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Participation in informal savings groups and women's empowerment in agriculture in Nigeria

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Abstract

While impact evaluations of formalized savings groups show that they can improve financial inclusion and women's economic empowerment in a variety of settings in sub-Saharan Africa, only very few studies examine the impact of informal savings groups. This paper examines the association between informal savings group membership, individual-level asset ownership, and household-level decision-making power for men and women using panel data from a nationally representative sample from Nigeria. We find a small but statistically significant association between informal savings group participation, and women's decision-making power and asset ownership in the household, but high drop-out rates from informal savings groups, especially for women. We hypothesize that informal savings group participation in Nigeria may not provide women with sufficient finance to accumulate resources required for investments in larger assets. We discuss implications for the design of formalized savings groups, with a focus on in-group trust, group governance, and access to capital.

I. Introduction

Across sub-Saharan Africa, governments are increasingly investing in savings groups either independently or in integration with national protection systems. A study by SEEP (2018) identified 20 social protection programs and policies in sub-Saharan Africa with a savings group component. In Nigeria, the Ministry of Women's Affairs and Social Development (MOWASD) in partnership with the World Bank is supporting the implementation of the Nigeria for Women Project (NFWP), which aims to reach 324,000 women across six states using a model of Women's Affinity Groups [(WAGS) de Hoop et al., 2021] to improve women's livelihood opportunities and economic empowerment. The Nigerian Government decided to include a savings component in each of the WAGs. With this decision the Nigerian government joined an increasing number of African governments in an effort to make strategic investments in savings groups (SEEP, 2018).

Evidence from a variety of settings in sub-Saharan Africa indicates that formalized savings groups can improve financial inclusion, but evidence on improvements in women's asset ownership and household-level decision-making power is more mixed. Evidence from various settings in sub-Saharan Africa suggests that participation in formalized savings groups increases savings and access to credit (Gash, 2017; Karlan, Savonitto, Thuysbaert, & Udry, 2017; Ksoll, Lilleør, Lønborg, & Rasmussen, 2016; Blattman et al., 2016). In addition, evidence from a cluster-randomized controlled trial in Ghana, Malawi, and Uganda suggests that participation in a community-based Village Savings and Loan Association (VSLA) led to an improvement in household business outcomes and women's empowerment (Karlan et al., 2017)¹, while a cluster-randomized controlled trial in Malawi indicated that savings and credit obtained through a VSLA can increase agricultural investments, thereby improving the number of meals consumed per day and household expenditures (Ksoll et al., 2016). However, Karlan et al. (2017) did not find statistically significant impacts on household income, consumption, food security, asset ownership, or community participation in their cluster-randomized controlled trial of VSLAs in Ghana, Malawi, and Uganda.

While the evidence base on the impact of formal savings groups is growing, only very limited evidence is available on the impact of informal savings groups in sub-Saharan Africa despite their high prevalence, especially in rural areas. For example, a scoping review of women's groups in Uganda indicates that many groups are formed by women themselves with limited external support (de Hoop et al. *Forthcoming*). One exception of a study examining the impact of informal savings groups is a randomized controlled trial by Beaman, Karlan, & Thuysbaert (2017) who found positive program impacts on food security, consumption smoothing and overall savings in Mali, but did not find statistically significant impacts on women's decision-making power in the household. However, while the study labels the group as informal, it focuses on the impact of a savings group with external support, indicating that the group has some semi-formal characteristics. The formality of savings groups can range from formal or semi-formal to informal,

¹ CARE defines VSLAs as "A group of 15-25 people (most often women) who save together and take small, low interest loans from those savings" (CARE, n.d.).

with the level of formality depending on the organizational structure, government regulation and extent of linkage to regulated finance institutions (Babajide, 2011). Most informal savings groups in sub-Saharan Africa do not receive financial support, and their prevalence makes them important to study for fully understanding group effectiveness, especially because the majority of rural and agricultural households in Nigeria find informal groups easier to access and flexible in operations (EFInA, 2010; Ayegba & Ikani, 2013).

This study contributes to the literature by examining the association between participation in informal savings groups, specifically Adashis, Esusus, and Ajos,² and indicators of women's empowerment and economic well-being in agricultural households using a nationally representative sample from Nigeria. In particular, we examine the association between participation in informal savings groups, and women's and men's asset ownership and decision-making power in the household using four rounds of panel data from the World Bank's Living Standards Measurement Study - Integrated Survey on Agriculture (LSMS-ISA) - Nigerian General Household Survey (GHS). To our knowledge, this is the first study that examines this association nationwide for farmers in Nigeria. We also assess how gender moderates the associations, and the extent to which participation in informal savings groups has an enduring association with individual-level asset ownership and decision-making power.

We examine the following research questions:

1. What are the spatial patterns of informal savings groups in Nigeria?
2. What are the trends in informal savings group membership and drop-out from informal savings groups in Nigeria and how do those trends differ between men and women?
3. What is the association between informal savings group membership and individual-level asset ownership and decision-making power in Nigeria?
4. How does the association between informal savings group membership, asset ownership and decision-making power differ between men and women?

We find evidence of a positive association between informal savings group participation, and women's decision-making power and asset ownership in the household, but high drop-out rates for women in particular. These findings indicate that informal savings group participation may not provide women with sufficient opportunities to accumulate the resources required for investments in larger assets even if these groups have the potential to improve women's asset ownership and decision-making power. The high drop-out rates are consistent with evidence from Nigeria indicating that informal savings groups and other women's groups face significant challenges because of poor group governance and low within-group trust, for example because of the capture of groups by group leaders, fraud, poor sense of belonging, and inappropriate activities (Desai et al., 2018). The results are also aligned with findings of a study by Kochar et al. (2021) who find

² An Esusu is a traditional savings group type in African societies where individuals contribute to informal savings and credit associations for their mutual benefit. In northern Nigeria, these groups are often called Adashi among the Hausa people and Ajo among the Yorubas ([https://in-formality.com/wiki/index.php?title=Esusu_\(Nigeria\)](https://in-formality.com/wiki/index.php?title=Esusu_(Nigeria))).

that self-help groups only have positive effects on women's intra-household decision-making power after women gain access to larger loans through community investment funds.

The remainder of the paper is structured as follows. Section 2 discusses the mechanisms through which participation in informal savings groups can improve women's asset ownership and decision-making power in a household. Section 3 is devoted to data and indicators used in the study. In section 4 we present spatial patterns and trends of participation in informal savings groups and women's asset ownership and decision-making power in Nigeria. Section 5 discusses the methodology and empirical specification of our model. Next, we discuss the results on the association between savings group participation and asset ownership, control over income, and decisions in agriculture in section 6. Section 7 concludes the paper with a discussion that includes limitations and possible extensions for future work.

II. Mechanisms of Change

Informal savings groups can improve women's asset ownership and decision-making power through two main mechanisms. First, women can gain access to savings and credit, which can help resolve credit constraints for women aiming to make investments towards increasing their future consumption and asset ownership. For example, a systematic review suggests that savings groups are effective at reducing poverty, and increasing income (Steinert et al., 2018). Second, women can develop opportunities to come together in groups and improve access to social and financial capital. Social and financial capital can enhance women's agency and increase their household-level decision-making power. This is consistent with findings of studies by Karlan et al. (2017) and Blattman et al. (2017) who show that formalized savings groups have positive effects on women's asset ownership and intra-household decision-making power in Uganda.

However, the described mechanisms will only result in improvements in women's asset ownership and decision-making power when savings and credit amounts are sufficient to make investments that are required to invest in assets and when group members trust each other. For example, Kochar et al. (2021) show that self-help groups only have positive effects on women's intra-household decision-making power after women gain access to larger capital in the form of community investment funds. The authors suggest that the access to larger capital funds enabled women to gain bargaining power because it enables them to realize a threat point (Kochar et al., 2021). However, savings groups with poor households often save only small amounts, which limits their opportunity to make larger loans (Burlando & Canidio, 2017). In addition, a social analysis of women's groups in Nigeria indicates that trust is only present to a degree in most informal savings groups in Nigeria (Desai et al., 2018). Without such in-group trust women will likely not provide each other with large amounts of collective savings for intra-group lending, especially not in informal savings groups.

III. Data

To answer the research questions, we use the World Bank's LSMS-ISA General Household Survey (GHS) in Nigeria. The GHS is a nationally representative panel dataset that contains information on household, individual, and farm characteristics.³ The agriculture module (administered to households that report agricultural activity) captures information on land characteristics, decisions related to cropping and crop management, and household-level livestock and farm assets. At the individual level, the questionnaire also captures information on whether specific household members saved or borrowed using an informal savings group (e.g., Adashi, Esusu, or Ajo), in the previous 6 or 12 months.⁴

We use four waves of the GHS between 2010/2011 and 2018/2019.⁵ The GHS takes the form of a household-level panel for the first three waves and a partially refreshed panel in the fourth wave. The tracking of individual household members over the four waves enables a longitudinal analysis at the individual-level. We restrict this analysis to individuals in agricultural households that are at least 18 years old, resulting in a sample of 39,544 individuals that includes 20,917 women and 18,627 men. Of these observations, we are able to obtain the community-level, household-level, and individual-level information for 14,306 observations (7,568 women and 6,738 men) that are included in all four waves, including the partially refreshed panel from 2018/2019.

We use three outcome categories to proxy for women's economic empowerment: individual-level asset ownership, women's decision-making authority or intra-household decision-making in agriculture, and women's control over agricultural income (Figure 1).

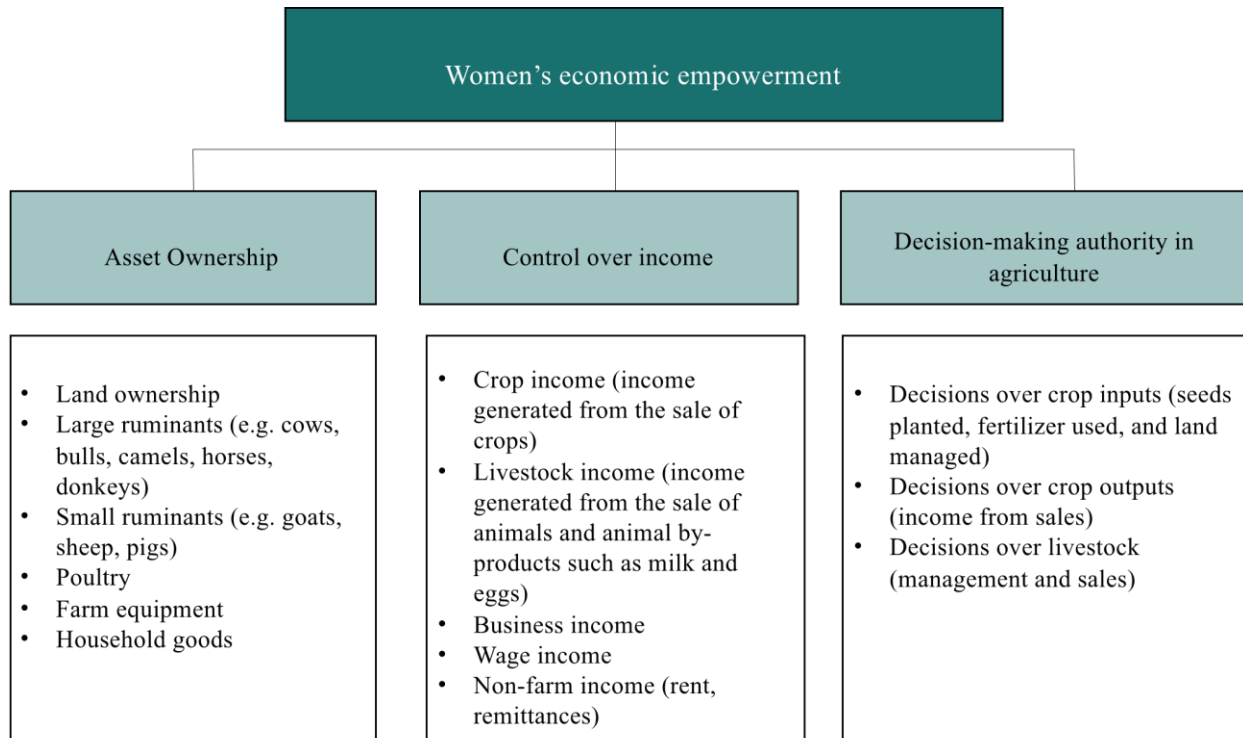
Asset ownership includes ownership of land, large ruminants, small ruminants, poultry, farm equipment, and household goods. Control over income in agriculture refers to income received from crops and livestock. Finally, we assess decision-making authority in agriculture by examining an individual's agency to have sole or joint decision-making power around crop inputs, crop outputs, and livestock. We also created an index that estimates the proportion of questions related to crop inputs, crop outputs, and livestock in which an individual has sole or joint decision-making power.

³ The survey includes information on education, health, labor, income sources, access to financial services, assets, expenditures, and consumption, among other topics.

⁴ The first two survey waves ask respondents whether they participated in an informal savings group in the last 6 months, while the last two waves ask whether respondents participated in an informal savings group in the last 12 months.

⁵ Specifically, the survey was administered in 2010/2011 (wave 1), 2012/2013 (wave 2), 2015/2016 (wave 3) and 2018/2019 (wave 4).

Figure 1. Women's economic empowerment in agriculture outcomes



IV. Spatial patterns and trends of informal savings groups, asset ownership, and decision-making power

This section examines research questions 1 and 2 on the spatial patterns and longitudinal trends of informal savings group participation in Nigeria. Further, we present patterns of women's and men's asset ownership and control over various types of income.

Table 1 shows that between 2010 and 2018, informal savings group participation increased for both men and women. In 2010, 23% of women saved or borrowed with an informal savings group, which increased with 10 percentage points to 33% in 2018 despite the fact that the survey in 2018 no longer asked respondents about borrowing from savings groups. The percentage of men who are informal savings group members increased from 18% to 24% between 2010 and 2018. A regression analysis examining yearly trends shows a statistically significant increase in informal savings group participation for both men and women in agricultural households. The higher likelihood of women participation in informal savings groups is possibly related to the greater access barriers women (particularly those in agriculture) face when attempting to gain access to formal finance institutions (Adegbite and Machethe, 2020).

Data from 2010 and 2012 also suggest that informal savings groups are more often used for savings than for borrowing purposes. In 2010, 21% of women and 18% of men in Nigeria used an informal savings group to save money, while 10% of women and 8% of men used an informal savings group to borrow money.

Table 1. Rate of savings group participation

	Percent				Trend
	2010	2012	2015	2018	Coef.
Women					
Saves or borrows with informal savings group	23	25	28	33	0.012***
Save money with informal savings group	21	23	28	33	0.015***
Borrows money with informal savings group	10	10	--	--	-0.004
Observations	5,002	4,966	4,938	6,011	
Men					
Saves or borrows with informal savings group	18	18	18	24	0.008***
Save money with informal savings group	16	17	18	24	0.010***
Borrows money with informal savings group	8	8	--	--	-0.004
Observations	4,425	4,414	4,428	5,360	

Note: Limited to women and men ages 18+ in agricultural households. Asterisks denote the level of statistical significance of the coefficient in a simple regression of each outcome variable on year. *** p<0.01, ** p<0.05, * p<0.1

Figure 2 and Figure 3 show the geographical patterns of informal savings group participation for women and men in agricultural households. Between 2010 and 2018, women's and men's aggregate savings group participation increased throughout Nigeria but unevenly by region. For women, savings group participation increased in the South-West, South-South and parts of the North-East of the country in particular with the highest increase in savings group participation in Yobe State in the North-East of Nigeria. The more restrictive social-cultural gender norms in the Northern zones and the deteriorating security situation caused by the presence of Boko Haram may have contributed to the smaller increases in savings group participation in the North, with women in the Southern zones of Nigeria having more opportunities to socialize outside the household (Desai et al., 2018). However, we cannot distinguish between these and other contextual factors when explaining the differences between trends in savings group participation rates of women across different regions in Nigeria. For men, savings group participation in 2010 was rather low, especially in the North-West and North-East part of Nigeria. However, overall savings group participation increased by 2018, particularly in the North-Central part of Nigeria and the South-South part of Nigeria.

Figure 2. Patterns of women's savings group participation over space and time

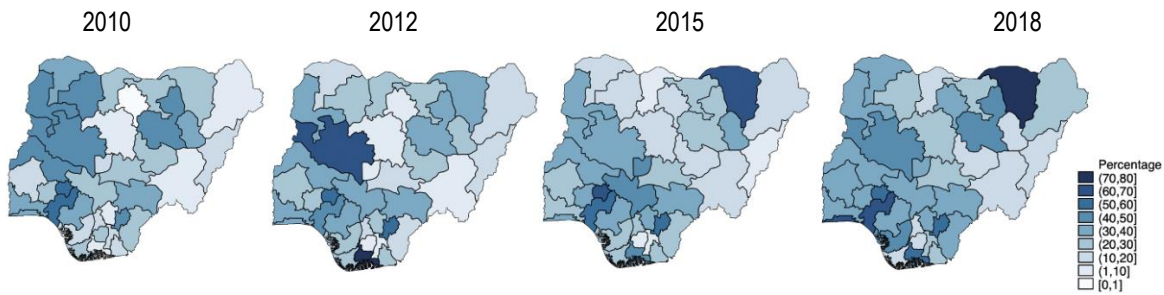
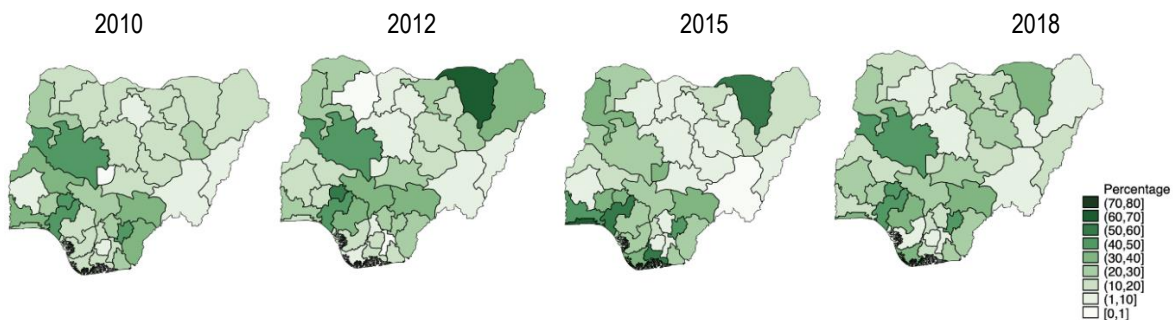


Figure 3. Pattern of men's savings group participation over space and time



Most Nigerian women and men only participate in informal savings groups for a relatively short period of time (Table 2). Over three survey waves (2010–2015, during which the dataset formed a complete panel), 25% of all women participated in a savings group during one wave, 15% participated during two waves, and 7% stayed in their savings group for three consecutive waves. Of those women participating in a savings group between 2010 and 2015 (35%), half remained in a savings group for one wave, a third stayed in a savings group for two waves and 15% stayed in a savings group for three waves. We found a similar pattern for men, with just 20% of men who participate in a savings group remaining in a savings group for one wave and only 8% of men remaining in a savings group for three consecutive waves.

The data also show considerable movement in and out of groups for men and women in Nigeria. Nearly a quarter of men and women entered a savings group between 2010 and 2015, and 21% exited a savings group over this same time period. Women appear to enter and exit savings groups more frequently than men with 28% entering a savings group between 2010 and 2015, and 23% exiting a savings group over this same time period. This finding is aligned with the study by EFINA (2010), which reports that men are more likely than women to use informal savings groups for longer-term investments in land and housing.

Table 2. Savings group participation entry and exit, 2010 to 2015

	Percent		
	Women	Men	Total
No survey waves in a savings group	52	65	58
1 survey wave in a savings group	26	21	23
2 survey waves in a savings group	15	10	13
3 survey waves in a savings group	7	4	6
Entered a savings group between 2010 and 2015	28	20	24
Exited a savings group between 2010 and 2015	23	19	21

We found a similar trend in control over income dimensions with women having less decision-making authority over farm-related activities and decisions over income earned from farming than men. Men are more likely to report controlling income from harvests, sale of animals or animal by-products, wage income and non-farm income, including income received from remittances and rent, with women more likely to report controlling business income. Women are also less likely than men to have decision-making authority over agricultural decisions with 48% of women and 66% of men in agricultural households in Nigeria making decisions over crop inputs (seeds, fertilizer), crop outputs (use of harvest) or livestock (management of animals). These findings are in line with previous evidence of Anderson, Reynolds, & Gugerty (2017) and Adegbite & Machette (2020) indicating that most women in small-scale agriculture in Nigeria depend on male household heads to make agricultural and financial decisions.

Table 3 and Table 4 show descriptive statistics on asset ownership, control over agricultural income, and decision-making authority in agriculture. In Nigeria, large gender gaps remain in asset ownership, particularly related to land and livestock ownership (FAO & ECOWAS Commission, 2018). Only seventy percent of women own at least one asset. A more detailed analysis reveals that women's asset ownership is mostly driven by ownership of household goods (61%), poultry (45%), and small ruminants, such as goat and sheep (35%). Only 6% of women own large ruminants, 17% own large farm equipment, and 20% of women own land. Table A2 in Annex A shows more details on sole and joint ownership of assets, and control over income and decision-making in agriculture of our respondents.

We also found large discrepancies in the type of assets women and men own. In particular, 63% of men own land, compared to 20% of women. Men are also more likely to own large ruminants, small ruminants and farm equipment. 79% of men own land, livestock, farm equipment, or household goods. However, women are relatively more likely to own lower value assets than men as shown by the lower discrepancy in asset ownership between men and women for categories that include poultry ownership and household goods. This is in line with findings from FAO & ECOWAS Commission (2018) reporting a large gender disparity in livestock production, with women typically involved in the production of small ruminants and poultry, while men typically produce high-value assets such as cattle, camels and donkeys.

Table 3. Percentage of women with asset ownership, control over income, and decision-making in agriculture

	2010		2012		2015		2018		Total	
	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.
Owner of a plot of land	21%	1039	16%	1227	14%	4069	24%	5011	20%	11346
Owner of a large ruminant	6%	1294	7%	1231	5%	1053	5%	995	6%	4573
Owner of a small ruminant	34%	2877	37%	2997	34%	2643	38%	2865	36%	11382
Owner of poultry	44%	2862	49%	2846	40%	2508	46%	2306	45%	10522
Owner of farm equipment	14%	4076	16%	4307	18%	3843	19%	1920	17%	14146
Owner of a household good	51%	4833	62%	4888	58%	4792	72%	5426	61%	19939
Owner of land or livestock or farm equipment or a household goods	63%	5002	71%	4966	66%	4937	78%	6011	70%	20916
Share of asset categories in which an individual has sole or joint ownership	34%	5002	39%	4966	33%	4937	45%	6011	38%	20916
Has control over crop income	27%	1486	30%	4458	27%	4562	32%	5167	30%	15673
Has control over livestock income	37%	3496	44%	3490	42%	3486	45%	3753	42%	14225
Has control over business income	57%	2991	59%	3185	54%	3023	48%	3393	54%	12592
Has control over wage income	--	--	57%	2853	31%	1017	39%	1741	47%	5611
Has control over other income (non-farm)	--	--	38%	505	25%	349	27%	662	30%	1516
Has control over crops, livestock, business income	52%	5002	66%	4966	61%	4937	64%	6011	61%	20916
Share of income categories in which an individual has sole or joint control over crops, livestock or business income	39%	5002	45%	4966	39%	4937	41%	6011	41%	20916
Decides over crop input	15%	4621	23%	4720	24%	4715	29%	5696	23%	19752
Decides over crop output	27%	1486	35%	2881	31%	3265	35%	3308	33%	10940
Decides over livestock	37%	3496	55%	3853	41%	3492	45%	3754	45%	14595
Has decision-making power over crops or livestock	35%	5002	56%	4966	49%	4937	50%	6011	48%	20916
Share of categories in which an individual has sole or joint decision-making power over crops or livestock	25%	5002	37%	4966	32%	4937	35%	6011	33%	20916

Table 4. Percentage of men with asset ownership, control over income, and decision-making in agriculture

	2010		2012		2015		2018		Total	
	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.
Owner of a plot of land	56%	1013	51%	1134	62%	3672	68%	4500	63%	10319
Owner of a large ruminant	70%	1144	63%	1131	58%	969	67%	909	64%	4153
Owner of a small ruminant	60%	2548	57%	2692	47%	2407	52%	2536	54%	10183
Owner of poultry	51%	2521	47%	2534	38%	2244	42%	2042	44%	9341
Owner of farm equipment	64%	3608	60%	3815	61%	3414	66%	1727	62%	12564
Owner of a household good	69%	4284	73%	4347	68%	4336	82%	4880	73%	17847
Owner of land or livestock or farm equipment or a household goods	75%	4425	79%	4414	74%	4426	87%	5360	79%	18625
Share of asset categories in which an individual has sole or joint ownership	63%	4425	61%	4414	58%	4426	68%	5360	63%	18625
Has control over crop income	60%	1333	61%	3999	58%	4078	62%	4607	60%	14017
Has control over livestock income	58%	3082	55%	3125	51%	3139	53%	3323	54%	12669
Has control over business income	49%	2632	55%	2826	47%	2680	53%	3035	51%	11173
Has control over wage income	--	--	63%	2581	53%	985	57%	1676	59%	5242
Has control over other income (non-farm)	--	--	55%	442	48%	350	49%	626	51%	1418
Has control over crops, livestock, business income	59%	4425	71%	4414	66%	4426	72%	5360	67%	18625
Share of income categories in which an individual has sole or joint control over crops, livestock or business income	50%	4425	59%	4414	54%	4426	58%	5360	56%	18625
Decides over crop input	62%	4087	60%	4223	63%	4224	67%	5115	63%	17649
Decides over crop output	60%	1333	62%	2591	58%	2960	63%	2949	61%	9833
Decides over livestock	58%	3082	61%	3438	51%	3142	53%	3324	56%	12986
Has decision-making power over crops or livestock	64%	4425	66%	4414	65%	4426	68%	5360	66%	18625
Share of categories in which an individual has sole or joint decision-making power over crops or livestock	60%	4425	60%	4414	57%	4426	62%	5360	60%	18625

Table 5 shows that in Nigeria, women are most likely to report joint ownership than sole ownership of assets and are more likely to decide over income and agricultural choices jointly than solely. Only 4% of women have sole ownership of any asset, 6% have sole control over income and 7% of women have sole decision-making authority over agriculture.

Table 5. Percentage of men and women that report sole or joint asset ownership, control over income and decision-making in agriculture

	Percent	
	Men	Women
Sole		
All assets	10	4
Control all income	13	6
All decisions in agriculture	21	7
Joint		
Any asset ownership	69	65
Control any income	55	55
Any decisions in agriculture	45	42
Jointly with opposing sex		
Any asset ownership	66	63
Control any income	52	51
Any decisions in agriculture	42	39

V. Empirical Specification

To address research questions 3) and 4), we estimate a regression model using panel data. Equation (1) depicts the structure of the model.:

$$Y_{it} = \alpha + \theta Savings\ group_{it} + \rho[Woman * Savings\ group]_{it} + \varphi X_{it} + year_t + \tau_i + \varepsilon_{it} \quad (1)$$

Here Y_{it} is the empowerment in agriculture outcome variable for individual i at time t ; $Woman_{it}$ is a dummy variable that is 1 for women; $Savings\ group_{it}$ indicates individual-level participation in an informal savings group, defined by having saved and/or borrowed with an informal savings group; X_{it} is a vector of control variables that include demographic characteristics, household characteristics and wealth, community characteristics and zone fixed effects,⁶ and $year_t$ is the year fixed effect accounting for each survey wave. In addition, τ_i is the individual fixed effect which controls for individual-level characteristics that do not change over time (e.g., certain preferences are commonly assumed fixed over a reasonable time frame). Our key explanatory variable is the

⁶ Table A1 in Annex A presents descriptive statistics of the control variables.

interaction term $[Woman * Savings\ group]_{it}$ which interacts the gender of the individual with their participation in an informal savings group. ρ then captures the differential association between informal savings groups participation and the outcomes for men and women. Because informal savings group participation is endogenous, we emphasize that our results should be interpreted as correlations and not as causal relationships though the results could possibly indicate a causal relationship.

We also conducted a number of secondary analyses to examine potential heterogeneities in the association between informal savings group participation and the outcome measures, spillovers to other household members, enduring associations, and a potential nonlinear relationship. First, we extended equation (1) with interaction terms between informal savings group participation and poverty status as well as various geographic characteristics to understand whether informal savings group participation is differentially correlated with the outcomes for certain sub-groups. Second, we examined intra-household spillovers by controlling for a dummy variable that is 1 for individuals who do not participate in an informal savings group but reside in a household with an informal savings group member. Third, we investigated enduring associations by including lagged participation in informal savings group in addition to contemporaneous participation in an informal savings group.

Finally, we included several robustness checks for functional form including correlated random-effects-fractional logit models to assess whether participation in informal savings groups is associated with joint or sole ownership of assets and/or decision-making over income and agriculture. We use the Correlated Random Effects (CRE) Logit Model to estimate sole and joint empowerment by empowerment outcome (Altonji & Matzkin, 2005; Wooldridge, 2005). This model is structured according to equation (2):

$$Y_{it} = \alpha + \theta Savings\ group_{it} + \varphi X_{it} + year_t + \tau_i + \varepsilon_{it} + \mu_i \quad (2)$$

Here Y_{it} is the binary empowerment in agriculture outcome variable for individual i at time t , owning an asset solely or jointly, controlling income solely or jointly, or making decisions in agriculture solely or jointly; $Savings\ group_{it}$ indexes individual-level participation in a savings group, defined by having saved or borrowed with an informal savings group; X_{it} is a vector of control variables such as demographic characteristics, household characteristics and wealth, community characteristics and zone fixed effects; and $year_t$ is the year fixed effect accounting for each survey wave.

VI. Associations between informal savings group participation and asset ownership, control over income, and decisions in agriculture

Table 6 presents estimates from equation (1) using individual-level fixed effects, year fixed effects and the control variables. Standard errors are clustered at the household level. We describe the results of two specifications of the model, the top panel shows the results using a women-sample only (7,568 observations), while the bottom panel shows the results in a mixed sample of men and women (14,306 observations).

Results of the model show that women's informal savings group members are more likely to own small assets than other women, but we find no positive association between informal savings group membership and larger assets (see Table 6). We find that for women, participation in a savings group is associated with a 2 percentage point increase in the likelihood of owning assets, a 9 percentage point increase in control over income and a 5 percentage point increase in decision-making authority over agriculture. In particular, participation in savings groups is positively associated with increased poultry and small ruminant ownership, rather than the ownership of land, farm equipment or large ruminants (Appendix, Table A3).

The results suggest that participation in informal savings groups may improve women's ability to invest in small livestock but not improve asset ownership of large assets, which require larger investments and are less frequently traded. The findings support earlier studies, which argued that informal finance mechanisms in rural areas might be less suitable to meet the level of investment required to transform agriculture (Ayegba and Ikani, 2013). We also present a robustness check using the Correlated Random Effects (CRE) Logit Model in Table A2a in Annex A. This robustness check shows qualitatively similar findings with more details on sole versus joint ownership of assets.

For women, participation in savings groups is positively and statistically significantly associated with most categories of control over income, including crop income, livestock income, business income and wage income (Appendix, Table A3), which is aligned with Karlan et al. (2017), who find that participation in savings groups has a statistically significant impact on women's household decision-making including women's ability to decide over business decisions and household expenses. In our data, women participating in informal savings groups are more likely to make agricultural decisions specifically over crop inputs such as use of seed and fertilizer and over livestock management. (Appendix, Table A3). In an analysis that includes both men and women (Table 6, bottom panel), we find larger associations between informal savings group participation, asset ownership, and decision-making power for women than for men. This result holds for control over income and for decision-making authority in agriculture. More specifically, women in informal savings groups are more likely to own small ruminants, control livestock income, and make decisions on crop inputs, as compared to male informal savings group members (bottom panel, Appendix Table A3).

In an analysis examining long-lasting associations (Table 7), we find a statistically significant and positive association between participation in a savings group in a prior wave and asset ownership. In a women-only analysis, we find that farmers who participated in a savings group in the previous wave are 3 percentage points more likely to own assets than farmers who did not participate in an informal savings group in prior survey wave. In contrast, we do not see any enduring associations between savings group participation, and control over income or decision-making in agriculture. We omitted the first wave from 2010 in this analysis, since we do not have data on participation in an informal savings group prior to 2010. As a result, we have a lower number of observations in Table 7 compared to Table 6.

These results are in line with household dynamics that gradually change over time in response to small amounts of savings and credit with changes in decision-making power requiring participation in savings groups over a much longer timespan or with larger loans. Informal savings group participation may enable investments into small assets such as goats, sheep and poultry, but improvements in control over income and decision-making in agriculture might require participation in savings groups over a longer period of time or larger loans, as shown in Kochar et al. (2021). However, the data do not allow for examining this hypothesis.

Table 6. Association between savings groups and asset ownership, control over income, and decisions in agriculture (individual-level panel analysis)

	Asset ownership		Control over income		Decisions in agriculture	
	Owner of any asset	Share of asset categories with ownership	All Income	Share of income categories with control	Agriculture	Share of agricultural production categories with decision-authority
WOMEN ONLY						
1= Individual participates in an informal savings group	0.02*	0.01*	0.09***	0.07***	0.05***	0.03***
	(0.062)	(0.070)	(0.000)	(0.000)	(0.000)	(0.000)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	7,568	7,568	7,568	7,568	7,568	7,568
WOMEN AND MEN						
1= Individual participates in an informal savings group	0.02***	0.00	0.02**	0.02*	0.00	0.00
	(0.003)	(0.672)	(0.015)	(0.099)	(0.948)	(0.918)
Female*Savings Group	0.00	0.01	0.06***	0.05***	0.06***	0.03***
	(0.793)	(0.322)	(0.000)	(0.000)	(0.000)	(0.002)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	14,306	14,306	14,306	14,306	14,306	14,306

Note: Robust p-values in parentheses, Asterisks denote the level of statistical significance of the coefficient, *** p<0.01, ** p<0.05, * p<0.1, Standard errors clustered at the household level.

Table 7. Enduring association between savings groups and asset ownership, control over income, and decisions in agriculture (individual-level panel analysis)

Enduring effects of participation in an informal savings group and asset ownership, control over income, and decisions in agriculture in Nigeria (Individual-level panel analysis)	Asset Ownership		Control over Income		Decisions in agriculture	
	Owner of any asset	Share of asset categories with ownership	All Income	Share of income categories with control	Agriculture	Share of agricultural production categories with decision-authority
WOMEN ONLY						
1= Individual participates in an informal savings group	0.02 (0.126)	0.02 (0.112)	0.06*** (0.001)	0.04*** (0.001)	0.05** (0.025)	0.03** (0.032)
1= Individual participated in an informal savings group in prior survey wave	0.03** (0.038)	0.02* (0.083)	0.02 (0.174)	-0.00 (0.803)	0.03 (0.119)	0.01 (0.327)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	5,835	5,835	5,835	5,835	5,835	5,835
WOMEN AND MEN						
1= Individual participates in an informal savings group	0.02** (0.017)	0.01 (0.407)	0.03*** (0.001)	0.03*** (0.007)	0.01 (0.251)	0.01 (0.463)
1= Individual participated in an informal savings group in prior survey wave	0.01 (0.134)	-0.00 (0.730)	0.01 (0.447)	0.00 (0.672)	0.01 (0.230)	0.01 (0.300)
Female*Savings Group	0.01 (0.708)	0.01 (0.646)	0.02 (0.240)	0.01 (0.467)	0.03 (0.198)	0.02 (0.216)
Female*Participated in savings group in prior survey wave	0.02 (0.273)	0.02 (0.181)	0.01 (0.590)	-0.01 (0.514)	0.01 (0.564)	-0.00 (0.992)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	11,238	11,238	11,238	11,238	11,238	11,238

Note: Robust p-values in parentheses, Asterisks denote the level of statistical significance of the coefficient, *** p<0.01, ** p<0.05, * p<0.1, Standard errors clustered at the household level.

Finally, we conducted sub-sample analyses to determine how the association between savings group participation, asset ownership, and decision-making power differs across sub-groups. First, we examined geographic differences in this association by dividing the country into Northern regions and Southern regions. Nigeria's south is economically more prosperous than the north, as measured by extensive oil reserves in the south as well as by more favorable socioeconomic indicators, such as higher education rates, higher household income and lower poverty rates (Dapel, 2018). Some studies attribute the differences to smaller investments in agriculture, a recent trend in deindustrialization, and higher rates of conflict with an increased presence of Boko Haram in various areas (Federal Republic of Nigeria, 2015; Dapel, 2018). The Northern Regions in Nigeria also tend to have more conservative socio-cultural and gender norms than the Southern Regions. Second, we assessed whether the associations between savings group participation, asset ownership, and decision-making power differs by poverty status by conducting sub-sample analyses for the 50% of households with the lowest asset holdings in 2010. Third, we examined differential associations between savings group participation, asset ownership, and household-level decision-making power for female-headed and male-headed households. Fourth, we examined the potential for intra-household spillovers from members participating in a savings group to other household members by introducing a dummy variable on the right hand-side that is one for individuals who do not participate in an informal savings group but reside in a household with another informal savings group member.

We found no major evidence for differential associations between informal savings group participation, asset ownership, and household-level decision-making power when conducting sub-sample analyses, but we found some evidence that individual participation in savings groups creates positive asset ownership spillovers for other household members. The sub-sample analyses do not show statistically significant differences between informal savings group participation, asset ownership, and household-level decision-making power for Northern or Southern Regions in Nigeria, households with lower and higher levels of asset ownership at baseline, or female-headed and male-headed households (see Table A4, A5, and A6 in Annex A). However, we find some evidence that individuals in households with informal savings group members are statistically significantly more likely to own assets even when they themselves are not the savings group members (see Table A7 in Annex A), providing some evidence for positive spillovers to other household members. We only find these positive spillovers for asset ownership, however.

VII. Discussion and Conclusion

Overall, the results suggest that informal savings groups are positively associated with improvements in women's decision-making and asset ownership in agricultural households, indicating a potential opportunity to improve women's economic empowerment with informal savings group membership. However, we need to exercise caution in interpreting the findings

because the research design did not allow for establishing causal effects of informal savings group membership. Therefore, these results should be considered as descriptive.

While we find that participation in informal savings groups in Nigeria is positively associated with asset ownership and decision-making power for both men and women, the association is particularly salient for women, especially for decision-making authority over income and agriculture. However, we still find large gender disparities in asset ownership and decision-making authority over income and agricultural outcomes. Women remain less likely than men to own high-value assets or to have decision-making authority in agriculture. Women are also more likely to report co-owning assets with their husbands or other members in the family instead of solely owning the asset.

We find large variations in savings group membership with larger drop-out rates of women. The data suggest that informal savings group participation increased in particular in the South-West, South-South and parts of the North-East of the country, and that savings group membership increased more for women than for men. While overall membership in savings groups increased, the longitudinal analyses showed high drop-out rates out of savings group members with very limited sustained membership over time. Women were more likely than men to drop-out of informal savings groups, which may limit their opportunity to accumulate sufficient funds to purchase larger assets.

The high drop-out rates in informal savings groups are potentially related to the poor governance of informal groups and low within-group trust. Evidence from Nigeria indicates that informal group-based programming is often defined by the capture of groups by group leaders, fraud, poor sense of belonging, and inappropriate activities (Desai et al., 2018). These processes in turn can lead to low within-group trust, which may cause higher drop-out rates, limiting the ability of informal savings groups to improve women's ownership of larger assets.

One potential way to improve the governance of informal savings groups in Nigeria is to transform informal savings groups into formal savings groups while aiming to generate higher-quality group governance and in-group trust. For example, groups could introduce rotating group leadership to stimulate democratic decision-making and within-group trust. The newly introduced and government-supported Nigeria for Women Project aims to introduce such processes after establishing new savings groups and transforming informal savings and other women's groups into formal savings groups. However, the success of this programming model will depend on various assumptions. A forthcoming impact evaluation will examine the ability of the Nigeria for Women project to generate democratic decision-making processes and in-group trust, which could then improve asset ownership and decision-making power among Nigerian women (de Hoop et al., 2021).

It also remains critical to better understand how to interpret the measurement of women's decision-making in agricultural households for a better understanding of women's empowerment

(Ibrahim & Alkire, 2007; Kabeer, 1999). Studies report that small differences in survey questions can lead to large variations in how women are ranked in terms of their decision-making power, which raises concerns about the ability of decision-making indicators to measure women's empowerment (Peterman, Schwab, Roy, Hidrobo, & Gilligan, 2021). In particular, it is unclear how to interpret the reporting of joint decision-making (Acosta et al., 2020; Peterman et al., 2021). Male and female survey respondents show large differences in intra-household perspectives on decision-making authority (Ambler, Doss, Kieran, & Passarelli, 2017; Deere & Twyman, 2012; Ghuman, Lee, & Smith, 2006). For example, in agricultural households in Tanzania, husbands and wives have different perceptions on their own and their spouses' decision-making authority over key farming, family and livelihood decisions (Anderson et al., 2017). Analyzing these differences in perceptions and unpacking sole and joint decision-making patterns can further develop our understanding of the relationship between participation in decision-making processes and women's empowerment (Seymour & Peterman, 2018).

The analysis in this paper contributes to our knowledge on informal savings groups in Nigeria but more research is needed if causal associations, longer term asset building, gender differences and outcomes within informal savings group and generalizability beyond the context of Nigeria are to be better understood. Such research could focus on experimental or quasi-experimental studies to determine the impact of informal and formal savings groups in nationally representative samples, particularly if combined with mixed-methods research to help interpret measures of decision-making power and how they are related to women's economic empowerment. In addition, research could focus on whether access to larger loans could lead to larger effects of savings groups on decision-making power and asset ownership.

Appendix

A1. Descriptive Statistics of control variables and determinants of participation in a savings group

Table A1. Descriptive statistics of control variables

	Women	Men
Age in completed years	38.4	40.3
Household head	9%	60%
Spouse of household head	66%	0%
Child of household head	17%	35%
Married	69%	60%
Separated or divorced	2%	1%
Widowed	12%	1%
Never attended school	40%	23%
Completed primary school	41%	59%
Completed secondary school	20%	34%
Saves or borrows with a formal institution (bank, cooperative, or savings association)	12%	24%
Number of members in household	7.30	7.30
Household asset value, real 2010 values, inverse hyperbolic sine transformation	11.2	11.3
Size of landholdings (acres)	1.02	1.05
Material for roof is straw or wood	14%	15%
Material for floor is earth or mud	34%	34%
Village contains a market	65%	64%
Village contains a bank or micro-financial institution	17%	18%
Village contains a clinic / hospital / health center / private practice	72%	71%
Village contains a bus stop	40%	41%
Village has an agricultural group (farmers' cooperative)	31%	31%
Village has a financial group (savings and credit group or business association)	37%	37%
Rural	82%	82%
Obs.	20,917	18,627

A.2 Sole and joint control over assets, decisions over income, and decisions in agriculture

Table A2. Descriptives of sole or joint asset ownership, control over income and decision-making in agriculture (women and men, 18+ in agricultural households), Nigeria

	Percent				
	Men	Women	Women in MHHs	Women in FHHs	Female spouses in MHHs
Land ownership	41	6	1	37	1
Large ruminants	56	1	0	25	1
Small ruminants	30	10	6	49	7
Poultry	21	18	13	48	17
Farm equipment	51	8	2	51	2
Household goods	16	6	2	34	2
All assets (sole ownership)	10	4	0	29	0
Control crop income	37	8	2	46	3
Control livestock income	25	12	7	48	9
Control business income	16	14	11	37	14
Control wage income	19	6	3	26	3
Control other income	30	10	3	50	4
Control all income (solely)	13	6	2	33	2
Decisions crop inputs	43	8	2	44	2
Decisions crop outputs	34	8	3	41	3
Decisions livestock	20	11	6	44	7
All decisions in agriculture (solely)	21	7	1	38	2
Land ownership	21	13	12	18	13
Large ruminants	8	5	5	21	5
Small ruminants	24	25	27	9	33
Poultry	24	27	29	11	36
Farm equipment	11	8	8	9	10
Household goods	57	55	58	39	66
Any asset ownership (jointly)	69	65	68	49	78
Control crop income	24	21	22	16	28
Control livestock income	29	30	32	11	39
Control business income	35	40	43	20	52
Control wage income	40	40	41	33	52
Control other income	20	20	22	9	32
Control any income (jointly)	55	55	58	36	69
Decisions crop inputs	20	16	15	19	18
Decisions crop outputs	27	25	25	23	31
Decisions livestock	37	36	38	19	46

	Percent				
	Men	Women	Women in MHHs	Women in FHHs	Female spouses in MHHs
Any decisions in agriculture (jointly)	45	42	44	32	53
Land ownership	14	12	12	13	13
Large ruminants	5	5	5	5	5
Small ruminants	22	22	24	4	29
Poultry	22	21	24	5	29
Farm equipment	8	7	8	4	9
Household goods	54	52	56	25	65
Any asset ownership (jointly with opp)	66	63	68	33	78
Control crop income	21	20	22	7	27
Control livestock income	27	27	30	5	37
Control business income	31	31	35	8	42
Control wage income	35	36	39	18	50
Control other income	19	19	21	4	31
Control any income (jointly with opp)	52	51	57	19	68
Decisions crop inputs	16	14	15	12	17
Decisions crop outputs	24	22	25	8	30
Decisions livestock	34	33	36	8	44
Any decisions in agriculture (jointly with opp)	42	39	43	18	53
Land ownership	37	81	86	46	85
Large ruminants	36	94	95	54	94
Small ruminants	46	64	67	42	60
Poultry	56	55	57	41	47
Farm equipment	38	83	90	40	88
Household goods	27	39	41	27	32
Any asset ownership (none)	21	30	32	22	21
Control crop income	40	70	76	38	70
Control livestock income	46	58	61	40	52
Control business income	49	46	46	43	35
Control wage income	41	54	56	41	46
Control other income	49	70	75	41	65
Control any income (none)	33	39	41	30	29
Decisions crop inputs	37	77	84	37	80
Decisions crop outputs	39	67	72	36	66
Decisions livestock	43	53	55	37	46
Any decisions in agriculture (none)	34	51	55	31	45

Table A2a. CRE – Multinomial logit model for savings groups and sole or joint empowerment by asset ownership, control over income, and decisions in agriculture in Nigeria (Average Partial Effects (APEs))

Average Partial Effects (APE) for	Asset owner (jointly)	Asset owner (solely)	Control income (jointly)	Control income (solely)	Decisions in Agriculture (jointly)	Decisions in Agriculture (solely)
WOMEN ONLY						
1= Saves or borrows with informal savings group	0.04*** (0.004)	-0.00 (0.787)	0.07*** (0.000)	0.01 (0.133)	0.05*** (0.000)	-0.00 (0.944)
Control variables	Y	Y	Y	Y	Y	Y
Zone fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Mean values of all time-varying explanatory variables	Y	Y	Y	Y	Y	Y
Obs.	20917	20917	20917	20917	20917	20917
MEN ONLY						
1= Saves or borrows with informal savings group	0.05*** (0.002)	-0.01 (0.383)	0.05*** (0.001)	-0.02** (0.021)	0.01 (0.418)	-0.01 (0.511)
Control variables	Y	Y	Y	Y	Y	Y
Zone fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Mean values of all time-varying explanatory variables	Y	Y	Y	Y	Y	Y
Obs.	18627	18627	18627	18627	18627	18627

A3. Association between savings group participation and asset ownership, control over income, and decisions in agriculture

Table A3. Association between savings groups and asset ownership, control over income, and decisions in agriculture (individual-level panel analysis)

	Asset ownership						Control over income					Decisions in agriculture		
	Land Owner	Large ruminant owner	Small ruminant owner	Poultry owner	Farm equipment owner	Household good owner	Crop Income	Livestock Income	Business Income	Wage income	Other Income	Crop inputs	Crop Outputs	Livestock
WOMEN ONLY														
1= Saves or borrows with informal savings group	-0.01 (0.525)	-0.00 (0.931)	0.05*** (0.007)	0.05** (0.020)	-0.01 (0.300)	0.02 (0.206)	0.02* (0.065)	0.07*** (0.000)	0.06*** (0.000)	0.09** (0.033)	0.06 (0.423)	0.03*** (0.001)	0.02 (0.226)	0.06*** (0.000)
Control variables	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	5,405	2,127	4,985	5,129	6,333	7,438	6,470	5,970	5,329	3,609	973	7,176	5,164	6,067
WOMEN AND MEN														
1= Saves or borrows with informal savings group	-0.02 (0.461)	0.01 (0.663)	-0.00 (0.832)	-0.02 (0.269)	0.00 (0.616)	0.02* (0.051)	0.00 (0.900)	0.01 (0.484)	0.03** (0.024)	0.07* (0.061)	0.04 (0.526)	0.00 (0.682)	-0.01 (0.531)	0.01 (0.288)
Female*savings group	0.00 (0.987)	-0.01 (0.677)	0.06** (0.017)	0.08** (0.021)	-0.01 (0.279)	0.00 (0.911)	0.02 (0.162)	0.06*** (0.006)	0.03 (0.226)	0.02 (0.737)	-0.03 (0.795)	0.03** (0.014)	0.03 (0.210)	0.05** (0.022)
Control variables	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	15,105	7,494	18,055	16,983	24,075	30,693	22,894	22,180	19,369	8,503	2,111	29,887	16,330	22,867

Note: Robust p-values in parentheses, Asterisks denote the level of statistical significance of the coefficient, *** p<0.01, ** p<0.05, * p<0.1, Standard errors clustered at the household level.

A4. Heterogeneous effects and Robustness Checks

Table A4. Region-specific effects of participation in an informal savings group and asset ownership, control over income, and decisions in agriculture in Nigeria (individual-level panel analysis)

	Owner of any asset	Share of asset categories with ownership	All Income	Share of income categories with control	Agriculture	Share of agricultural production categories with decision-authority
WOMEN ONLY						
1= Individual participates in an informal savings group	0.04** (0.015)	0.01 (0.390)	0.07*** (0.000)	0.08*** (0.000)	0.03 (0.121)	0.04** (0.014)
Savings Group* North Nigeria	-0.03 (0.246)	0.01 (0.756)	0.03 (0.189)	-0.01 (0.711)	0.04 (0.160)	-0.01 (0.625)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	7,568	7,568	7,568	7,568	7,568	7,568
WOMEN AND MEN						
1= Individual participates in an informal savings group	0.02** (0.022)	-0.00 (0.652)	0.04* (0.051)	0.04** (0.034)	-0.00 (0.818)	-0.01 (0.591)
Female* Savings Group	0.02 (0.281)	0.01 (0.467)	0.03 (0.207)	0.03 (0.152)	0.04 (0.119)	0.05** (0.030)
North Nigeria* Savings Group	0.00 (0.933)	0.01 (0.303)	-0.02 (0.419)	-0.04* (0.087)	0.01 (0.697)	0.01 (0.400)
Female* Savings Group* North Nigeria	-0.03 (0.279)	-0.01 (0.776)	0.05* (0.094)	0.03 (0.311)	0.03 (0.372)	-0.02 (0.369)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	14,307	14,307	14,307	14,307	14,307	14,307

Note: Robust p-values in parentheses, Asterisks denote the level of statistical significance of the coefficient, *** p<0.01, ** p<0.05, * p<0.1, Standard errors clustered at the household level.

Table A5. Heterogeneous effects of participation in an informal savings group by baseline poverty status (individual-level panel analysis)

	Owner of any asset	Share of asset categories with ownership	All Income	Share of income categories with control	Agriculture	Share of agricultural production categories with decision-authority
WOMEN ONLY						
1= Individual participates in an informal savings group	0.03 (0.211)	0.02 (0.208)	0.04** (0.048)	0.04*** (0.003)	0.03 (0.150)	0.03* (0.060)
Savings Group * Poor in 2010	-0.03 (0.323)	-0.01 (0.589)	0.02 (0.511)	0.01 (0.774)	0.02 (0.680)	-0.00 (0.959)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	5,912	5,912	5,912	5,912	5,912	5,912
WOMEN AND MEN						
1= Individual participates in an informal savings group	0.01 (0.178)	0.01 (0.255)	0.03*** (0.003)	0.03*** (0.002)	0.01 (0.252)	0.01 (0.467)
Female* Savings Group	0.01 (0.557)	0.00 (0.871)	0.01 (0.614)	0.01 (0.607)	0.02 (0.436)	0.02 (0.276)
Poor in 2010* Savings Group	0.02 (0.197)	0.00 (0.967)	0.00 (0.805)	-0.02 (0.328)	-0.02 (0.280)	-0.01 (0.405)
Female* Savings Group* Poor in 2010	-0.05 (0.127)	-0.02 (0.582)	0.01 (0.756)	0.02 (0.488)	0.03 (0.459)	0.01 (0.809)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	11,615	11,615	11,615	11,615	11,615	11,615

Note: Robust p-values in parentheses, Asterisks denote the level of statistical significance of the coefficient, *** p<0.01, ** p<0.05, * p<0.1, Standard errors clustered at the household level.

Table A6. Gender of household head and effects of participation in an informal savings group (individual-level panel analysis)

	Owner of any asset	Share of asset categories with ownership	All Income	Share of income categories with control	Agriculture	Share of agricultural production categories with decision-authority
WOMEN ONLY						
1= Individual participates in an informal savings group	0.03** (0.048)	0.02* (0.067)	0.09*** (0.000)	0.07*** (0.000)	0.06*** (0.000)	0.04*** (0.000)
1= Female-headed household	0.13** (0.048)	0.12*** (0.006)	0.05 (0.378)	0.04 (0.335)	0.08 (0.175)	0.04 (0.422)
Savings Group* Female-headed household	-0.02 (0.497)	0.00 (0.929)	-0.01 (0.615)	0.01 (0.804)	-0.04 (0.119)	-0.02 (0.452)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	7,568	7,568	7,568	7,568	7,568	7,568
WOMEN AND MEN						
1= Individual participates in an informal savings group	0.02*** (0.004)	0.00 (0.746)	0.02** (0.015)	0.02* (0.094)	-0.00 (0.892)	-0.00 (0.925)
Female* Savings Group	0.01 (0.555)	0.01 (0.264)	0.06*** (0.000)	0.05*** (0.000)	0.07*** (0.000)	0.04*** (0.001)
1= Female-headed household	0.14** (0.021)	0.09** (0.022)	0.14** (0.014)	0.08* (0.055)	0.08 (0.210)	0.03 (0.409)
Female* Female-headed household	-0.06 (0.470)	-0.03 (0.493)	-0.13* (0.073)	-0.09* (0.075)	-0.06 (0.427)	-0.04 (0.483)
Savings Group* Female-headed household	0.11 (0.155)	0.07 (0.143)	0.03 (0.682)	0.00 (0.923)	0.07 (0.413)	0.05 (0.306)
Female* Savings Group* Female-headed household	-0.13 (0.112)	-0.07 (0.147)	-0.05 (0.537)	-0.00 (0.965)	-0.12 (0.157)	-0.08 (0.170)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	14,307	14,307	14,307	14,307	14,307	14,307

Note: Robust p-values in parentheses, Asterisks denote the level of statistical significance of the coefficient, *** p<0.01, ** p<0.05, * p<0.1, Standard errors clustered at the household level.

Table A7. Association between participation in an informal savings group and asset ownership, control over income, and decisions in agriculture in Nigeria, with test spillover effects (Individual-level panel analysis)

	Owner of any asset	Share of asset categories with ownership	All Income	Share of income categories with control	Agriculture	Share of agricultural production categories with decision-authority
WOMEN ONLY						
1= Individual participates in an informal savings group	0.02* (0.057)	0.02* (0.060)	0.09*** (0.000)	0.07*** (0.000)	0.05*** (0.000)	0.03*** (0.000)
1= Does not participate but another HH member participates in a savings group	-0.00 (0.951)	-0.00 (0.889)	-0.00 (0.834)	-0.00 (0.790)	0.00 (0.802)	0.00 (0.911)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	7,568	7,568	7,568	7,568	7,568	7,568
WOMEN AND MEN						
1= Individual participates in an informal savings group	0.03*** (0.000)	0.00 (0.481)	0.02** (0.021)	0.01 (0.187)	0.00 (0.847)	-0.00 (0.729)
1= Does not participate but another HH member participates in a savings group	0.03** (0.033)	0.00 (0.668)	-0.01 (0.609)	-0.01 (0.197)	0.00 (0.792)	-0.01 (0.131)
Female* Savings Group	-0.01 (0.681)	0.01 (0.432)	0.06*** (0.000)	0.05*** (0.000)	0.06*** (0.000)	0.04*** (0.002)
Female* Other household member in savings group	-0.03 (0.128)	-0.00 (0.699)	-0.00 (0.966)	0.00 (0.729)	0.00 (0.861)	0.01 (0.279)
Control variables	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Individual fixed effects	Y	Y	Y	Y	Y	Y
Obs.	14,307	14,307	14,307	14,307	14,307	14,307

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