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Demographic and Behavioral Drivers of Informal Savings Group Participation: Evidence from Uganda with Broader African Implications

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ABSTRACT

This study explores the factors influencing membership in Village Savings and Loan Associations (VSLAs) using advanced statistical techniques, including Firth's penalized logistic regression and Random Forest analysis. Data were collected from a sample of 155 women in Luweero District, Uganda. The analysis identified significant predictors of VSLA membership, including age, regular contributions to savings accounts, financial influence from peers, and income levels. The predictive model achieved an area under the curve (AUC) of 0.87, indicating strong accuracy. The findings suggest that targeting older individuals and promoting consistent financial behaviors can enhance VSLA participation. Recommendations include designing outreach programs focused on these factors and implementing targeted financial literacy initiatives to engage younger individuals effectively, thereby fostering greater financial inclusion and community resilience.

Keywords: Financial literacy, Informal saving groups, Uganda, VSLA, women

RÉSUMÉ

Cette étude analyse les facteurs qui influencent l'adhésion aux Associations Villageoises d'Épargne et de Crédit (VSLA), en recourant à des méthodes statistiques avancées telles que la régression logistique pénalisée de Firth et l'analyse par forêts aléatoires (Random Forest). Les données proviennent d'un échantillon de 155 femmes dans le district de Luweero, en Ouganda. Les prédicteurs significatifs de l'adhésion à une VSLA se révèlent être l'âge, la constance des cotisations, l'influence financière de l'entourage et les niveaux de revenus. Le modèle atteint une aire sous la courbe (AUC) de 0,87, témoignant d'une forte exactitude prédictive. Les résultats suggèrent que cibler les personnes plus âgées et encourager des comportements financiers réguliers peut améliorer le taux de participation aux VSLAs. Les recommandations incluent la mise en place de programmes de sensibilisation axés sur ces facteurs et l'introduction d'initiatives spécifiques d'éducation financière pour attirer plus efficacement les plus jeunes, favorisant ainsi une inclusion financière élargie et une résilience communautaire renforcée.

Mots-clés : éducation financière, groupes d'épargne informels, Ouganda, VSLA, femmes

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Globally, Village Savings and Loan Associations (VSLAs) have emerged as a powerful tool for enhancing financial inclusion in communities with limited access to formal banking services (Allen and Panetta, 2010). These self-managed savings groups allow low-income individuals to save, borrow, and invest, fostering economic resilience and social cohesion. While VSLAs were traditionally informal, many are now registered at the sub-county level and receive official registration numbers, though they generally operate with fewer regulatory requirements than Savings and Credit Cooperative Organizations (SACCOs). SACCOs, in contrast, are fully regulated financial cooperatives that require compliance with national financial regulations. Such community-driven financial solutions have seen remarkable success, especially in regions with restricted access to formal banking (Hendricks and Chidiac, 2011). In Africa, particularly in Sub-Saharan countries, VSLAs have become critical for bridging financial gaps, providing alternative savings mechanisms, and empowering individuals economically, especially women, who often face significant financial exclusion (Karlsson and Leatherman, 2015).

In East Africa, VSLAs play an essential role in financial inclusion, especially in rural areas of countries like Uganda, Kenya, and Tanzania, where traditional banking services are less accessible (Borda-Rodriguez and Vicari, 2015). By promoting self-reliance and social solidarity, VSLAs address multiple socio-economic challenges, reducing poverty, fostering small-scale enterprises, and empowering women who are frequently excluded from formal financial systems (Karlan *et al*., 2017). Several studies in Kenya and Tanzania have demonstrated that VSLAs contribute not only to economic stability but also to social outcomes such as improved health and education among members' families (Gash and Odell, 2013).

From a theoretical perspective, social capital theory highlights the role of networks, trust, and reciprocity in enabling collective financial behavior, particularly in settings where formal mechanisms are unavailable (Putnam, 1995). VSLAs are built on social capital, leveraging the trust and social ties within communities to establish a stable financial resource for members (Annan *et al*., 2013). While this trust-based model works primarily within the group, interactions with non-members may differ, as access to financial services like borrowing is typically restricted to members, and non-members may not benefit from the same level of trust and reciprocity within the group. Furthermore, collective action theory (Olson, 1965) elucidates how individuals cooperate for mutual economic benefit within these groups, pooling resources and ensuring accountability in a way that benefits the community at large (Hoff and and Sen, 2005). Empowerment theory (Kabeer, 1999) further explains how VSLAs, particularly in rural Africa, provide marginalized groups, particularly women, with financial resources, decision-making power, and control over their lives (Bara and Peña, 2015).

In Uganda, VSLAs have shown potential for fostering financial inclusion, particularly in rural settings where formal financial services remain scarce (Kato and Kratzer, 2013). However, while participation in these associations has been rising, it remains uneven, and there is limited understanding of the factors influencing membership among different demographic groups. Socio-economic characteristics such as age, education, and income levels have been suggested to play a role, but studies specifically addressing these dynamics are limited (Davis *et al,*, 2018). For example, social networks and financial literacy have been found to be critical drivers of participation, underscoring the importance of community involvement and education in fostering financial inclusion (Chattopadhyay *et al*., 2021).

This study aims to address this gap by examining the key drivers of VSLA membership among women in rural Uganda. By exploring factors such as financial literacy, income, business ownership, and social influences, this study seeks to provide insights into optimizing VSLAs for broader financial inclusion. Understanding these

determinants in a more comprehensive African context can aid in designing targeted interventions that resonate with the unique financial landscapes of rural communities across the continent.

Literature Review

Village Savings and Loan Associations (VSLAs) are part of a larger movement toward community-based financial models aimed at enhancing financial inclusion, particularly in areas with limited formal banking access. Savings models like VSLAs have become increasingly popular worldwide, with similar frameworks, such as Self-Help Groups (SHGs) in South Asia and communal banks in Latin America, gaining traction in their respective regions. Recent studies on SHGs in India, for example, reveal that these groups not only improve financial access but also bolster women's social standing and entrepreneurial opportunities, fostering empowerment and community resilience (Banerjee *et al*., 2021; Mukherjee *et al*., 2023). Communal banks in Latin America similarly enable members to engage in group-based financial activities that provide credit access to underserved communities, often in coordination with local microfinance institutions to enhance stability and reach (Giné and Townsend, 2022; Kumar and Subrama).

While VSLAs share core principles with other community-based financial models, their role in Uganda's financial landscape presents distinct characteristics. Unlike commercial banks, which require formal documentation and collateral, VSLAs offer flexible, trust-based savings and credit mechanisms that are more accessible to low-income individuals. However, the lack of integration with formal banking structures limits their ability to scale and offer more diverse financial services. While some VSLAs in Uganda have started forming linkages with microfinance institutions, this connection remains underdeveloped compared to more structured financial inclusion models seen elsewhere (Bauchet and Morduch, 2020). These differences underscore the adaptability of savings models to local contexts and the need for targeted approaches that address specific economic and social conditions. Studies across African countries demonstrate the significance of VSLAs in enhancing economic security, social cohesion, and empowerment, especially for women. For instance, in Tanzania, VSLAs have been shown to improve household resilience and financial literacy, with participation leading to greater financial stability and capacity for small-scale investments (Brannen and Sheehan-Connor, 2016). Similarly, research in Kenya found that VSLAs boost women's financial independence and entrepreneurial activities by allowing members to save and access credit collectively, which helps reduce reliance on informal, often exploitative, lenders (Gugerty *et al*., 2019).

Comparatively, similar models, like the "stokvel" savings groups in South Africa, demonstrate the adaptability of informal financial models to local contexts. Stokvels, like VSLAs, facilitate savings and credit access within close-knit groups but also play an essential role in preserving social networks and cultural practices (Verhoef, 2020). In Ghana, VSLAs and other group-based savings models have proven effective in mitigating poverty and encouraging micro-entrepreneurship, particularly in rural areas where formal financial services remain sparse (Abdullah and Bortei-Doku Aryeetey, 2021).

Despite these successes, the factors influencing VSLA participation can vary widely by context. In Malawi, studies show that household income, education, and social networks are significant determinants of VSLA involvement, suggesting that outreach strategies need to be tailored to demographic profiles and community needs (Ksoll *et al.,* 2021). In Ethiopia, where VSLAs are integrated with local economic empowerment programs, findings suggest that these associations can contribute substantially to food security and investment in agriculture, offering a route to sustainable livelihoods in resource-poor settings (Bernard *et al*., 2022).

These African-based studies underscore the role of VSLAs as part of a larger movement to promote financial inclusion and align with global development goals. Specifically, VSLAs support

the United Nations Sustainable Development Goals (SDGs), including SDG 5 on gender equality and SDG 8 on economic growth, by enabling access to essential financial services for marginalized groups (United Nations, 2015). Moreover, African savings models like VSLAs highlight unique regional practices that contribute to financial empowerment, offering valuable insights for both policymakers and development organizations focused on scaling such initiatives.

This study is particularly relevant to the global goals of financial inclusion and sustainable development as outlined in the United Nations Sustainable Development Goals (SDGs). VSLAs directly support SDG 5 on gender equality and SDG 8 on economic growth by offering financial services to populations, especially women, traditionally excluded from formal banking (United Nations, 2015). Recent studies affirm that VSLAs and similar savings models contribute to women's empowerment by promoting financial literacy, decision-making power, and economic independence, which have significant implications for poverty reduction (Taylor and Lounsbury, 2021; Jayachandran, 2022). Additionally, VSLAs contribute to SDG 8 by promoting sustainable economic growth and fostering entrepreneurship at the grassroots level, ultimately strengthening community resilience (Anderson *et al*., 2022). By contextualizing VSLAs within these global trends, this study contributes valuable insights into how financial inclusion initiatives in Uganda resonate with larger financial inclusion goals, providing lessons applicable across African contexts and beyond.

MATERIALS and METHODS

Research design. The research design, study population, study area and sampling approaches employed in this study is based on the work of Namawejje *et al.,* (2022); Namawejje *et al*., (2023), and Namawejje and Yawe (2024). A multi-stage sampling strategy was employed in two phases. First, purposive sampling was used to select one of the three sub-counties in Luweero District, chosen for its higher proportion of women engaged in farming. In the second phase, a list of households from Local Council One (LC1) was obtained through systematic sampling, based on prior survey records typically maintained for administrative purposes. We selected a sample of 155 women, all aged 18 years and above using Kish's formula (Kish, 1967), with a design effect of 0.6 and a 95% confidence level. The response rate was 98% and the majority of participants were subsistence farmers with small businesses.

Data collection. Data were collected using a semi-structured questionnaire via the Open Data Kit (ODK) software, as described by Namawejje *et al*. (2022, 2023). The questionnaire was adapted from existing financial literacy tools developed by Kempson (2009), Lusardi (2019), OECD (2011, 2020), Santos and Tavares (2020), and Namawejje *et al*. (2022), among others, and was modified to align with the study's objectives outlined in the introduction. Both verbal and written consent were obtained prior to data collection to accommodate participants with varying literacy levels and ensure informed participation. Each participant gave verbal consent and either signed a written consent form or provided a thumbprint if unable to sign (Namawejje *et al.* 2022, 2023).

Variables and measures. The outcome variable was VSLA membership, which was binary. Women were categorized as either members of a VSLA or non-members. Belonging to a Village Savings and Loan Association (VSLA) was coded as "1" if a woman was a member, and "0" if she was not, with "0" serving as the reference group.

Explanatory variables. These included different financial factors such as financial literacy score, based on the correct answers provided by each woman in Section D of the questionnaire, which followed the framework of Namawejje and Yawe (2024). The average financial literacy scores of VSLA members and non-members were calculated. Other variables are seen in Table 1

Table 1. Explanatory variables used

Variable	Coding	Reference group
Age groups	1 = 18-24, 2 = 25-34, 3 = 35-44, 4 = 45-54, 5 = 55-64, 6 = 65-74	1 = "18-24"
Individual monthly income range	1 = below Shs. 50,000/=, 2 = Shs. 50,001- Shs. 150,000/=, 3= Shs. 150,001- Shs. 250,000/=, 4 = Shs. 250,001 - Shs. 500,000/=, 5 = Shs 500,001 and above, 6 = None	1 = "below Shs. 50,000 /= "
Ever received personal finance training	1= Yes, 0= No	0 = No
Own any business	1 = Yes, 0 = No	0 = No
Contribute to a VSLA saving account regularly	1 to 4 (scale)	"Not at all true"
Financial influence by friends	1 to 4 (scale)	"None"
Afraid of borrowing	1 to 4 (scale)	"Not at all true"
Give importance to saving money from monthly or any income	1 to 4 (scale)	"Not at all true"

Data analysis. Univariate analysis was performed to describe the distribution of each variable in the dataset. This included calculating measures of central tendency (mean, median) and dispersion (standard deviation, range) for continuous variables, and frequencies and percentages for categorical variables. For example, the mean financial literacy score of participants was calculated, and the proportion of VSLA members versus non-members was summarized. This analysis provided a foundational understanding of the data distribution and characteristics of individual variables.

Equation for mean: $mean = \frac{1}{N}\sum_{i=1}^{N} x_i$

Equation for Standard Deviation: $s=\sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - mean)^2}$

At bivariate analysis was conducted to examine the relationships between VSLA membership (dependent variable) and other categorical predictors. We used the Chi-square test and Fisher's exact test to determine the significance of associations. Chi-square Test: The Chi-square test was used for larger sample sizes to assess the independence of two categorical variables. The test statistic is calculated as:

$$Chi - square = \sum \frac{(O_i - E_i)^2}{E_i}$$

where O_i is the observed frequency, and $E_i$is the expected frequency under the null hypothesis of independence.

Fisher's Exact Test: Fisher's Exact Test was used for smaller sample sizes or when expected frequencies were less than 5. It calculates the exact probability of obtaining the observed distribution under the null hypothesis of independence.

At multivariate analysis, Firth's penalized logistic regression was used to address the issue of separation and to provide more reliable estimates

of odds ratios. This method is particularly useful in datasets with rare outcomes or small sample sizes.

Firth's Penalized Logistic Regression: The model is specified as:

$$\text{Logit (P(Y=1))}=\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_8 X_k$$

Where logit(P(Y=1)) is the log odds of VSLA membership, β_0 is the intercept, and $\beta_1, \beta_2 \ldots \beta_8$ are the coefficients for the predictors $X_1, X_2 \ldots, X_8$ which are 1) Ever received personal finance training before; 2) Individual monthly income range; 3) Own any business; 4) I contribute to a VSLA saving account regularly; 5) Financial influence by friends; 6) Afraid of borrowing; 7) Give importance to saving money from monthly or any income.

Firth's correction penalizes the likelihood function to address issues of small sample bias. The model is used to compute both the p-values and confidence intervals for unadjusted and adjusted results to account for confounding. Also,a random Forest was chosen for its robustness in handling complex datasets with multiple variables and its ability to assess variable importance. This algorithm builds multiple decision trees and aggregates their predictions, which helps reduce overfitting and enhances model generalization. Variable importance was determined using two metrics, that is, Mean Decrease Accuracy and Mean Decrease Gini. These metrics help in identifying the most influential factors affecting VSLA membership, making Random Forest a suitable choice for this analysis. In addition, to evaluate the performance of the Firth's penalized logistic regression model, the Receiver Operating Characteristic (ROC) curve was used. It helps visualize the trade-off between sensitivity (true positive rate) and specificity (true negative rate) across different classification thresholds, offering a clear measure of model discriminative ability.

From the ROC curve, the Area under the Curve (AUC) was calculated, providing a summary measure of the model's ability to discriminate between VSLA members and non-members. An AUC of 0.87 indicates a high level of model performance, as it suggests the model is highly effective at distinguishing between the two classes.

Ethical considerations. The study received ethical review and approval from the TASO Research and Ethics Committee (approval number: TASO-2022-147). Participation was entirely voluntary, with both verbal and written consent obtained from the women, who were guaranteed full confidentiality.

RESULTS and DISCUSSIONS

Descriptive statistics of the respondents. Table 2 presents the mean financial literacy scores for both VSLA members and non-members. The difference in financial literacy scores between VSLA members and non- members is statistically significant ($p<0.05$), indicating that participation in a VSLA has a positive influence on the financial literacy of participants. Notably, 75.48% of the study participants were members of a VSLA, while only 24.52% were non-members, suggesting a high level of engagement in these associations, which are known to enhance financial knowledge and skills (Johnson and Nino-Zarazua, 2011; Karlan *et al*., 2017a).

Table 2. VSLA membership and financial literacy score

VSLA membership	Frequency (n)	Percentage (%)	Financial literacy mean score	Standard Deviation	p-value
No	38	24.52	5.74	1.70	0.04606
Yes	117	75.48	6.39	1.80	

Proportions of correct answers for each financial literacy question by VSLA membership. Table 3 presents the proportion of correct answers by VSLA membership for each financial literacy question. VSLA members consistently outperformed non-members across all questions. This performance disparity could be attributed to the financial literacy skills imparted through VSLA participation, such as calculating interest rates, managing business sales, and understanding the concepts of loans and savings, skills which non-members may not have been exposed to. Given that VSLA members excel in financial literacy, extending similar training or support to non-members could enhance their financial competencies (Brannen, 2010; Karlan *et al.,* 2017a)

Relationship between financial factors and VSLA membership. Table 4 shows the relationship between various financial factors and VSLA membership. The variables: individual monthly income range, business ownership, regular contributions to a VSLA savings account, financial influence from friends, fear of borrowing, and the importance placed on saving income were all statistically significant at the 5% level ($p<0.05$). Additionally, age was statistically significant at the 10% level ($p<0.1$), indicating a weaker but still notable association.

Table 3. Financial literacy performance among VSLA non-members and VSLA members

Financial literacy questions	VSLA non-member	VSLA member
Overall Financial literacy score	5.74	6.39
Q1: Computing interest rate	0.789	0.821
Q2: Simple interest rate	0.316	0.368
Q3 : Time value of money	0.789	0.838
Q4: Inflation rate	0.184	0.274
Q5: Loan repayment	0.947	0.957
Q6: Regulators of financial institutions in Uganda	0.237	0.239
Q7: Financial borrowing Institutions	0.158	0.368
Q8: Main reasons for proper financial record keeping	0.821	0.821
Q9: Meaning of profits got from business	0.895	0.906
Q10: Computing profits from business	0.632	0.803

Source: Field data

Table 4. Relationship between financial factors and VSLA membership

Variable	**Frequency (n)**	**VSLA Non-member Frequency (n)**	**VSLA member Frequency (n)**	**Chi-square**	**p-value**
Ever received personal finance training before					
No	121	33	88	1.64	0.20
Yes	34	5	29		
Individual monthly income range					
Below Shs50,000/=	46	19	27		
Shs 50,000- Shs150,000/=	51	8	43	-	0.005[a]
Shs 150,001- Shs 250,000/=	27	5	22		
Shs 250,001-Shs 500,000/=	22	2	20		

Shs 500,001 and above	8	3	8		
None	1	1	0		
Own any business					
No	55	21	17	7.497	0.006
Yes	100	34	83		
I contribute to a VSLA saving account regularly					
Not at all true	80	26	54		
Somewhat not true	6	3	3	-	0.002[a]
Somewhat true	23	6	17		
Very true	46	3	43		
Financial influence by friends					
None	22	11	11		
Not much	37	6	31	9.47	0.023
Some	40	9	31		
Alot	56	12	44		
I am afraid of borrowing					
Not at all true	43	6	37		
Somewhat not true	7	2	5	-	0.047[a]
Somewhat true	32	5	27		
Very true	73	25	48		
I give importance to saving money from my monthly income or any income that I get					
Not at all true	8	5	3		
Somewhat not true	5	2	3		
Somewhat true	31	9	22	-	0.031[a]
Very true	111	22	89		
Age					
18-24	17	9	8		
25-34	49	10	39		
35-44	38	6	32		
45-54	28	9	19		
55-64	17	3	14	-	0.0698[a]
65-74	6	1	5		

Note: The superscript 'a' in the p-value column indicates that the p-value was calculated using Fisher's Exact Test, while all other p-values were obtained using the Chi-square test. Fisher's Exact Test was used when expected cell counts were low to ensure accuracy. A p-value < 0.05 indicates a statistically significant relationship between the explanatory variable and VSLA membership, meaning there is strong evidence to suggest an association between them.

Influencers of VSLA membership. The findings in Table 5 reveal a clear relationship between income levels and VSLA membership, where women with higher individual monthly incomes are significantly more likely to participate in VSLAs compared to those with lower incomes. For instance, women earning between Shs.50,000/=–Shs.150,000/= were 3.4 times more likely to belong to a VSLA than those earning below Shs.50,000/=, with a statistically significant p-value of 0.02. Similarly, those in the Shs.250,000/=–Shs.500,000/= income range were 5.7 times more likely to be members, highlighting the substantial impact of increased income on VSLA engagement. These results suggest that women with higher incomes may perceive VSLAs as a safer or more beneficial financial option, likely due to their ability to contribute to savings and access loans within the group**.**

This aligns with previous studies, which have shown that individuals with greater financial resources are more likely to participate in savings groups due to their ability to contribute more regularly and take advantage of financial services offered by these associations (Brannen, 2010; Ksoll *et al.,* 2016). Additionally, higher-income women might have better financial literacy, making them more aware of the potential benefits of VSLA participation. However, the significant odds ratios across different income categories also point to the VSLA's ability to attract women from diverse financial backgrounds, indicating that while income plays a role, the social and communal benefits of the VSLA model are likely important factors as well (Sebstad and Cohen, 2009; Karlan *et al*., 2017). This has important policy implications, suggesting that scaling VSLA programs to rach lower-income women, possibly through targeted financial literacy programs, could enhance their financial inclusion and empowerment."

Table 5. Influencers of VSLA membership

Variable	**OR-unadjusted**	**p-values (95% CI) unadjusted**	**OR-adjusted**	**p-values (95% CI) adjusted**
Ever received personal finance training before				
No[R]	1			
Yes	2.03	0.14(0.8-6.04)	0.86	0.83(0.22-3.64)
Individual monthly income range				
Below Shs50,000/=[R]	1			
Shs 50,000- Shs150,000/=	3.63	0.01(1.5-9.7)	3.4	0.02(1.2-10.1)
Shs 150,000- Shs 250,000/=	2.90	0.047(1.0-9.4)	3.07	0.07(0.8-13.2)
Shs 250,000-Shs 500,000/=	5.81	0.006(1.6-31)	5.7	0.04(1.11-40.6)
Shs 500,000 and above	1.11	0.88(0.26-5.3)	0.24	0.19(0.02-2.08)
None	0.24	0.35(0.00-4.7)	0.35	0.55(0.00-10.47)
Own any business				
No[R]	1			
Yes	2.97	0.004(1.4-6.3)	1.58	0.36(0.59-4.20)
I contribute to a VSLA saving account regularly				
Not at all true[R]	1			
Somewhat not true	0.49	0.37(0.1-2.44)	0.19	0.11(0.03-1.53)
Somewhat true	1.31	0.6(0.49-3.83)	0.91	0.9(0.24-3.94)
Very true	6.04	0.0005(2.1-24)	5.76	0.008(1.5-31.3)
Financial influence by friends				
None[R]	1		1	
Not much	4.85	0.007(1.5-17)	4.71	0.041(1.1-23)
Some	3.32	0.03(1.1-10.2)	2.54	0.17(0.68-9.7)
Alot	3.56	0.02(1.3-10.2)	3.69	0.06(0.93-15.8)
I give importance to saving money from my monthly income or any income that I get				
Not at all true[R]	1			
Somewhat not true	2.2	0.5(0.3-20.5)	0.85	0.91(0.06-19.1)
Somewhat true	3.7	0.089(0.8-19)	1.7	0.6(0.22-13.0)
Very true	6.3	0.011(1.6-29)	2.57	0.6(0.22-13.02)
Age				
18-24[R]	1			
25-34	4.20	0.014(1.4-14)	7.13	0.008(1.6-35)

35-44	5.59	0.006(1.6-21)	9.07	0.0056(1.9-50)
45-54	2.29	0.17(0.7-7.9)	4.30	0.054(0.98-21)
55-64	4.63	0.04(1.1-23)	9.43	0.012(1.7-68)
65-74	4.10	0.14(0.6-46)	12.62	0.039(1.13-280)
I am uncertain about where my money is spent				
Not at all true[R]	1			
Somewhat not true	0.87	0.82(0.3-3.3)	1.1	0.89(0.28-4.78)
Somewhat true	0.31	0.02(0.1-0.8)	0.34	0.075(0.1-1.12)
Very true	0.83	0.7(0.32-2.13)	1.61	0.41(0.52-5.21)

R is the reference category; OR refer to Odds Ratio. All interpretations in Table 5 are based on the adjusted Odds Ratios and p-values, as they account for confounding variables.

Additionally, women who reported being either not much influenced financially by friends (OR=4.71, p=0.041, 95% CI: 1.1–23) or heavily influenced by friends (OR=3.69, p=0.06, 95% CI: 0.93–15.8) were more likely to belong to a VSLA compared to those who experienced no financial influence from friends. These findings suggest that social networks and peer influence play a significant role in promoting participation in VSLAs. The social capital created through peer interactions may encourage women to engage in these savings groups, as financial decisions and behaviors are often shaped by trusted social relationships (Granovetter, 2005; Ksoll *et al.,* 2016). After adjusting for age, the data indicate that women aged 65–75 (OR=12.62, p=0.039, 95% CI: 1.13–280), 55–64 (OR=9.43, p=0.012, 95% CI: 1.7–68), 45–54 (OR=4.30, p=0.054, 95% CI: 0.98–21), 35–44 (OR=9.07, p=0.0056, 95% CI: 1.9–50), and 25–34 (OR=7.13, p=0.008, 95% CI: 1.6–35) were significantly more likely to be members of VSLAs compared to women aged 18–24. This trend suggests that older women are more inclined to participate in VSLAs, possibly due to greater financial responsibilities or a heightened awareness of the benefits of saving and borrowing.

These results are consistent with existing literature indicating that older individuals are more likely to engage in financial groups due to accumulated experience in managing finance, higher levels of trust in collective financial mechanisms, and the need for long-term financial planning (Dupas and Robinson, 2013; Karlan *et al*., 2017a). Younger women, on the other hand, may lack the resources or knowledge to participate in VSLAs, or may not yet see the need for such financial structures. Programs aiming to increase VSLA membership could therefore focus on providing targeted financial literacy and savings support to younger women, who may benefit from early engagement in such initiatives (Kato, 2015; Ksoll *et al*., 2016).

Comparative discussion between Uganda and other countries The findings from this study reveal significant predictors of VSLA membership, including age, income, and peer influence, which align with trends observed in similar studies across Africa and globally. For instance, in research conducted in Kenya, higher income and older age were also associated with increased participation in informal savings groups, highlighting a common understanding of the barriers faced by lower-income individuals in accessing such financial services (Karlan *et al*., 2017b**)**.

Moreover, the positive influence of peer relationships on VSLA membership mirrors findings from studies in South Asia, where social networks and peer support were critical in promoting engagement in savings groups (Schmidt *et al*., 2015). These parallels suggest that the dynamics of informal savings groups share similarities across different cultural and economic contexts, emphasizing the importance of community and social capital in fostering financial inclusion.

The implication of these findings for global financial inclusion initiatives is profound, particularly for vulnerable populations in developing countries. As demonstrated in this study, targeting financial literacy programs and support for lower-income women could be an effective strategy for enhancing

participation in VSLAs and similar savings groups. Programs that focus on building social networks and promoting peer influence may also serve to increase engagement, leading to improved financial literacy and empowerment among participants.

Overall, the evidence underscores the need for tailored interventions that recognize the unique challenges faced by different demographics while leveraging the power of community and social influence to foster greater financial inclusion.

Model validation using the ROC curve. After fitting Firth's penalized logistic regression, we validated the model using the Receiver Operating Characteristic (ROC) curve to assess its performance in predicting binary outcomes. The ROC curve plots the true positive rate (sensitivity) against the false positive rate (1-specificity) across various classification thresholds, as illustrated in Figure 1. This graphical representation helps evaluate the model's ability to distinguish between the two outcome classes, that is, VSLA membership (member vs. non-member), with the area under the curve (AUC) providing a quantitative measure of overall model performance.

The ROC curve displays an area under the curve (AUC) of 0.87, indicating that the model is highly effective at distinguishing between women who are members of a VSLA and those who are not. This suggests that the features used in the model provide strong discrimination between VSLA members and non-members. The strong predictive power can be attributed to the relevance and influence of the predictors included in the model, which enhances confidence in its ability to accurately predict VSLA membership. This is particularly important for program targeting, outreach, and understanding the factors that influence VSLA participation.

The AUC value of 0.87 further validates the model's efficacy (Katumba *et al*., 2024). AUC values range from 0.5 to 1.0, where 0.5 indicates random guessing and 1.0 signifies perfect classification. An AUC of 0.87 demonstrates that the model significantly outperforms random chance, highlighting its high accuracy in predicting VSLA membership.

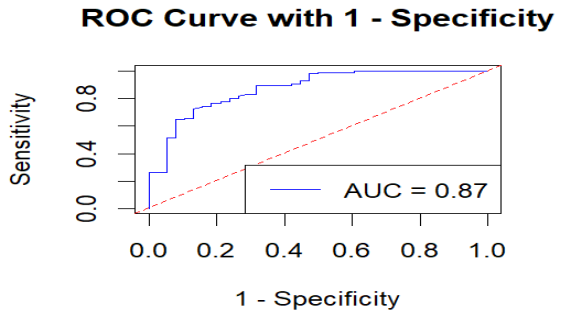

Figure 1. ROC curve predicting the performance of the model. AUC* represents area under the curve

Using random forests to understand the order of importance of the variables, larger values indicate that removing the variable substantially decreases the model's accuracy, highlighting its high importance. Mean Decrease Gini represents the decrease in the Gini index when a variable is included in the model. Larger values suggest that the variable contributes significantly to improving the purity of the nodes in the tree, indicating its greater importance.

From Table 6, the results indicate that the 'age-groups' variable exhibits the highest Mean Decrease Accuracy and Mean Decrease Gini values, suggesting it is the most crucial variable in the model. Its removal leads to a significant decrease in model accuracy, and it greatly enhances the purity of the nodes in the decision tree. This is followed in importance by the variable 'I contribute to a VSLA saving account regularly,' then 'financial influence by friends,' and 'individual monthly income range.' The variables 'own any business' and 'I give importance to saving money from my monthly income or any income that I get' have the lowest Mean Decrease Accuracy and Mean Decrease Gini values.

These variables contribute the least to the model's accuracy and node purity, indicating they might be less important. Consequently, the first four variables with higher values are deemed more important and play a significant role in predicting VSLA membership.

Table 6. Order of importance of the variables

Variable	Mean Decrease Accuracy	Mean Decrease Gini
Age-groups	5.13	4.46
Individual monthly income range	3.23	3.91
Own any business	1.83	1.35
I contribute to a VSLA saving account regularly	5.87	2.86
Financial influence by friends	4.09	3.36
I am uncertain about where my money is spent	2.47	3.02
I give importance to saving money from my monthly income or any income that I get	1.74	2.36

Note*: Mean Decrease Accuracy measures the reduction in the model's accuracy when a variable is excluded.

CONCLUSIONS

The analysis conducted in this study underscores the significant role of the 'age-groups' variable in predicting membership in Village Savings and Loan Associations (VSLAs). The superior Mean Decrease Accuracy and Mean Decrease Gini values for age highlight its critical influence on participation, with older individuals exhibiting a higher likelihood of engagement. Other noteworthy predictors include regular contributions to a VSLA savings account, financial influence from peers, and individual monthly income range. Conversely, the variables related to business ownership and the importance of saving income demonstrate minimal impact on model accuracy, suggesting they are less decisive in determining VSLA membership. Overall, the findings illuminate the paramount importance of age, along with regular savings contributions, social financial influence, and income levels, as key drivers of VSLA participation.

Policy and Practical Implications The findings from this study highlight the critical roles of age and financial behaviors in predicting Village Savings and Loan Association (VSLA) membership, which carry substantial policy and practical implications for enhancing financial inclusion initiatives. Policymakers should prioritize these factors in the design and implementation of programs aimed at increasing VSLA participation. To effectively target older adults, initiatives could include tailored outreach campaigns that emphasize the benefits of VSLA membership, such as improved savings behaviors and enhanced access to credit. Other studies have shown that elderly individuals often have greater financial responsibilities and are more inclined to participate in savings groups due to accumulated experience and the necessity of long-term financial planning (Dupas and Robinson, 2013; Karlan *et al.*, 2017). Thus, designing programs that resonate with their needs and priorities can significantly boost participation rates.

In addition, integrating financial literacy programs that focus on improving savings behavior and fostering peer influence can create a supportive environment for current and prospective VSLA members. Previous research indicates that peer influence is a powerful motivator in financial decision-making, especially within communal savings frameworks (Granovetter, 2005; Ksoll *et al.*, 2016). By integrating financial literacy into Uganda's education policies, particularly within vocational and technical training curricula, organizations can equip younger individuals with the knowledge needed to recognize the benefits of VSLA participation. Strengthening financial education through formal and non-formal learning channels can help diversify VSLA membership and enhance the long-term sustainability of these programs (Handa *et al.*, 2015; Kato, 2015a,b).

Furthermore, making VSLAs more accessible and appealing to younger individuals through innovative outreach strategies, mobile savings options, or technology-driven solutions could foster greater

engagement Linking VSLA participation to youth-based funding models such as the Parish Development Model (PDM) can enhance financial inclusion by providing targeted financial support and capacity-building opportunities. Integrating these initiatives ensures that young people have structured access to credit, savings, and investment opportunities, preparing them for future financial responsibilities while reinforcing a culture of saving that benefits the broader community (Brannen, 2010; Johnson and Nino-Zarazua, 2011).

RECOMMENDATIONS

Given these insights, it is recommended that VSLA programs strategically focus on engaging older populations, who are more inclined to participate. Local governments, NGOs, and international development organizations across East Africa and Africa at large should leverage these findings to design targeted outreach initiatives that emphasize the importance of regular savings and the role of social networks in financial decision-making. Such strategies could enhance participation rates and foster community cohesion.

To bolster VSLA engagement among younger demographics, tailored financial literacy programs should be developed and adapted to various regional contexts. These programs can address specific needs and barriers faced by younger individuals, equipping them with essential financial skills and knowledge. Evidence suggests that financial education significantly improves financial behaviors and enhances participation in savings groups (Brannen, 2010; Karlan *et al*., 2017). By prioritizing financial literacy initiatives, local organizations can create pathways for increased involvement in VSLAs and similar models, promoting financial inclusion and empowerment among vulnerable populations.

Moreover, integrating these educational components within existing community structures could foster a culture of savings and financial prudence, aligning with broader development goals and initiatives aimed at enhancing economic resilience and reducing poverty across the region (Granovetter, 2005; Dupas and Robinson, 2013).

Limitations of the Study. This study acknowledges several limitations that may affect the interpretation of its findings. First, while the predictive model effectively identifies significant determinants of Village Savings and Loan Association (VSLA) membership, its effectiveness is constrained by the dataset's scope and the reliability of self-reported data. Self-reported information is susceptible to biases, such as social desirability bias, which can lead to inaccuracies in responses (Ksoll *et al*., 2016).

Additionally, the **cross**-sectional nature of the data limits the ability to observe behavioral changes over time, preventing any causal inferences regarding the predictors of VSLA membership. Longitudinal studies would provide a more comprehensive understanding of how participation evolves and the factors influencing such changes. Moreover, the analysis does not consider all potential influencing factors, such as cultural or regional variations in VSLA participation that may significantly impact outcomes (Handa *et al*., 2015; Karlan *et al*., 2017b). Factors like social norms, economic conditions, and community dynamics are crucial for understanding the landscape of financial participation but were not captured in this study. The results are therefore based on the available variables, and unmeasured factors could also play a significant role in determining VSLA membership.

Areas for Future Research. Future research should explore additional factors influencing VSLA membership, such as cultural or community-specific variables. Longitudinal studies could provide insights into how predictors of VSLA membership evolve over time. Additionally, research could investigate the effectiveness of targeted interventions designed to increase participation among younger individuals and less influential variables. Examining the impact of different financial education strategies on VSLA engagement would also contribute valuable knowledge to improve program design and implementation.

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CONFLICT OF INTEREST

Authors declare no conflict of interest with regard to this paper

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