation methods or multiple hypothesis testing, possibly

due to the limited statistical power of this trial.[9] Regarding spillovers, some households in non-treated communities joined VSLA groups in the treatment areas.

Karlan et al. (2017) conducted a multi-country RCT in Ghana, Malawi, and Uganda to assess the impact of an intervention promoting the formation of VSLAs. No capital was injected into the VSLAs or cash transfers provided to the households in the treated clusters. This cluster-randomized trial involved 282 clusters assigned to the treatment group and 279 to the control group. In Ghana and Uganda, 36 percent of the households in treated communities joined a VSLA, while in Malawi, the corresponding figure was lower, at 22 precent. Interestingly, VSLA membership in the control localities also increased, from zero at baseline to 6 percent at endline. After 2 to 3 years from the start of the intervention, notable improvements in financial inclusion were observed: total savings balances increased by 34 percent relative to the control group, and the likelihood of holding savings or receiving a loan also increased. However, impacts on household food security, incomes, revenues, assets, and per capita consumption were muted. Businesses operated by households in the treated communities tended to operate longer, were more likely to employ someone, and households reported 24 percent higher profits compared to those in the control villages. The study also found evidence of improvements in women's empowerment.

Beaman, Karlan, and Thuysbaert (2014) tested an intervention that promoted VSLA groups among women in rural Mali without capital injections or cash transfers. This cluster RCT included 209 villages in the treatment group and 291 in the control group. The study included a baseline survey conducted in 2009 and an endline survey in 2012. In addition, high-frequency surveys that collected data on financial transactions, incomes, food consumption, nonfood expenditures, among other aspects were conducted on sub-sample of households. Nearly 30 percent of households in treated villages joined a VSLA, compared to 6 percent in control villages. In treated villages, there was an increase in total savings and a higher likelihood of obtaining a loan relative to control villages. The value of livestock increased by about 13 percent, but there was no evidence of an increase in business profits or the likelihood of running a small business. Some positive impacts on food consumption levels and food security were documented, though modest in magnitude. These relatively small effects could be attributed to the fact that the endline survey occurred during a post-harvest period, generally characterized by better food security. However, analysis of the high-

[9] The number of clusters is relatively small and the VLS take-up in treated communities is (only) 40 %.

frequency data shows that households in treatment villages were better able to smooth consumption during the lean season. Finally, there were no statistically significant impacts on indicators of social capital or women's empowerment.

Table A1. Sampling details of previous VSLA RCT studies

Study	Country	Number of treatment clusters	Number of control clusters	Total sample size	VSLA take up at endline in the treatment group
Marguerie el al. (2023) *	Cote d'Ivoire	53	60	1,599	69.5%
Ksoll et al. (2016)	Malawi	23	23	1,737	45%
Karlan et al. (2017)	Ghana, Malawi, and Uganda	282	279	13,564	32%
Beaman et al. (2014)	Mali	209	241	5,579	37%

** Multi-arm study where one arm received VSLA promotion, two arms received cash transfers, and one arm served as a pure control group. The study also included a spillover sample. The numbers reported in the table refer to the VSLA promotion arm or to the pure control arm and only include the main study sample (not the spillover sample).*