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Women's Savings and Credit Cooperatives Increase Household Income among Female-Headed Households in Rural Ethiopia

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Abstract

Female-headed households (FHHs) in sub-Saharan Africa face persistent barriers to financial inclusion, leaving them disproportionately vulnerable to poverty and food insecurity. Women's Savings and Credit Cooperatives (WSCCs) have been promoted as member-owned institutions that expand access to savings, credit, and training, yet their specific income effects for FHHs remain underexplored. This study provides the first causal estimate of WSCC membership on household income among FHHs in East Hararghe Zone, Ethiopia. Descriptive statistics, endogenous switching regression (ESR) model and thematic analysis were used to analyze survey data collected from 108 FHHs, 12 focus group discussions and 24 key informants' interviews. Results show that WSCC membership increased annual household income by 11,560 Birr ($p < 0.01$), representing a 36.8% gain. Determinants of membership included proximity to WSCC office, awareness, childcare access, and participation in female support groups, while education, social networks, and training drove income growth among members. Findings highlight the critical role of human capital and collective institutions in enhancing livelihoods. Policy interventions should prioritize reducing access barriers and strengthening training to maximize WSCCs' empowerment potential for FHHs.

1. Introduction

Female-headed households (FHHs) constitute a significant and growing segment of rural populations in sub-Saharan Africa, including Ethiopia. Nationally, approximately 27% of rural households are headed by women, often as a result of widowhood, divorce, or male migration [1]. These households are disproportionately vulnerable to poverty, food insecurity, and social marginalization due to restricted access to land, credit, extension services, and labor [2, 3]. Women in FHHs shoulder the dual burden of economic provision and domestic responsibilities, typically without adequate safety nets.

Structural inequalities further compound this vulnerability. Women in FHHs generally own smaller plots of land, attain lower levels of education, and face entrenched social norms that constrain their economic participation [2]. Poverty rates among FHHs remain significantly higher than those of male-headed households, with a headcount ratio of 32% compared to 24% [4]. These disparities underscore the urgent need for interventions that enhance women's access to productive resources and financial services.

Women's Savings and Credit Cooperatives (WSCCs) have emerged as a promising mechanism to address financial exclusion among rural women. Unlike conventional microfinance institutions, WSCCs are member-owned and member-governed, fostering collective responsibility and solidarity [5]. They provide platforms for savings, credit, and training, enabling women to invest in income-generating activities, accumulate assets, and improve household welfare [6, 7]. In Ethiopia, WSCCs operate under the Cooperative Proclamation No. 985/2016, which mandates gender-inclusive membership and women's economic empowerment as core principles [10]. The Ethiopian government's Homegrown Economic Reform agenda prioritizes financial inclusion, with WSCCs recognized as key vehicles for reaching women in rural areas [11].

FHHs in rural Ethiopia face unique constraints, including absence of male labor, limited collateral, heavy care responsibilities, and restricted access to formal credit, which exacerbate their poverty and food insecurity [2, 3]. Despite their prevalence, most impact evaluations of microfinance and cooperatives aggregate households or focus on male-headed contexts, thereby obscuring the distinct experiences of FHHs [8, 9]. Moreover, determinants of WSCC membership among FHHs—such as distance to cooperative centers, childcare responsibilities, awareness levels, and social networks—remain underexplored. While extensive literature documents the positive impacts of microfinance on income and empowerment broadly, evidence specific to FHHs in Ethiopia remains limited.

This study addresses these gaps by providing the first rigorous causal estimate of WSCC membership on household income among FHHs in East Hararghe Zone, Ethiopia. By focusing exclusively on FHHs, the research generates evidence to inform cooperative policy, microfinance design, and social protection programs targeting one of Ethiopia's most vulnerable rural populations.

2. Literature Review

2.1 Theoretical Framework

This study draws on three complementary theoretical perspectives to explain the impact of WSCC membership on household income among female-headed households: the Sustainable Livelihoods Framework, Credit Constraint Theory, and Gender and Empowerment Theory. These theories provide a comprehensive framework for understanding how WSCC membership can affect income outcomes and why FHHs may benefit differently from WSCC participation.

2.1.1 Sustainable Livelihoods Framework

The Sustainable Livelihoods Framework (SLF), as developed by Scoones [12] and extended by DFID [13], provides a foundational lens for understanding how households utilize assets to achieve livelihood outcomes. The framework posits that households' livelihood outcomes (e.g., income, food security, well-being) depend on their access to five capital assets: human capital (education, skills, health), social capital (networks, relationships, trust), natural capital (land, water, resources), physical capital (infrastructure, equipment), and financial capital (savings, credit, income).

In the context of FHHs, the SLF is particularly relevant. FHHs typically lack financial capital (savings, credit) and social capital (networks, information), which limits their ability to engage in income-generating activities and improve their livelihoods [2, 3]. WSCCs intervene by directly building financial capital through loans and savings mechanisms, and social capital through group solidarity, collective action, and training [5, 7]. The framework predicts that WSCC membership should improve livelihood outcomes, conditional on the household's initial asset endowment and the enabling environment (e.g., distance to WSCC, childcare access, awareness).

The SLF also emphasizes the importance of the vulnerability context—the shocks, trends, and seasonality that affect households' ability to sustain their livelihoods. For FHHs in rural Ethiopia, the vulnerability context includes economic shocks (drought, price collapses), health shocks (illness, death), and social shocks (conflict, displacement) [14]. WSCCs may help households cope with these shocks by providing savings mechanisms, credit for diversification, and social networks that offer support during crises [5]. This study tests the prediction that WSCC membership improves income outcomes by enhancing FHHs' access to financial and social capital.

2.1.2 Credit Constraint Theory

Credit Constraint Theory, as developed by Stiglitz and Weiss [15], explains why poor households, especially female-headed ones, face rationing in formal credit markets. The theory identifies three main barriers to credit access: asymmetric information (lenders cannot fully assess borrowers' risk), lack of collateral (poor households have few assets to pledge), and high transaction costs (costs of screening, monitoring, and enforcement are high relative to loan sizes). These barriers are particularly acute for women in developing countries, who often lack formal property rights, have limited education, and face discriminatory lending practices [8].

WSCCs mitigate these constraints through several mechanisms. First, group lending and joint liability reduce default risk and monitoring costs [5]. Second, regular savings requirements build financial discipline and provide a track record of repayment capacity. Third, the member-owned and member-governed structure fosters social collateral the pressure to repay to maintain social standing and access to future credit [15]. Fourth, WSCCs reduce transaction costs by bringing financial services closer to members' communities [16].

The theory predicts that relieving credit constraints allows households to invest in productive activities, thereby increasing income. For FHHs, who face more severe credit constraints than male-headed households, the marginal benefit of credit access may be particularly high [2, 8]. This study tests the prediction that WSCC membership increases income by relieving credit constraints and enabling investment in income-generating activities.

2.1.3 Gender and Empowerment Theory

Gender and Empowerment Theory, as developed by Kabeer [17] and extended by Alkire et al. [18], provides a framework for understanding how women's access to resources translates into improved welfare. Kabeer defines empowerment as "the expansion in people's ability to make strategic life choices in a context where this ability was previously denied to them" [17]. This definition emphasizes three interrelated dimensions:

Resources

Access to material, human, and social resources that enable choice. In the context of WSCCs, resources include credit, savings, training, and social networks. These resources provide the means for women to

invest in income-generating activities and build assets.

Agency

The ability to define one's goals and act upon them, including decision-making power, negotiation ability, and self-confidence. WSCCs can build agency through leadership opportunities, collective action, and confidence-building activities [5, 18]. For FHHs, the absence of a male spouse means women often have full decision-making authority over loan utilization and earnings, which may amplify income gains [19].

Achievements

The outcomes of strategic choices, including well-being, income, and empowerment itself. Achievements are the ultimate goals of empowerment [17].

In the context of FHHs, Gender and Empowerment Theory predicts that WSCC membership will increase both resources (income) and agency (decision-making power), leading to achievements (improved welfare). The absence of a male spouse in FHHs is expected to amplify income gains because women retain full control over loan funds and face no resource diversion by a spouse [19]. This study tests the hypothesis that FHHs benefit more from WSCC membership than women in male-headed households.

2.2 Conceptual Framework

The conceptual framework guiding this study is illustrated in Fig. 1. The framework posits that WSCC membership affects household income through three mechanisms.

First, **financial capital**: WSCCs provide loans and savings mechanisms that enable FHHs to invest in income-generating activities, diversify livelihoods, and build assets [6, 7]. This directly increases income and reduces vulnerability to shocks.

Second, **social capital**: WSCCs build social networks, trust, and collective action among members, providing information, support, and opportunities for cooperation [5]. Social networks enhance members' ability to access markets, share information, and cope with shocks.

Third, **human capital**: WSCCs provide training in financial literacy and business management, enhancing members' skills and decision-making capacity [7]. Training enables women to utilize loans productively, manage cash flows, and plan for repayment.

The framework also incorporates the role of **enabling factors**: distance to WSCC, childcare access, awareness of services, and participation in female support groups. These factors facilitate or constrain WSCC membership and, consequently, income gains. Additionally, the framework acknowledges the **vulnerability context**—economic shocks can disrupt income-generating activities and undermine the effectiveness of credit.

2.3 Empirical Literature

2.3.1 WSCCs and Income

Several studies have documented positive income effects of WSCC membership. In Kenya, Oduor and Mwangi [20] found that WSCC membership increased household income by 25–35% for mixed households (both male- and female-headed). In Ethiopia, Abebaw and Haile [21] reported a 22–28% income gain for general cooperative members. In Uganda, Mulwa et al. [22] found that WSCC membership increased the probability of value-added participation by 22 percentage points. However, these studies often combine male- and female-headed households, obscuring the specific effects for FHHs.

Few studies isolate FHHs to examine the specific impact of microfinance or cooperative membership on their income. Rahman and Khan [8] in Bangladesh found that microfinance participation increased income by only 18% for FHHs—half the gain they reported for male-headed households. They attributed the smaller effect to social stigma and limited market access. In Ethiopia, Tesfaye and Muluye [7] reported a 21% income increase for female cooperative members but did not separate FHHs from women in male-headed households.

Recent systematic reviews (e.g., Banerjee et al., 2015; Duvendack et al., 2011) have called for more rigorous evidence on microfinance impacts, particularly for women in Sub-Saharan Africa [23, 24]. These reviews highlight the need for studies that isolate specific subgroups, employ robust identification strategies, and examine mechanisms of impact.

2.3.2 Determinants of WSCC Membership

Research on determinants of cooperative membership among women has identified several key factors. Distance to financial services consistently emerges as a significant barrier. Armendáriz and Morduch [16] identified transaction costs—including travel costs—as major barriers to microfinance uptake. In Ethiopia, Tesfaye and Muluye [7] found that distance negatively affected access to rural financial services.

Awareness of services is another critical determinant. Studies in Ethiopia have shown that women with higher awareness of cooperative services are significantly more likely to join [25]. Social networks and peer influence also play a crucial role, as women often learn about cooperatives through friends, family, or community groups [5].

Childcare responsibilities have been identified as a practical barrier to women's participation in development interventions. Kabeer [17] qualitatively noted that care responsibilities constrain women's time and mobility. However, no previous WSCC study has quantified the effect of childcare access on membership probability.

Marital status has been shown to influence women's ability to participate in financial programs. Ashraf et al. [19] in the Philippines found that married women were less likely to open savings accounts due to

spousal opposition. This finding suggests that marital status may constrain women's agency over financial resources.

2.3.3 Mechanisms of Impact

Qualitative research has identified several mechanisms through which WSCCs affect women's income and empowerment. Diversification of income-generating activities is a key mechanism, as women use loans to start or expand petty trade, livestock rearing, and food processing [5]. Full control over loan funds and earnings is particularly important for FHHs, who face no spousal interference in resource allocation [19].

Social support and training are additional mechanisms. Women's groups provide solidarity, information sharing, and collective action that enhance business performance and resilience [5]. Financial literacy and business management training improve women's ability to manage cash flows, plan for repayment, and reinvest profits [7].

2.3.4 Gaps in the Literature

Despite the growing body of evidence on WSCCs and income, several gaps persist. First, the specific impact of WSCC membership on FHH income has not been rigorously quantified in Ethiopia. Second, the determinants of WSCC membership among FHHs—particularly the role of distance, childcare access, awareness, and marital status—have not been adequately examined. Third, the mechanisms through which WSCCs affect FHH income remain poorly understood. This study addresses these gaps by providing the first rigorous causal estimate of WSCC membership on household income among FHHs in Ethiopia.

3. Methodology

3.1 Description of the Study Area

The study was conducted in East Hararghe Zone, Oromia Region, Ethiopia. East Hararghe Zone is located in the eastern part of the Oromia Region, approximately 500 km east of Addis Ababa. The zone covers an area of approximately 17,935 square kilometers and has a population of about 2.8 million people, of whom nearly 87% reside in rural areas [26]. The zone features diverse agro-ecological zones, including highlands (2,500–3,000 meters above sea level), midlands (1,500–2,500 meters), and lowlands (500–1,500 meters). Major crops grown include coffee, khat, maize, sorghum, and legumes. The zone was selected because it has a high concentration of WSCCs (502 cooperatives across 19 districts) and is characterized by high poverty rates and significant gender disparities [2].

3.2 Sampling and Sample Size

A multi-stage sampling procedure was employed. In the first stage, East Hararghe zone was purposively selected due to its high concentration of WSCCs, high poverty rates, significant gender disparities and the significant role of women in agricultural value chains. In the second stage, four districts namely

Kombolcha, Fadis, Kurfa Chele, and Babile, were randomly selected from the 19 districts in the zone to capture variation in agro-ecological conditions, market access, and WSCC density. In the third stage, a total of 113 WSCCs were identified in the sample districts in consultation with district cooperative development offices and 67 WSCCs that had been operational for at least 2 years were randomly selected in proportion to the number of WSCCs in each district. In the fourth stage, a total of 108 female-headed households (63 WSCC members and 45 non-members) were randomly sampled from WSCC member and non-member lists obtained from kebele administrations (the smallest administrative unit in Ethiopia) and WSCC records.

Sample Size Determination: Based on a power analysis using the following parameters: power = 0.80, alpha = 0.05, expected effect size (Cohen's d) = 0.30 standard deviations (conservative estimate based on previous studies [21]), the minimum sample size was calculated as 102 households. We oversampled to 108 to account for potential missing data, incomplete responses, and to maintain statistical power for subgroup analyses. The achieved sample size (N = 108) provides sufficient power to detect the hypothesized income effect.

3.3 Data Collection

Quantitative data were collected from March to June 2025 using semi-structured household surveys administered by 12 trained enumerators. The survey instrument was developed in English, translated into Afan Oromo (the local language) and back-translated to ensure accuracy. Pre-testing was conducted with 10 households to refine question wording. The survey covered household demographics, WSCC membership, land holding, social networks, awareness, credit access, training, female support groups, childcare access, and distance to WSCC, and total annual household income from all sources. Enumerators received two days of training, and daily field checks were conducted to verify data quality.

Qualitative data were also collected through 12 focus group discussions (FGDs) with WSCC members and non-members (8–10 participants per group), stratified by household type and membership status. This stratification allowed for comparative analysis of experiences, challenges, and barriers to WSCC participation across different household types and membership statuses. Additionally, 24 key informant interviews (KIIs) were conducted with WSCC leaders, district cooperative officers, extension agents, and community leaders.

3.4 Analytical Approach

Descriptive Analysis

Descriptive statistics, including means, standard deviations, frequencies, and percentages, were computed to summarize the characteristics of the sample FHHs. To compare WSCC members and non-members, independent sample t-test was used for continuous variables, while χ^2 -test was applied for categorical variables. These analyses provided an initial understanding of the differences between the two groups.

Endogenous Switching Regression (ESR)

To estimate the causal impact of WSCC membership on income while accounting for selection bias from both observed and unobserved factors, an endogenous switching regression (ESR) model was employed [27, 28]. The ESR model addresses selection bias by simultaneously estimating a selection equation (determinants of WSCC membership) and two outcome equations (income determinants for members and non-members). The model is specified as:

Selection equation

$M_i^* = \gamma Z_i + v_i$, $M_i = 1$ if $M_i^* > 0$, else 0 (1)

Where M_i^* is a latent variable representing the propensity to join a WSCC, Z_i are variables affecting membership (including the exclusion restriction, distance to WSCC), and v_i is the error term.

Outcome equations

$Y_{1i} = \beta_1 X_{1i} + \varepsilon_{1i}$ if $M_i = 1$ (members);

$Y_{0i} = \beta_0 X_{0i} + \varepsilon_{0i}$ if $M_i = 0$ (non-members). (2)

Where Y_{1i} and Y_{0i} are household incomes for members and non-members, respectively; X_{1i} and X_{0i} are vectors of explanatory variables (education, social networks, training, land, family size, age); β_1 and β_0 are parameters to be estimated; and ε_{1i} and ε_{0i} are error terms.

The Average Treatment Effect on the Treated (ATT) is computed as:

$ATT = E(Y_{1i} - Y_{0i} | M_i = 1)$. (3)

The ESR model was estimated using full information maximum likelihood (FIML) via the movestay command in Stata 17 [28]. The selection equation included distance to WSCC office as an exclusion restriction—a variable that affects membership but does not directly affect income except through membership. The validity of this exclusion restriction was tested using a placebo regression.

Robustness Checks

To test the sensitivity of the results, several robustness checks were performed.

First, *propensity score matching (PSM)* with nearest neighbor matching (k = 5) and radius matching (caliper = 0.05) were employed as alternative methods to estimate the ATT, providing a check against the ESR results [29, 30]. PSM addresses selection on observables and provides a non-parametric alternative to ESR.

Second, *income per capita* was used as an alternative outcome variable to test whether the results were sensitive to the measurement of income [30]. This checks whether the effect holds for per capita income (which accounts for household size) as well as total household income.

Third, *kernel density plots* were used to assess the common support condition [31]. The common support condition requires that treated (members) and control (non-members) observations have overlapping propensity score distributions.

Fourth, a *Rosenbaum bounds sensitivity analysis* was conducted to assess the robustness of the results to unobserved confounding [32, 33]. This test calculates the level of unobserved confounding (gamma, Γ) that would be needed to overturn the significant treatment effect.

Fifth, a *placebo regression* tested the validity of the exclusion restriction by regressing income on distance and all control variables. If distance significantly predicts income after controlling for other factors, the exclusion restriction is invalid.

4. Results and Discussion

4.1 Descriptive Statistics Results

Table 1 presents the characteristics of FHHs by WSCC membership status. WSCC-member FHHs had significantly higher annual income (43,210 Birr) than non-members (31,450 Birr), a raw difference of 37.4% ($p < 0.01$). Members also had higher education (3.4 vs. 2.1 years, $p < 0.01$), stronger social networks (0.64 vs. 0.42, $p < 0.01$), and better awareness of WSCC services (0.72 vs. 0.48, $p < 0.01$). They lived closer to WSCC offices (6.8 km vs. 10.2 km, $p < 0.01$) and were more likely to have received training (78% vs. 0%, $p < 0.01$), participate in a female support group (71% vs. 11%, $p < 0.01$), and have access to childcare (54% vs. 9%, $p < 0.01$). No significant differences were found in terms of marital status, age, land, and family size.

Table 1
Characteristics of female-headed households by WSCC membership status.

Annual income (Birr)	**31,450 (9,876)**	**43,210 (11,234)**	**11,760**	**0.000**
Education (years)	2.1 (1.1)	3.4 (1.3)	1.3	0.000
Distance to WSCC (km)	10.2 (4.8)	6.8 (3.9)	-3.4	0.000
Awareness score (0–1)	0.48 (0.20)	0.72 (0.19)	0.24	0.000
Social network index (0–1)	0.42 (0.14)	0.64 (0.13)	0.22	0.000
Credit access (1 = yes)	0.29 (0.46)	0.48 (0.50)	0.19	0.003
Training received (1 = yes)	0.00 (0.00)	0.78 (0.42)	0.78	0.000
Female support group (1 = yes)	0.11 (0.32)	0.71 (0.46)	0.60	0.000
Childcare access (1 = yes)	0.09 (0.29)	0.54 (0.50)	0.45	0.000
Married (1 = yes)	0.16 (0.37)	0.08 (0.27)	-0.08	0.182
Age (years)	48.5 (12.3)	46.2 (11.8)	-2.3	0.324
Land (ha)	0.38 (0.16)	0.45 (0.21)	0.07	0.112
Family size (#)	4.3 (1.5)	4.5 (1.6)	0.2	0.514
Note: p-values from independent sample t-tests for continuous variables and χ^2 tests for binary variables.				
Source: Author computation from survey data				

4.2 Econometric Model Results

4.2.1 Diagnostic Tests for the ESR Model

Before interpreting the ESR results, several diagnostic tests were conducted to validate the model and ensure the reliability of the estimates. These tests assessed the presence of endogenous switching, the common support condition, the normality of residuals, sensitivity to unobserved confounding, and the validity of the exclusion restriction.

A Wald test of the joint null hypothesis that the correlation coefficients between the selection and outcome equations are zero ($\rho_1 = \rho_0 = 0$) was performed. The test yielded a χ^2 statistic of 5.87 with a p-value of 0.053 (Table 2). This result is statistically significant at the 10% level, indicating that the selection and outcome equations are correlated. In other words, unobserved factors influencing WSCC membership also affect household income, confirming the presence of endogenous switching. This justifies using the ESR model over a standard regression, which would yield biased estimates if selection bias were ignored.

Table 2
Wald test for independence of selection and outcome equations.

Hypothesis	χ^2 statistic	df	p-value
$\rho_1 = \rho_0 = 0$	5.87	2	0.053

The common support condition requires that treated (WSCC members) and control (non-members) observations have overlapping propensity score distributions. Kernel density plots showed substantial overlap in propensity scores between members and non-members, satisfying the common support condition. This ensures that for each treated observation, there are comparable control observations with similar propensity scores, which is essential for reliable estimation of the treatment effect.

The joint normality assumption of the error terms in the ESR model was assessed using the Shapiro-Wilk test. The test failed to reject the null hypothesis of normality ($W = 0.987$, $p = 0.187$), indicating that the residuals are normally distributed. A Q-Q plot (available from the corresponding author) showed residuals lying close to the 45-degree line, further confirming the joint normality assumption. This validates the use of full information maximum likelihood (FIML) estimation in the ESR model.

To assess robustness to hidden bias from unobserved confounding, a Rosenbaum bounds sensitivity analysis was conducted. The test (Table 3) indicates that the treatment effect remains statistically significant ($p < 0.05$) up to $\Gamma = 2.5$, where the upper-bound p-value is 0.031. At $\Gamma = 3.0$, the p-value increases to 0.089, rendering the effect non-significant. The gamma parameter represents the odds of differential assignment due to an unobserved confounder. A Γ value of 2.5 implies that an unobserved confounder would need to increase the odds of WSCC membership by 150% to overturn the significant income effect. This relatively high level of robustness suggests that the estimated effect is not easily explained by unobserved heterogeneity. For instance, unobserved motivation or entrepreneurial ability would need to increase membership odds by 150% to explain away the income effect—an unlikely scenario. This provides strong confidence in the causal interpretation of the ATT estimates.

Table 3
Rosenbaum bounds sensitivity analysis for the ATT.

Gamma (Γ)	Upper-bound p-value	Critical level
1.0	0.000	---
1.5	0.000	---
2.0	0.002	---
2.5	0.031	< 0.05
3.0	0.089	---

Note: Gamma (Γ) is the odds of differential assignment due to an unobserved confounder. The effect remains significant ($p < 0.05$) up to $\Gamma = 2.5$.

The validity of the exclusion restriction that distance to WSCC affects income only through membership was tested using a placebo regression. A placebo regression of income on distance and all control variables found the coefficient on distance to be small and statistically insignificant (β = -87.34, p = 0.471). This supports the validity of the exclusion restriction, as distance does not directly affect income after controlling for other factors.

Additionally, the strong first-stage correlation between distance and WSCC membership (F = 17.8) confirms the instrument's relevance. An F-statistic above the conventional threshold of 10 indicates that the instrument is sufficiently strong and not weak, further validating its use as an exclusion restriction in the ESR model. The placebo test results are presented in Table 4.

Table 4
Placebo test direct effect of distance on household income.

Variable	Coefficient	Std. Error	t	p-value
Distance to WSCC (km)	-87.34	120.56	-0.72	0.471
Education (years)	340.12	98.45	3.46	0.001
Social network index	2890.45	845.67	3.42	0.001
Land (ha)	1450.23	980.12	1.48	0.142
Family size	-210.45	189.34	-1.11	0.269
Age	-65.23	45.67	-1.43	0.156
Constant	18500.23	2150.34	8.60	0.000
Note: Dependent variable = annual household income (Birr). N = 108, R^2=0.4237. The insignificance of distance supports the exclusion restriction.				

Table 5
Summary of diagnostic test results.

Test	Statistic/Result	Interpretation
Wald test	χ^2 = 5.87, p = 0.053	Endogenous switching confirmed
Common support	Substantial overlap in propensity scores	Satisfied
Normality of residuals	W = 0.987, p = 0.19	Joint normality assumption satisfied
Rosenbaum bounds	Γ = 2.5 (p = 0.03)	Robust to unobserved confounding
Placebo test	β = -87.34, p = 0.47	Exclusion restriction valid
First-stage F	F = 17.8	Strong instrument

4.2.2 Determinants of WSCC Membership

Table 6 presents the probit estimates for the determinants of WSCC membership among female-headed households. The model is statistically significant, as indicated by the log-likelihood ratio (-42.34) and Pseudo R^2 (0.287), suggesting that the selected covariates jointly explain WSCC membership.

Distance to WSCC had a significant negative effect on membership probability ($\beta = -0.189$, $p < 0.01$). Specifically, each additional kilometer from a WSCC office reduced the probability of membership by 7.2 percentage points. This finding underscores the importance of physical proximity for cooperative participation, consistent with Credit Constraint Theory [15], which emphasizes transaction costs including travel costs as barriers to accessing formal credit. The result also aligns with empirical evidence from Ethiopia, where distance negatively affected cooperative membership decisions and access to rural financial services [7]

Awareness of WSCC services had a strong positive effect ($\beta = 1.234$, $p < 0.01$), with a marginal effect of 0.471. This suggests that women with higher awareness of WSCC services are 47.1 percentage points more likely to join. This finding highlights the critical role of information dissemination in promoting financial inclusion, consistent with the Sustainable Livelihoods Framework [12, 13], which emphasizes the importance of access to information as a form of social capital.

Participation in a female support group positively predicted membership ($\beta = 1.145$, $p < 0.01$), increasing the probability by 43.7 percentage points. This underscores the role of social networks and collective action in facilitating cooperative participation, aligning with Gender and Empowerment Theory [17, 18], which emphasizes the importance of agency and social solidarity in women's empowerment. Previous studies in Ethiopia have similarly shown that women's self-help groups provide skills training and financial support, enabling women to start or expand businesses [5]

Childcare access had a positive effect ($\beta = 0.823$, $p < 0.01$), increasing membership probability by 31.4 percentage points. This finding highlights the importance of addressing practical barriers particularly care responsibilities that constrain women's time and mobility. Female-headed households bear disproportionately heavy care responsibilities, and childcare services may facilitate women's participation in WSCCs.

Married female heads were 16 percentage points less likely to join than single, divorced, or widowed women ($\beta = -0.423$, $p < 0.05$). This suggests that marital status constrains membership, possibly due to spousal opposition or resource diversion. This finding aligns with qualitative evidence from Ethiopia, where married women sometimes face pressure to share loan funds with their husbands [19]

Education positively and significantly influenced membership ($\beta = 0.234$, $p < 0.05$), with each additional year of schooling increasing the probability of joining by 8.9 percentage points. This is consistent with the Sustainable Livelihoods Framework, which emphasizes human capital as a key asset for accessing resources and improving livelihoods [25]

Table 6
Determinants of WSCC membership (Probit model).

Variable	Coefficient	Robust SE	z-value	p-value	Marginal effect
Distance to WSCC (km)	-0.189***	0.045	-4.20	0.000	-0.072
Awareness score	1.234***	0.456	2.71	0.007	0.471
Female support group	1.145***	0.389	2.94	0.003	0.437
Childcare access	0.823***	0.312	2.64	0.008	0.314
Married (vs. single)	-0.423**	0.189	-2.24	0.025	-0.162
Education (years)	0.234**	0.098	2.39	0.017	0.089
Age	-0.012	0.011	-1.09	0.276	-0.005
Constant	-1.512***	0.489	-3.09	0.002	---
Notes: Log-likelihood = -42.34, Pseudo R^2 = 0.287, N = 108. Marginal effects at sample means. *** and ** refer to significance at 1% and 5% probability levels.					

The Pseudo R^2 of 0.287 indicates that the model explains approximately 29% of the variation in membership, which is comparable to similar studies (Tesfaye & Muluye, 2020, reported a Pseudo R^2 of 0.31) [7].

4.2.3 Determinants of Income

Table 7 reports the income determinants for WSCC members and non-members separately, estimated using the ESR model. The results reveal striking differences in the factors that drive income for the two groups.

For members, education ($\beta = 0.234$, $p < 0.05$), social network index ($\beta = 0.312$, $p < 0.01$), and training received ($\beta = 0.198$, $p < 0.05$) were positively and significantly associated with income. This suggests that WSCC membership creates an enabling environment where women can effectively leverage human capital (education), social capital (networks), and capacity building (training) to generate income.

The strong effect of social networks on income for members highlights the importance of peer support, information sharing, and collective action mechanisms which is consistent with social capital theory [29] and the Sustainable Livelihoods Framework [12, 13] The significant positive effect of training underscores the value of capacity building in enhancing women's ability to utilize loans productively, consistent with evidence from microfinance 'plus' programmes in Ethiopia [35].

For non-members, only education ($\beta = 0.167$, $p < 0.10$) and land ($\beta = 0.124$, $p < 0.10$) were significantly associated with income. Social networks and training had no effect on income for non-members, suggesting that without WSCC membership, women are unable to effectively leverage these assets to

generate income. The lack of significance for social networks among non-members is notable, as it suggests that social capital alone without access to credit and financial services may not translate into income gains. This finding underscores the importance of WSCCs in providing the institutional platform through which women can mobilize their assets productively.

The finding that land increases income only for non-members suggests that WSCC membership may substitute for land as a productive asset, enabling women to generate income through trade and services rather than relying solely on agriculture. This is consistent with the diversification mechanism identified in qualitative data (Section 4.2.6).

The correlation coefficients (ρ_1 = -0.124, $p < 0.10$; ρ_0 = -0.098, n.s.) indicate limited selection on unobservable, suggesting that unobserved factors do not substantially bias the estimates. The negative sign of ρ_1 suggests that women with lower unobserved income potential are more likely to join WSCCs, which is consistent with the expectation that WSCCs target poorer and more vulnerable households.

Table 7
Income equations from ESR model (Dependent variable: Log annual income).

Variable	**Members (N = 63)**	**Non-Members (N = 45)**
Education (years)	0.234** (0.098)	0.167* (0.089)
Social network index (0–1)	0.312*** (0.112)	0.087 (0.134)
Training received (1 = yes)	0.198** (0.085)	---
Land (ha)	0.089 (0.067)	0.124* (0.071)
Family size	-0.045 (0.034)	-0.052 (0.041)
Age	-0.012 (0.009)	-0.015 (0.010)
Constant	9.234*** (0.567)	8.789*** (0.612)
σ (error variance)	0.312***	0.289***
ρ (correlation with selection)	-0.124*	-0.098

Note: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. *σ is the error variance; ρ is the correlation coefficient between selection and outcome equations.*

4.2.4 Average Treatment Effect on the Treated (ATT)

Table 8 presents the Average Treatment Effect on the Treated (ATT) estimated from the ESR model. WSCC membership significantly increased household income by 11,560 Birr per year ($p < 0.01$), representing a 36.8% increase relative to the counterfactual mean income of non-members (31,450 Birr). The 95% confidence interval ranged from 7,740 to 15,380 Birr, indicating that the true effect is likely between 24.6% and 48.9% of baseline income.

The effect is also economically significant. An additional 11,560 Birr per year represents a substantial income gain that could significantly improve household welfare. Based on local cost estimates, this amount could cover school fees for two children for a year, provide three months of household food consumption, or enable investment in income-generating activities [4]. This finding provides strong evidence that WSCCs are effective tools for poverty reduction and income enhancement among female-headed households in rural Ethiopia.

The magnitude of the effect (36.8%) is larger than most previously reported income gains from microfinance and cooperative membership. In Kenya, Oduor and Mwangi [20] found that WSCC membership increased household income by 25–35%, while in Ethiopia, Abebaw and Haile [21] reported a 22–28% income gain for cooperative membership. The larger effect observed in this study likely reflects the exclusive focus on FHHs, who retain full control over loan funds and face no spousal resource diversion [19]

Table 8
Average Treatment Effect on the Treated (ATT).

Outcome	ATT (Birr)	Bootstrap SE	z-value	p-value	95% CI	Percentage gain
Household income	11,560	1,950	5.93	0.000	[7,740, 15,380]	36.8%
Note: Percentage gain relative to counterfactual mean income of non-members (31,450 Birr). Bootstrap with 500 replications.						
Robustness Checks						

Table 9 presents the ATT estimates from alternative methods to assess the robustness of the main ESR results. Propensity score matching (PSM) with nearest neighbor matching (k = 5) yielded an ATT of 11,400 Birr, while radius matching (caliper = 0.05) yielded an ATT of 11,520 Birr. Both estimates are nearly identical to the ESR result of 11,560 Birr, confirming the robustness of the findings.

When using *income per capita* as an alternative outcome variable, the ATT was 4,570 Birr ($p < 0.01$), representing a 32.4% gain relative to non-members' per capita income of 14,100 Birr. This is slightly lower than the 36.8% gain for total household income, reflecting the slightly larger family size among members (4.5 vs. 4.3, though not statistically significant). The consistency of the effect across both income measures strengthens confidence in the results.

The consistency of estimates across ESR and PSM strengthens the causal interpretation of the results. ESR addresses selection bias from both observed and unobserved factors, while PSM addresses selection bias from observed factors. The convergence of estimates from these different methods suggests that the estimated treatment effect is not an artifact of model specification.

Table 9
Robustness check – comparison of ATT estimates.

Method	ATT (Birr)	Bootstrap SE	95% CI
ESR (main model)	11,560	1,950	[7,740, 15,380]
PSM (nearest neighbor, k = 5)	11,400	2,100	[7,284, 15,516]
PSM (radius matching, caliper = 0.05)	11,520	2,050	[7,502, 15,538]

Note: All estimates significant at $p < 0.01$. *Per capita income ATT represents percentage gain of 32.4% relative to non-members' mean per capita income of 14,100 Birr.

4.2.6 Qualitative Findings: Mechanisms and Challenges

To complement the quantitative results, we conducted 12 focus group discussions (FGDs) with WSCC members and 24 key informant interviews (KIIs) with cooperative leaders, development agents and district officers. Thematic analysis was used to identify patterns and themes following Braun and Clarke's [34] six-step framework. Thematic analysis revealed three mechanisms through which WSCC membership improves household income, as well as two persistent challenges that constrain the full realization of benefits.

Diversification of Income-Generating Activities

Most FGD participants reported that WSCC loans enabled them to start or expand income-generating activities beyond subsistence farming, including petty trade, livestock rearing, and food processing. This diversification is consistent with the Sustainable Livelihoods Framework [12, 13], which emphasizes that households improve livelihood outcomes by diversifying income sources and reducing reliance on a single activity.

A member from Kombolcha district explained: *"Before joining the cooperative, I only grew maize on my small plot. With my first loan of 3,000 Birr, I bought two goats. Within a year, they gave birth, and I sold one goat for 4,500 Birr. Now I also sell milk and butter at the local market."* (FGD, female head, age 42)

This illustrates how credit enabled transition from subsistence agriculture to market-oriented activities, generating steady income and reducing vulnerability to agricultural shocks. Key informants confirmed that WSCC loan officers encourage members to propose business plans, and some cooperatives provide market linkage support. A district officer noted:

"We encourage women to think beyond subsistence. Many start with petty trade, but over time they expand into processing and marketing." (KII, district cooperative officer, Kombolcha)

Full Control over Loan Funds and Earnings

A recurring theme among FHHs was the absence of spousal interference, allowing them to retain full control over loan funds and any resulting profits. Several women contrasted their situation with that of

married women in male-headed households who sometimes had to surrender part of the loan to their husbands. This finding aligns with Gender and Empowerment Theory [17, 18], which emphasizes that women's agency particularly control over resources is essential for translating credit access into improved welfare.

A participant in Fadis district stated: *"I am a widow. When I get a loan, the money stays with me. I decide how much to invest, what to buy, and when to sell. My children help, but the decisions are mine. My friend who has a husband, often complains that he takes her loan for khat."* (FGD, female head, age 55)

This highlights the critical role of household dynamics in shaping the impact of credit on women's livelihoods. The absence of a male spouse in FHHs enables women to appropriate the full benefits of their loans and investments. Ashraf et al. [19] found that women in female-headed households valued commitment savings products because they protected funds from spousal demands, further underscoring the importance of full control over resources.

Social Support and Training Benefits

Members consistently valued the social networks formed within WSCCs. Regular meetings, saving together, and collective problem-solving created a sense of solidarity that extended beyond the cooperative context. This finding aligns with social capital theory [29], which emphasizes that social networks, trust, and norms of reciprocity facilitate cooperation and economic transactions.

A member noted: *"When my child was sick and I could not attend the market, my group members sold my vegetables for me. We also share information about which crops to plant and where to find better prices."* (FGD, Kurfa Chele district)

Training in financial literacy and business management—received by 78% of members—was cited as particularly helpful for first-time borrowers. A key informant observed: *"Women who complete our basic business training are much more likely to repay on time and to reinvest their profits. They learn to separate household money from business money, which many did not do before."* (KII, cooperative manager)

This underscores the value of capacity building in enhancing the effectiveness of credit. Financial literacy and business management training enable women to manage cash flows, plan for repayments, and reinvest profits—skills essential for sustainable income generation. This is consistent with evidence from microfinance 'plus' programmes in Ethiopia [35].

Persistent Challenges

Despite the positive impacts, members reported two major challenges that constrained the full realization of benefits from WSCC membership.

First, vulnerability to economic shocks sometimes forced women to divert loan funds from investment to immediate consumption. Drought, illness of livestock, or family emergencies often disrupted income-

generating activities and delayed loan repayment. A participant in Kurfa Chele district explained: *"Last year, my husband became ill. All our savings went to treatment. I could not repay my loan on time. The cooperative understood, but it was very stressful."* (FGD, female head, age 48)

This aligns with vulnerability theory [14], which emphasizes that households facing shocks are forced to prioritize survival over investment, undermining the effectiveness of credit. Key informants noted that WSCCs could mitigate this vulnerability by providing flexible repayment schedules, grace periods, or emergency savings options.

Second, social stigma against women who take loans remained in some communities, particularly among married female heads. A key informant explained:

"Some husbands discourage their wives from joining because they fear the wife will become independent. For widows and divorced women, this is less of a problem, but for married FHHs for example, when the husband is away for work the pressure can still exist." (KII, district cooperative officer)

This finding highlights the role of social norms and gender relations in shaping women's access to and use of credit. Despite their status as household heads, married FHHs still face constraints related to spousal opposition and community stigma. This is consistent with Gender and Empowerment Theory [17], which emphasizes that social norms and power relations shape women's ability to exercise agency.

A participant in Kombolcha elaborated: *"When I first joined, my neighbors laughed at me. They said a woman should not take loans. But when they saw my business growing, they changed. Now some of them want to join too."* (FGD, female head, age 45). This quote illustrates how women's success can challenge and gradually transform social norms, creating pathways for greater acceptance and participation in WSCCs.

5. Discussion

1. Interpretation of Findings

The 36.8% income gain observed in this study supports the hypothesis, derived from Gender and Empowerment Theory [17, 18], that female-headed households (FHHs) may benefit more from WSCC membership, as they retain full control over loan funds and are not subject to resource diversion by a spouse [19]. Focus group discussions (FGDs) corroborate this finding; participants reported using loans for diversified income-generating activities and highly valued retaining full command over their earnings. This finding is also consistent with evidence from Bangladesh, where Rahman and Khan [8] observed that FHHs experienced diminished benefits from microfinance when they lacked control over loan funds, thereby underscoring the critical role of agency in translating credit access into tangible income gains.

The ESR outcome equations reveal that education, social networks, and training significantly increase income for members but not for non-members. This aligns with the Sustainable Livelihoods Framework [12, 13]: WSCCs not only provide capital but also create an enabling environment where women can

effectively leverage human capital (education, training) and social capital (networks). The finding that training is significant only for members underscores the value of capacity building in enhancing the effectiveness of credit. This is consistent with evidence from microfinance 'plus' programmes in Ethiopia, which integrated training with credit to improve women's decision-making over productive assets and control over income [35]. Similarly, studies on women's savings groups in sub-Saharan Africa have shown that financial literacy training enhances women's ability to manage cash flows, plan for repayments, and reinvest profits [5].

Consistent with Credit Constraint Theory [15], the finding that distance reduces membership probability highlights a practical barrier to relieving credit constraints. Each additional kilometer from a WSCC office reduced the probability of membership by 7.2 percentage points, underscoring the importance of physical accessibility for financial inclusion. This finding aligns with Armendáriz and Morduch [16], who identified transaction costs—including travel costs—as major barriers to microfinance uptake. The finding that childcare access increases membership probability by 31 percentage points is particularly noteworthy, as it highlights the role of practical interventions in reducing barriers to women's participation.

Vulnerability to economic shocks and persistent social stigma, especially for married female heads, remain barriers that policy should address. Economic shocks such as drought, illness, or price collapses often force women to divert loan funds from investment to immediate consumption, undermining the effectiveness of credit. This is consistent with vulnerability theory [14], which emphasizes that households facing shocks prioritize survival over investment. The social stigma against women who take loans, particularly among married female heads, reflects deeply entrenched gender norms that constrain women's agency [17]. Addressing these barriers requires a multi-pronged approach, including flexible repayment schedules, community sensitization, and targeted outreach to married female heads.

5.2 Comparison with Previous Studies

Our estimated ATT of 36.8% is substantially larger than most previously reported income effects from microfinance and cooperative membership. In Kenya, Oduor and Mwangi [20] found that WSCC membership increased household income by 25–35% for mixed households (both male- and female-headed). In Ethiopia, Abebaw and Haile [21] reported a 22–28% income gain for general cooperative members without distinguishing household headship. The higher gain in our study likely reflects two factors: (1) exclusive focus on FHHs, who retain full control over loan funds and face no spousal resource diversion, and (2) the specific design of WSCCs in East Hararghe, which bundle credit with training and social support. This is consistent with the argument that interventions targeting women's agency—particularly control over resources—yield larger impacts on household welfare [17, 19].

Few studies isolate FHHs to examine the specific impact of microfinance or cooperative membership on their income. Rahman and Khan [8] in Bangladesh found that microfinance participation increased income by only 18% for FHHs—half the gain we report. They attributed the smaller effect to social stigma

and limited market access, which may be less severe in our study area due to active female support groups and community sensitization efforts. In Ethiopia, Tesfaye and Muluye [7] reported a 21% income increase for female cooperative members but did not separate FHHs from women in male-headed households. Our 36.8% gain suggests that FHHs benefit substantially more than women living with spouses, a finding that aligns with Gender and Empowerment Theory [17] and our qualitative evidence of full resource control.

The negative effect of distance on membership (marginal effect − 7.2% per km) is consistent with Armendáriz and Morduch [16], who identified transaction costs including travel costs as a major barrier to microfinance uptake. In Ethiopia, Tesfaye and Muluye [7] similarly found that distance negatively affected access to rural financial services. Our finding that childcare access increases membership probability by 31 percentage points is novel—no previous WSCC study has quantified this moderator. However, Kabeer [17] qualitatively noted that care responsibilities constrain women's participation in development interventions; our study provides the first marginal effect estimate for childcare access in the WSCC context.

The finding that married female heads are 16 percentage points less likely to join aligns with Ashraf et al. [19] in the Philippines, where married women were less likely to open savings accounts due to spousal opposition. Our qualitative data confirm that even among FHHs (where the husband is absent), married women whose husbands have migrated face pressure to share loan funds—a previously undocumented nuance. This suggests that marital status, rather than household headship alone, is an important determinant of women's ability to exercise agency over financial resources.

Notably, age and family size did not significantly affect membership or income in our models. This may reflect that WSCCs are equally accessible across age groups and household sizes, suggesting their potential for broad inclusion among FHHs regardless of demographic characteristics.

5.3 Policy Implications

The findings have several important policy implications for promoting financial inclusion and women's empowerment in rural Ethiopia.

First, *reduce distance barriers* through community-based WSCCs or mobile banking services. The negative significant effect of distance on membership (7.2 percentage points per kilometer) highlights the need to bring financial services closer to FHHs. Establishing community-based savings groups, village-level WSCCs, or mobile banking services can reduce transaction costs and improve accessibility for remote households. District cooperative offices should prioritize the establishment of WSCCs in underserved areas and consider mobile banking solutions to reach the most remote communities.

Second, *provide targeted outreach to married female heads*. Married female heads are 16 percentage points less likely to join than single, divorced, or widowed women. Targeted outreach efforts—including community sensitization, couples' training, and men's discussion groups—can address spousal opposition and social stigma. Engaging husbands and families in WSCC programs may enhance

women's participation and empowerment outcomes. Development programs should recognize that household headship alone is an inadequate indicator of women's empowerment or autonomy.

Third, *integrate WSCCs with childcare services*. Currently, only 54% of members had access to childcare. Integrating childcare services with WSCC programs can reduce the care burden that constrains women's time and mobility. This could include establishing childcare facilities at WSCC offices, providing childcare subsidies, or partnering with community-based childcare providers. This intervention has the potential to increase membership by 31 percentage points, a substantial impact.

Fourth, *pair loans with training in financial literacy and business management*. Training received by 78% of members was cited as particularly helpful for first-time borrowers. Providing financial literacy and business management training—covering budgeting, record-keeping, and financial planning—can enhance women's ability to utilize loans productively and manage cash flows. Training should be mandatory for all new members and reinforced periodically. This recommendation is supported by both the quantitative finding that training significantly increases income for members and qualitative evidence of its practical value.

Fifth, *strengthen women's support groups*. Participation in female support groups increased membership probability by 43.7 percentage points. Formalizing women's support groups within WSCCs can provide peer support, information sharing, and collective action, building the social capital that facilitates membership and enhances income gains. This can be achieved by creating spaces for women's groups to meet, providing resources for group activities, and integrating group leadership into WSCC governance structures.

Sixth, *develop shock-responsive lending mechanisms*. Vulnerability to economic shocks diverts loan funds to consumption, undermining the effectiveness of credit. Flexible repayment schedules, grace periods, loan restructuring, savings-linked insurance, and emergency funds can help borrowers cope with shocks without defaulting on loans. Cooperative development offices should develop guidelines for shock-responsive lending and provide training to WSCC managers on implementing these mechanisms.

Seventh, *conduct community sensitization campaigns*. Social stigma against women who take loans, particularly among married female heads, constrains membership and empowerment. Community sensitization campaigns engaging religious and traditional leaders, community meetings, and media campaigns can challenge gender norms and promote acceptance of women's economic participation. These campaigns should highlight success stories of women who have benefited from WSCCs to inspire others.

5.4 Limitations

The study has several limitations that should be acknowledged when interpreting the findings.

First, the *modest sample size* (N = 108) limits the generalizability of the findings and the ability to conduct detailed subgroup analyses. While the sample size was determined based on power calculations (power

= 0.80, alpha = 0.05) and is consistent with similar impact evaluation studies using ESR, larger samples would enable more robust estimation and analysis of heterogeneity (e.g., by district, type of WSCC, or length of membership). The findings should be interpreted as indicative rather than definitive, and replication with larger samples would strengthen confidence.

Second, the *cross-sectional data* limit causal claims. While the ESR model addresses selection bias from both observed and unobserved factors, it cannot fully eliminate concerns about reverse causality or time-varying unobservables. Specifically, we cannot rule out that higher-income women may be more likely to join WSCCs (reverse causality). The length of membership among members averaged 3.2 years (SD = 1.8, range = 0.5-7 years), suggesting sufficient time to realize income effects, but temporal precedence cannot be established definitively. Longitudinal data would provide stronger evidence for causal relationships and allow tracking of income changes before and after WSCC membership.

Third, *self-reported income* may be subject to recall bias, social desirability bias, and difficulties in accurately valuing home-consumed production. While we cross-checked reported income with cooperative records where available (correlations > 0.85), some measurement error is inevitable. We used multiple strategies to minimize this: calendar of events to anchor recollections, cross-checking with cooperative records, and valuing home-consumed production at local market prices. Future studies could use income diaries or objective asset indices as complementary outcome measures.

Fourth, the validity of the *exclusion restriction* (distance to WSCC) is an assumption that cannot be definitively tested. While we conducted a placebo test to support its validity, there remains a possibility that distance correlates with other unobserved factors that affect income (e.g., market access, infrastructure). However, the strong first-stage correlation (F = 17.8) and the insignificance of distance in the placebo regression lend confidence to the exclusion restriction. The Rosenbaum bounds sensitivity analysis (Γ = 2.5) further supports the robustness of the findings to unobserved confounding.

Fifth, the study focuses on *one zone in Ethiopia*, which may not be representative of other regions. East Hararghe has specific agro-ecological, cultural, and institutional characteristics that may influence the findings. The zone is characterized by high population density, diverse agro-ecologies, and significant market integration, which may differ from other regions of Ethiopia. Replication in other contexts is needed to determine the generalizability of the results.

Sixth, the study does not examine *heterogeneity by length of membership*. Members with longer membership may have realized greater income gains than recent joiners. Future research should collect detailed data on membership duration and test whether the income effect grows over time.

Despite these limitations, the consistency of ATT estimates across ESR and PSM, the high Rosenbaum bound (Γ = 2.5), the convergence of quantitative and qualitative evidence, and the statistical power of the study design lend strong confidence to the main conclusion that WSCC membership significantly increases household income among FHHs in rural Ethiopia.

6. Conclusion

6.1 Summary of Findings

This study provides the first rigorous causal estimate of WSCC membership on household income exclusively among FHHs in Ethiopia. Using an endogenous switching regression model with robust diagnostic tests, we find that WSCC membership significantly increases annual household income by 11,560 Birr (approximately 210 USD), representing a 36.8% gain relative to the counterfactual income of non-members. This effect is robust to alternative estimation methods (PSM), alternative outcome measures (per capita income), and sensitivity to unobserved confounding (Rosenbaum bound $\Gamma = 2.5$).

The determinants of WSCC membership include distance to WSCC office (marginal effect − 7.2 percentage points per km), awareness of services (+ 47.1 percentage points), participation in female support groups (+ 43.7 percentage points), childcare access (+ 31.4 percentage points), marital status (-16.2 percentage points for married women), and education (+ 8.9 percentage points per year). These findings highlight the importance of addressing practical barriers, building awareness, leveraging social networks, and recognizing the constraining role of marital status.

For members, income is driven by education, social networks, and training, while for non-members, only education and land are significant determinants. This suggests that WSCC membership creates an enabling environment where women can effectively leverage human capital (education, training) and social capital (networks) to generate income. The absence of training effects for non-members underscores the critical role of capacity building in enhancing the effectiveness of credit.

Qualitative findings reveal three mechanisms of impact: diversification of income-generating activities, full control over loan funds and earnings, and social support and training benefits. Persistent challenges include vulnerability to economic shocks and social stigma, particularly for married female heads. These findings provide a comprehensive picture of how WSCCs affect FHH livelihoods and the barriers that constrain full realization of benefits.

6.2 Contributions

This study makes three key contributions to the literature on financial inclusion, cooperative development, and women's empowerment.

First, it provides the *first rigorous causal estimate* of WSCC income effects for FHHs in Ethiopia. While previous studies have examined cooperative impacts more broadly or have focused on women in mixed samples, this study isolates FHHs and provides credible causal evidence using ESR with appropriate diagnostic tests. The large effect size (36.8%) underscores the transformative potential of WSCCs for this vulnerable population.

Second, it identifies *novel determinants of membership*, particularly childcare access and marital status. The finding that childcare access increases membership probability by 31 percentage points provides

the first quantitative evidence of this barrier in the WSCC context. The finding that married female heads are 16 percentage points less likely to join extends previous research on spousal opposition to the specific context of FHHs, revealing that household headship alone does not guarantee agency.

Third, it demonstrates the *value of mixed-methods approaches* in understanding the mechanisms and challenges of cooperative participation. The qualitative findings on mechanisms (diversification, full control, social support) and challenges (economic shocks, social stigma) provide depth and context to the quantitative results, offering practical guidance for program design and policy implementation.

6.3 Implications for Theory

Our findings extend the Sustainable Livelihoods Framework by demonstrating that WSCCs build financial, social, and human capital simultaneously. The framework emphasizes the importance of multiple asset types, and our results show that WSCCs create an enabling environment where women can leverage education, training, and networks together to generate income. The finding that social networks and training are significant only for members suggests that these assets are complementary to access to financial capital; without credit, social networks and training may not translate into income gains.

Our findings also extend Gender and Empowerment Theory [17, 18] by showing that control over resources (facilitated by FHH status) is a critical pathway to income gains. The contrast between FHHs (who benefit more) and married women who face spousal interference highlights the importance of agency—not just access to resources—in translating credit into income gains. This suggests that interventions should not only provide credit but also address the power dynamics within households that shape women's ability to exercise agency.

6.4 Recommendations for Future Research

Based on the findings and limitations of this study, several directions for future research emerge.

First, *longitudinal studies* are needed to establish temporal precedence and track income changes before and after WSCC membership. Panel data would allow researchers to estimate fixed effects models that control for time-invariant unobserved heterogeneity, strengthening causal claims.

Second, *larger sample studies* across multiple zones and regions of Ethiopia are needed to assess the generalizability of the findings. The specific agro-ecological, cultural, and institutional characteristics of East Hararghe may limit the external validity of the results. Replication in other regions with different contexts would strengthen the evidence base.

Third, *randomized controlled trials* (RCTs) could provide the strongest evidence of causal effects by randomly assigning communities or households to WSCC interventions. While RCTs are resource-intensive, they would address concerns about selection bias and reverse causality more definitively than observational methods.

Fourth, *studies on heterogeneity* by length of membership, type of WSCC (e.g., those offering different training packages), and characteristics of FHHs (e.g., widowed vs. divorced vs. married with absent spouse) would provide more nuanced insights for program design.

Fifth, *studies on spillover effects* are needed to understand whether WSCCs benefit non-members in the same communities through information sharing, market price effects, or social norm changes. If spillover effects are present, the total impact of WSCCs on community welfare may be larger than our ATT suggests.

Sixth, *cost-effectiveness analyses* would help policymakers understand whether the income gains from WSCCs justify the investment in cooperative formation and support. Comparing the costs of WSCC programs with the income gains generated would provide evidence for resource allocation decisions.

Seventh, *studies on long-term impacts* are needed to understand whether the income gains are sustained over time and whether WSCC membership leads to intergenerational benefits (e.g., improved education for children, asset accumulation, and resilience to shocks).

Declarations

Ethical Approval and Consent to Participate This study was reviewed and approved by the Institutional Research Ethics Review Committee of Haramaya University, Ethiopia. Formal administrative permission to conduct the household survey across the target districts was granted by the local zonal and district administrative offices. Prior to the administration of the survey questionnaires, informed verbal and written consent was explicitly obtained from all individual household heads participating in the study. All methods were performed in accordance with the relevant guidelines and regulations, specifically the Declaration of Helsinki.

Clinical trial number: not applicable.

Consent for Publication Not applicable. This manuscript does not contain any individual person's data, images, or videos.

Availability of Data and Materials The datasets generated and analyzed during the current study are not publicly available due to participant privacy and institutional data sharing agreements but are available from the corresponding author on reasonable request.

Competing Interests The authors declare that they have no competing interests (financial or non-financial) that could have influenced the work reported in this paper.

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Authors' Contributions Ibrahim Aliyi: conceptualized the study, designed the methodology, conducted the data collection, performed the econometric analysis using the Endogenous Switching Regression model, and drafted the manuscript. Jema Haji, Feresenbet Zeleke, and Kedir Jemal: supervised the research framework, reviewed the statistical results, and critically revised the manuscript for intellectual content. All authors read and approved the final manuscript.

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Figures

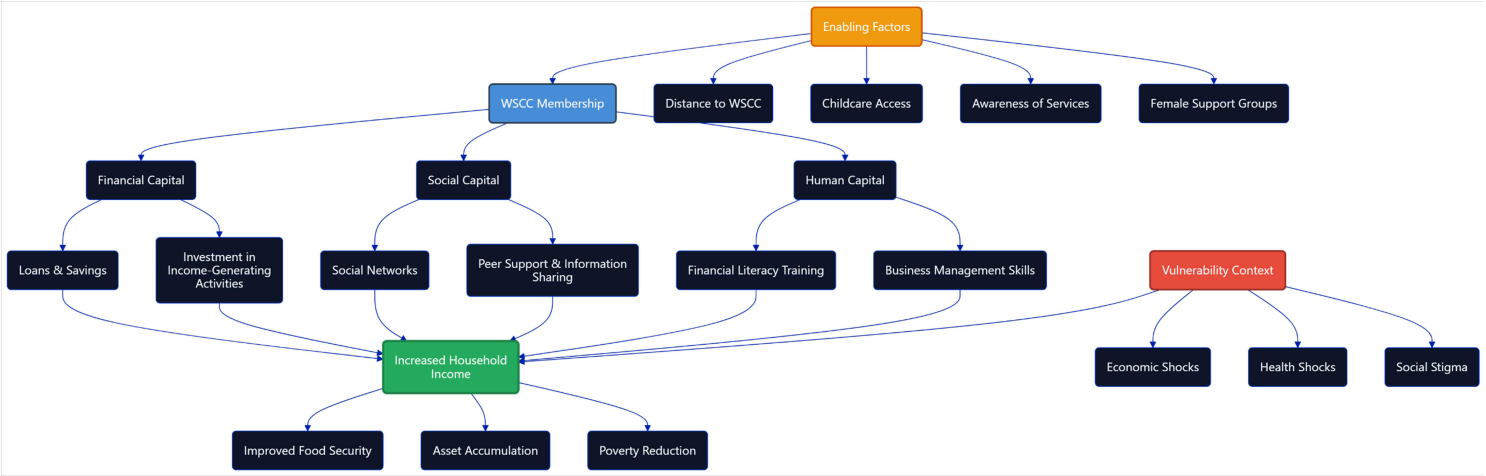


Figure 1

conceptual framework linking WSCC membership to household income among female-headed household in rural Ethiopia

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