

Friends and Benefits? Endogenous Rotating Savings and Credit Associations and Women's Empowerment in India

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Introduction

- Debate on the performance of micro-credit programs on women's agency, access and achievements
- History of **agency-led micro-credit** has been disappointing
- Commercially driven micro-credit schemes– exploitative and profit driven
- Faults in the agency led systems cannot sidestep the significance of micro-credit for women
- Exogenous agency and state based micro-credit structures understate the micro evidence of successful informal credit associations
- Pertinent need to explore endogenous savings and credit systems formed within a community

Exogenous Micro-credit

- Issues with exogenous agency based micro-credit
 - ① Complex in structure
 - ② Impulsive in credit delivery
 - ③ Driven by profit motives
 - ④ Lack dynamism to continuously include women into a network of sustainable finance
- Example: Grameen loan: lacks the essence of individual self-selection, does not harness the trust and credit worthiness of other members
- Loans unprofitable, unaffordable, and prone to corruption
- Recent efforts: micro-credit through SHGs and NGOs turning quickly into for-profit organizations (Ngo and Wahhaj, 2012)
- External monitoring required—transaction costs are high

Endogenous Micro-credit

- Micro-credit systems could be endogenous: self-sustaining, bottom-up and localized
- Empirical evidence suggests wide use of Rotating Savings and Credit Associations (ROSCAs)
- Simply put, ROSCAs are collectives, where each member gets the sum of the periodic contribution of all members at least once in the lifetime of the association ▶ SAM
- Examination of the impact of ROSCAs has remained elusive due to the lack of a nationally representative study
- Most studies have been either theoretical, qualitative in nature or geographically limited

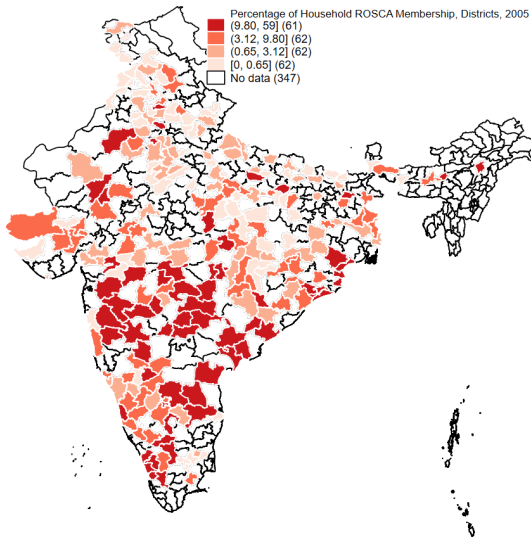
Objectives

- Build a theoretical model that could be used to compare the effect of household savings on women's bargaining power
- Test the model predictions using the India Human Development Survey, 2005-2012
- Empirically examine the effects of ROSCAs on Women's empowerment
 - ① Economic freedom
 - ② Economic decision making
 - ③ Mobility
 - ④ Household decision making
 - ⑤ Reproductive and social agency
- Compare ROSCAs:
 - ① Self help groups
 - ② Non-governmental organizations
 - ③ Loans form government programs
 - ④ Loans from micro-credit agencies

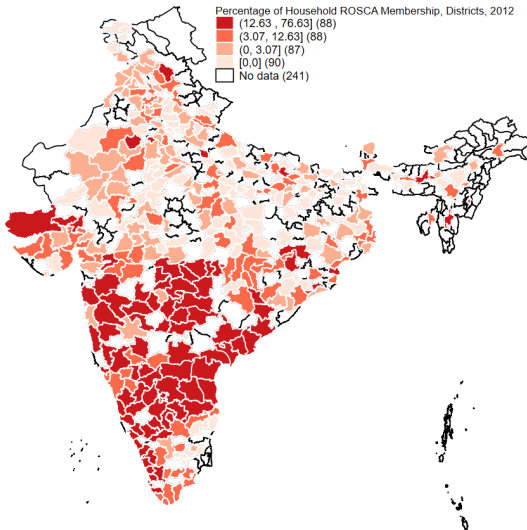
ROSCAs in India

- Registered since the Travancore Chitties Act of 1918
- Small number of people, mostly women, originally confined to villages—periodic contributions made both in cash and kind
- South Indian women have higher participation— states of Andhra Pradesh, Tamil Nadu and Kerala
- Women's participation in ROSCAs dominates household participation rates
- Gender, language, caste and religion are the main determinants of participation

ROSCA membership 2005



ROSCA membership 2012



Theoretical Model

- Nash bargaining model—maximize a two period time separable utility function of a household comprised of a husband and wife
- Household has two options to save for the good D , either in autarky by themselves or through ROSCAs
- Model relaxes restrictive assumptions on relative preference for the good being higher for the wife
- Incorporates returns from bidding ROSCAs and models the rate of default
- Based on previous studies, we assume that the socio-economic effects of ROSCA membership are disproportionately experienced by women
- If the household saves S^R in ROSCAs in the first period, then it acquires the good D in the second period.
- The household acquires a return on savings τS for being willing to wait to get the good in the second period, which for expositional purposes is realized by the wife only

- The good to be acquired through savings, D is a choice variable for which the preference for the wife is given by δ and the preference of the husband is given by $(1 - \delta)$
- Possibility of default is $(1 - P)$ in period 2
- In the first period, the household expresses demand for household good D
- Household could either save S by itself (autarky) for the two periods, or save in a two member ROSCA S^R
- Combined income of husband and wife is fixed in both periods with $Y = Y^h + Y^w$
- Utility functions that exhibit Constant Relative Risk Aversion (CRRA) over the household's primary consumption C_1 and C_2 , with θ as the relative risk aversion parameter

Two period Savings in ROSCA and Autarky

- Household joint utility function is then derived from the co-operative Nash bargaining model, stated as

$$U_{HH} = (U_H)^{(1-\gamma)}(U_W)^\gamma \quad (1)$$

- γ is the relative bargaining power of the wife and $(1 - \gamma)$ is the relative bargaining power of the husband
- Constraints: (i) $S^R \geq 0$ (ii) $Y \geq C_1 + S^R$, (iii) $Y + S^R \geq C_2 + D$
- If ROSCA membership, then, max. problem is

$$\text{Log}(U_{HH}) = (1-\gamma)[(U(Y-S^R)) + (U(Y+S^R-D) + (1-\delta)PD - (1-P)(1-\delta)D)]$$

$$+ \gamma[(U(Y - S^R)) + \tau S + (U(Y + S^R - D) + \delta PD + \delta(1 - P)D)]$$

subject to

$$S^R \geq 0$$

$$Y \geq C_1 + S^R$$

$$Y + S^R \geq C_2 + D$$

(2)

Two period Savings in ROSCA and Autarky

- By the first order optimality condition given the choice variable of savings in ROSCAs, we have

$$\partial \text{Log}(U_{HH}) / \partial S^R = 0 \quad (3)$$

$$\partial \text{Log}(U_{HH}) / \partial S^R = U'(C_1) = U'(C_2) + \gamma\tau \quad (4)$$

$$U'(C_1) = (C_1)^{-\theta} = (Y - S^R)^{-\theta} \quad (5)$$

$$U'(C_2) = (C_2)^{-\theta} = (Y + S^R - D)^{-\theta} + \gamma\tau = (Y - S^R)^{-\theta} \quad (6)$$

- The savings necessary to buy the household good in case of an autarky is given by $S = D/2$

Two period Savings in ROSCA and Autarky

- First derivative of the log utility function with respect to the second choice variable D , that is $\partial \text{Log}(U_{HH})/\partial D = 0$, if $P=1$ yields:

$$S^{R^*} = Y - \frac{1}{[(2\gamma\delta + 1 - \delta - \gamma + \gamma\tau)]^{1/\theta}} \quad (7)$$

- If the households had been saving by themselves (autarky):

$$S^* = Y - \frac{1}{[2\delta\gamma + (1 - \gamma) - \delta]^{1/\theta}} \quad (8)$$

- Proposition 1: Household would have to save less compared to autarky to acquire the good, effectively increasing women's consumption in first period compared to autarky. $S^{R^*} < S^*$. Households would want to save more in ROSCAs as compared to autarky.

Model Calibrations

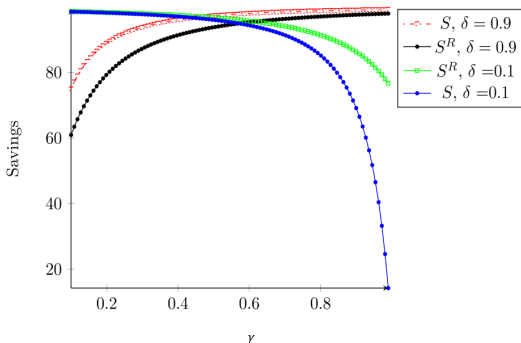


Figure 3: Equilibrium effective savings in ROSCAs and autarky, $P = 1$ (no default), $\theta = 0.5$ (relative risk preference) and $\tau = 0.2$ (rate of return on savings). Note savings has been normalized on a scale of 0 to 100. $\gamma \in (0,1)$. With very low preference for the good $\delta = 0.1$, savings for the good D does not increase women's bargaining power, however, the rate of reduction in bargaining power is lower in ROSCAs compared to autarky.

Model Predictions

- The first and second derivations of savings in ROSCA when $P = 1$ in comparison to autarky

$$\partial\gamma/\partial S = \frac{\theta(Y - S)^{-\theta-1}}{(2\delta - 1)} \quad (9)$$

$$\partial^2\gamma/\partial S^2 = \frac{(1 + \theta)\theta(Y - S)^{-\theta-2}}{(2\delta - 1)} \quad (10)$$

$$\partial\gamma/\partial S^R = \frac{\theta(Y - S)^{-\theta-1}}{(2\delta + \tau - 1)} \quad (11)$$

$$\partial^2\gamma/\partial S^{R^2} = \frac{(1 + \theta)\theta(Y - S)^{-\theta-2}}{(2\delta + \tau - 1)} \quad (12)$$

- Equations (11) and (12) show that the savings in ROSCAs yields a higher increase in women's bargaining power compared to savings in autarky
- Proposition 2: Given no default, the relationship between saving in ROSCAs and the women's bargaining power is positive

Model Calibrations

- Proposition 3: ROSCAs improve women's bargaining power even in the absence of strong preferences

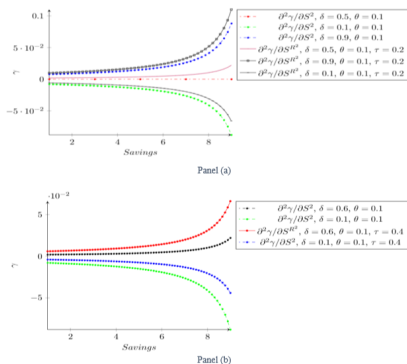


Figure A2: In this figure, we plot the equation, $\frac{\partial^2 \gamma}{\partial s^2} = \frac{(1+\theta)(\gamma-s)^{-\theta-2}}{2\delta-1}$ for autarky and equation, $\frac{\partial^2 \gamma}{\partial s^2} = \frac{(1+\theta)(\gamma-s)^{-\theta-2}}{2\theta+1}$ for ROSCAs under different conditions of the parameters. The figure shows that at similar levels of preferences. In panel (a), we see that at $\delta = 0.5$, savings under autarky does not have any effect on wife's bargaining power, but at the same level of preference, ROSCAs have a positive effect on wife's bargaining power. When we increase the value of τ , from 0.2 to 0.4, the gap between the effects of savings in autarky and ROSCAs on wife's bargaining power increases. Both panel (a) and panel (b) combined shows that at any level of preference, δ , for the good D , ROSCAs yield a higher bargaining power for women as compared to savings in autarky.

Exogenous Micro-Credit

- We assume a repayment rate τ for the loan from the micro-credit agency to be paid in the second period at the rate τD
- The household is farsighted and saves S in the first period

$$\begin{aligned} \text{Log}(U_{HH}) = & (1 - \gamma)[(U(Y + D - S) + (1 - \delta)D) + U(Y + S - D(1 + \tau))] \\ & + \gamma[(U(Y + D - S) + \delta D) + U(Y + S - D(1 + \tau))] \end{aligned} \quad (13)$$

$$(Y + D - S)^{-\theta} = (Y + S - (1 + \tau)D)^{-\theta} \quad (14)$$

$$\partial S / \partial \gamma = \frac{1}{\theta} \left(\frac{1}{\tau} [2\delta\gamma + 1 - \gamma - \delta] \right)^{-(1+\theta)/\theta} \left(\frac{1}{\tau} (2\delta - 1) \right) \quad (15)$$

$$\partial \gamma / \partial S = \frac{\theta(Y + D - S)\tau^{-(\theta+1)}}{(2\delta - 1)} \quad (16)$$

$$\partial^2 \gamma / \partial S^2 = \frac{(1 + \theta)\theta(Y + D - S)\tau^{-(\theta+2)}}{(2\delta - 1)} \quad (17)$$

Model Predictions

- Marginal effect of the women's bargaining power on the decision to take the micro-credit is positive as long as her preferences for the good to be acquired from micro-credit is stronger than the husband as shown by equation (15)
- If the preference for the good is higher for the husband, that is if $\delta < 0.5$, then an increase in savings with the agency based micro-credit reduces wife's bargaining power

Model Predictions

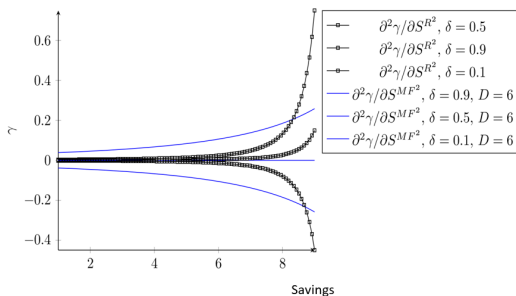


Figure 5: Comparative Static Effect of Bargaining Power in Savings, $P = 1$, $\theta = 0.5$ and $\tau = 0.2$ $D = 6$. Note at $\delta = 0.5$, micro-finance-based scheme has no effect on woman's bargaining power, but savings in ROSCAs has a positive effect on the bargaining power of the women.

Panel Model with IV

- Panel fixed effects model with IV

$$Y_{it} = \alpha + \delta Rosca_{it} + X'_{it}\beta + \theta_i + \pi_t + \epsilon_{it} \quad (18)$$

$$Rosca_{it} = \alpha + \lambda I_{jt} + X'_{it}\beta + \theta_i + \pi_t + \epsilon_{it} \quad (19)$$

- Controls: Household income, household head's education, age of the respondent, household size

Cross Sectional Model with IV

The baseline estimate is as follows:

$$Y_i = \alpha_i + \delta Rosca_i + X' \beta + \gamma d_i + \theta c_i + \epsilon_i \quad (20)$$

IV: District level ROSCA membership

$$Rosca_{ij} = \alpha_{ij} + \lambda I_j + X' \beta + \gamma d_i + \theta c_i + \epsilon_{ij} \quad (21)$$

- Y_{ij} represents the outcome of interest, five indices and categorical variables of empowerment for women ▶ PCA
- X is a vector of controls: household income, household head education, sex, age, adult women's education, and household size.
- Why IV: decision to participate or be accepted in a ROSCA is based on both observed (income, age, employment, ethnicity and popularity of ROSCAs) and unobserved characteristics at the village/PSU level

Economic Freedom

- ROSCA membership increases women's
 - ① Likelihood of cash in hand for expenditure by 1.7 pp.
 - ② Joint property ownership by 3.3 pp
 - ③ Bank account ownership by 7.8 pp
 - ④ Any employment (>240 hours a year) by 1.4 pp
 - ⑤ Employment in business activity by 1.4 pp
- ▶ Economic Freedom

Economic Decision

- ROSCA membership increases women's
 - ① Say in major purchases by 3.9 pp
 - ② Most say in major purchases by 1 pp
 - ③ Likelihood of grocery shopping for the household by 2.7 pp
 - ④ Husband discussing expenditure by 1.1 pp
 - ⑤ Husband discussing work by 3.8 pp
- ▶ Economic Decision

Agency and collective goods

- ROSCA membership increases
 - ① Contraceptive usage by 4.9 pp
 - ② Membership in Mahila Mandal by 17.9 pp
 - ③ Likelihood of having indoor piped drinking water by 1.6 pp
 - ④ Likelihood of having a pit or flush toilet by 1.9 pp
 - ⑤ Likelihood of having a separate kitchen by 3.7 pp
 - ⑥ Increases electricity hours by 0.60 hours in a day
- Agency

Mobility

- ROSCA membership
 - ① Reduces the likelihood of asking permission to visit health center by 3.2 pp and increases the likelihood of visiting health center alone by 3.9 pp
 - ② Reduces the likelihood of asking for permission to visit a friends house by 6.7 pp and increases the likelihood of visiting friends alone by 7.9 pp
 - ③ Reduces the likelihood of asking permission for grocery shopping by 6.1 pp and increases the likelihood of grocery shopping alone by 1.8 pp
- ▶ Mobility

Household Decisions

- ROSCA membership increases women's
 - ① Ability to make child wedding decision by 5.2 pp
 - ② Most say in child wedding decision by 0.6 pp (not significant)
 - ③ Ability to make decision when the child is ill by 1.9 pp
 - ④ Most say in child wedding decision by 0.6 pp
 - ⑤ Ability to make decision about the number of children by 4.7 pp
 - ⑥ Most say in the number of children by 1.8 pp
- ▶ Household Decision

Endogenous Exogenous Comparison

Table: 6. Endogenous-exogenous micro-credit and women's economic empowerment, India, IHDS, 2005-2012

Variables	(1) Cash for expenditure	(2) Say in Purchase Decision	(3) Property Ownership	(4) Work Business
HH. ROSCA member	0.016** (0.007)	0.039*** (0.009)	0.033*** (0.009)	0.014*** (0.005)
Loan from money lender	-0.012* (0.007)	-0.022** (0.009)	-0.010 (0.007)	0.003 (0.004)
Loan from bank	0.006 (0.006)	-0.010 (0.008)	0.026*** (0.007)	0.012*** (0.004)
Loan from ROSCA	0.053*** (0.019)	0.012** (0.040)	0.018* (0.020)	0.010** (0.011)
Loan from govt. program	0.015 (0.031)	-0.036 (0.022)	-0.037 (0.037)	0.025 (0.016)
HH. NGO member	0.013 (0.017)	-0.004 (0.022)	0.008 (0.020)	-0.003 (0.012)
HH. SHG member	0.006 (0.006)	0.037*** (0.008)	0.004 (0.008)	0.004 (0.004)
HH and individual controls	Y	Y	Y	Y
Observations	49,927	49,856	48,088	49,969
Number of individuals	25,374	25,374	25,299	25,373

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Endogenous-Exogenous Comparison

Table: 7. Panel fixed effects instrumental variable regression- ROSCAs and economic freedom for women, India, IHDS, 2005-2012

	(1)	(2)	(3)	(4)	(5)
Variables	Cash for expenditure	Name house papers	Bank account	Any employment	Business employment
HH. ROSCA member	0.022** (0.014)	0.041*** (0.017)	0.082** (0.035)	0.020* (0.016)	0.021** (0.016)
Log real HH. income	0.005* (0.003)	0.006* (0.003)	0.015** (0.007)	0.012*** (0.003)	0.012*** (0.003)
Wave dummy	0.089*** (0.007)	0.024*** (0.009)	0.137*** (0.022)	0.101*** (0.008)	0.101*** (0.008)
HH. and individual controls	Y	Y	Y	Y	Y
F test (instrument)	2115	2088	1294	2136	2167
Observations	49,927	48,088	26,904	49,801	49,779
Number of individuals	25,374	25,299	19,473	25,373	25,373

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Conclusion

- Analysis shows the relevance and prevalence of ROSCAs in India
- ROSCAs to be better than other micro credit schemes
- Endogenous system provides economic returns, knowledge of finances, disciplining mechanisms, and the social awareness
- Multi-functional organizations where friends, peer, and community members benefit from being in an association
- Policy
 - ① Support longstanding ROSCAs–insurance
 - ② Promote ROSCA Start-ups

Economic Freedom

Table: 1. Panel fixed effects- ROSCAs and Economic Freedom for Women, India, IHDS, 2005-2012

Variables	(1) Cash for expenditure	(2) Name on house papers	(3) Woman bank account	(4) Woman any employment	(5) Woman Business employment
HH. ROSCA member	0.017** (0.007)	0.033*** (0.009)	0.078*** (0.018)	0.014* (0.008)	0.014*** (0.005)
Log real HH. income	0.005* (0.003)	0.006* (0.004)	0.016** (0.007)	0.012*** (0.003)	0.013*** (0.002)
Wave dummy (2005=0, 2012=1)	0.091*** (0.007)	0.025*** (0.009)	0.133*** (0.022)	0.099*** (0.008)	0.013*** (0.005)
HH. head education (0-15)	-0.000 (0.001)	0.001 (0.001)	-0.009*** (0.003)	-0.005*** (0.001)	-0.001** (0.001)
Women's education (0-15)	0.001* (0.001)	0.000 (0.001)	0.012* (0.002)	0.001 (0.001)	0.000 (0.001)
Women's age in years	0.003*** (0.001)	0.001 (0.001)	0.004 (0.003)	-0.002** (0.001)	0.001 (0.001)
Household Size	-0.011*** (0.001)	-0.002 (0.001)	-0.012*** (0.003)	-0.000 (0.002)	-0.002** (0.001)
Poor (0/1)	-0.022*** (0.006)	0.007 (0.006)	0.007 (0.022)	-0.011 (0.007)	0.001 (0.004)
Marital Status (Base: Spouse absent)					
Married	-0.033** (0.013)	-0.007 (0.016)	-0.054* (0.032)	0.003 (0.016)	0.001 (0.008)
Widowed	-0.029 (0.018)	0.162*** (0.025)	0.090* (0.047)	0.038* (0.023)	-0.008 (0.011)
Separated	-0.016 (0.036)	0.036 (0.053)	0.033 (0.093)	0.136*** (0.042)	0.044 (0.030)
Observations	49,692	47,865	15,037	49,801	49,779
Number of Individuals	25,372	25,290	7,606	25,373	25,373

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Economic Decisions

Table: 2. Panel fixed effects- ROSCAs and economic decision making for women, India, IHDS, 2005-201

	(1)	(2)	(3)	(4)	(5)
Variables	Say in Major purchase	Most say in major purchase	Grocery shopping for family	Husband discusses Expenditures	Work
HH. ROSCA member	0.039*** (0.009)	0.010* (0.007)	0.027*** (0.009)	0.011 (0.007)	0.038*** (0.008)
Log real HH. income	-0.011*** (0.004)	-0.013*** (0.003)	-0.003 (0.004)	-0.001 (0.003)	-0.006* (0.003)
Wave dummy	0.099*** (0.010)	0.007 (0.007)	0.073*** (0.010)	0.037*** (0.007)	0.020** (0.009)
HH and individual controls	Y	Y	Y	Y	Y
Observations	49,856	49,636	49,869	48,533	48,483
Number of individuals	25,374	25,371	25,373	25,153	25,149

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Agency

Table: 3. Panel fixed effects- ROSCAs, agency and collective goods in households, India, IHDS, 2005-2012

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Contraceptive Use	Membership Mahila Mandal	Indoor Pipe Water	Toilet	Separate Kitchen	Electricity Hours
HH. ROSCA member	0.049*** (0.010)	0.179*** (0.009)	0.016** (0.008)	0.019** (0.008)	0.037*** (0.009)	0.606*** (0.132)
Log real HH. income	0.011*** (0.004)	-0.001 (0.002)	0.012*** (0.003)	0.011*** (0.003)	0.018*** (0.004)	-0.069 (0.054)
Wave dummy	0.221*** (0.010)	0.019*** (0.006)	0.024*** (0.008)	0.125*** (0.007)	0.001 (0.010)	-1.363*** (0.147)
HH. and individual controls	Y	Y	Y	Y	Y	Y
Observations	45,538	50,020	50,023	49,890	49,978	41,157
Number of individuals	24,953	25,374	25,374	25,374	25,373	22,927

Robust standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Mobility

Table: 4. Panel fixed effects- ROSCAs and women's mobility, India, IHDS, 2005-2012

	(1)	(2)	(3)	(4)	(5)	(6)
	Health Center		Friend's house		Grocery Shopping	
Variables	Ask Permission	Visit Alone	Ask Permission	Visit Alone	Ask Permission	Visit Alone
HH. ROSCA member	-0.032*** (0.010)	0.039*** (0.009)	-0.067*** (0.010)	0.079*** (0.010)	-0.061*** (0.013)	0.018* (0.010)
Log real HH. income	-0.020*** (0.004)	0.010** (0.004)	-0.006 (0.004)	0.006 (0.004)	-0.009* (0.005)	0.010** (0.004)
Wave dummy	0.069*** (0.010)	0.050*** (0.010)	-0.032*** (0.010)	0.091*** (0.010)	0.067*** (0.013)	0.054*** (0.010)
HH. and individual controls	Y	Y	Y	Y	Y	Y
Observations	49,817	48,821	49,536	48,329	42,020	44,664
Number of individuals	25,367	25,329	25,361	25,314	24,151	24,996

Robust standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Household Decisions

Table: 5. Panel fixed effects- ROSCAs and women's household decision making, India, IHDS, 2005-2012

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Child Wedding Decision	Child Wedding Most Say	Child Ill Decision	Child Ill Most Say	Number of Children Decision	Number of Children Most Say
HH. ROSCA member	0.052*** (0.008)	0.006 (0.007)	0.019*** (0.007)	0.006** (0.010)	0.047*** (0.008)	0.018** (0.009)
Log real HH. income	-0.003 (0.003)	-0.007*** (0.003)	-0.003 (0.003)	-0.011*** (0.004)	-0.010*** (0.003)	-0.022*** (0.004)
Wave dummy	0.078*** (0.008)	0.047*** (0.007)	0.036*** (0.007)	-0.007 (0.011)	0.102*** (0.008)	0.064*** (0.010)
HH and Individual controls	Y	Y	Y	Y	Y	Y
Observations	47,932	48,279	48,428	48,633	48,898	48,211
Number of individuals	25,231	25,184	25,256	25,199	25,352	25,282

Robust standard errors in parentheses

* * * $p < 0.01$, * * $p < 0.05$, * $p < 0.1$

First Stage

Table 6. First Stage Regression Results of the 2SLS Model: Dependent Variable Women's Membership in ROSCAs, IV- Mean Village/PSU ROSCA Membership

	(1)	(2)	(3)	(4)	(5)
Variables	Women's Membership in ROSCAs (Economic Freedom)	Women's Membership in ROSCAs (Mobility)	Women's Membership in ROSCAs (Agency)	Women's Membership in ROSCAs (Economic Decision)	Women's Membership in ROSCAs (Household Decision)
Mean Village/PSU ROSCA Membership	0.66*** (0.08)	0.63*** (0.02)	0.64*** (0.02)	0.66*** (0.02)	0.67*** (0.01)
HH and Individual Control	Y	Y	Y	Y	Y
p-value significance					
Kleibergen-Paap rk LM statistic (Underidentification)	***	***	***	***	***
F statistic Cragg-Donald Wald (Weak identification test)	2981.16	3011.69	1789.11	2673.76	2997.88
p-value significance					
Anderson-Rubin Wald test (Weak instrument robust)	***	***	***	***	***
p-value significance					
Hansen J Statistic	***	***	***	***	***
Observations	32757	31967	20898	31223	32118
Caste	5	5	5	5	5
District	370	370	370	370	370

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Panel Fixed Effects

Table: 7. Effect of Household ROSCA Membership on Women's Economic, Reproductive and Social Decision Making

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Ownership of Property	Cash in Hand	Decision Number of Children	Decision Child Marriage	Decision Child Ill
Household ROSCA Membership	0.08*** (0.02)	0.04** (0.02)	0.14*** (0.02)	0.14*** (0.02)	0.07*** (0.02)
Wave dummy	Y	Y	Y	Y	Y
Household controls	Y	Y	Y	Y	Y
Sanderson-Windmeijer Multivariate F test for Excluded Instrument	3,586	3,749	3,663	3,564	3,730
Observations	30,058	31,162	30,082	30,388	31,140
Number of Households	15,029	15,581	15,041	15,194	15,570

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

▶ Panel FE-IV

Endogenous-Exogenous

Table: 8. Comparison of Exogenous and Endogenous Schemes of micro-credit- OLS with district and caste fixed effects

	(1)	(2)	(4)	(5)	(6)
VARIABLES	Economic Freedom	Economic Decision	Household Decision	Agency	Mobility
ROSCA Membership	0.23*** (0.02)	0.20*** (0.03)	0.16*** (0.02)	0.67*** (0.03)	0.18*** (0.03)
NGO Membership	0.05 (0.04)	0.12* (0.07)	0.04 (0.05)	0.17*** (0.06)	0.14** (0.07)
Loan from Govt. Prog.	-0.03 (0.09)	0.06 (0.12)	-0.10** (0.08)	0.01 (0.07)	-0.08 (0.15)
Loan micro-credit	0.11*** (0.02)	0.02 (0.02)	0.04* (0.02)	0.17*** (0.02)	0.08*** (0.02)
SHG Membership	0.22*** (0.02)	0.12*** (0.02)	0.06*** (0.01)	0.53*** (0.02)	0.19*** (0.02)
Household Controls	Y	Y	Y	Y	Y
District	370	370	370	370	370
Caste	4	4	4	4	4
Observation	32758	27845	32136	20868	31946

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note: Loan from government program, the data is available for 143 households and they are 80% poor and middle class as per IHDS (2012)

Log Odds

Table 9. Logistic Regression Equation-Log odds Ratios: Variables from Empowerment indices with highest factor loads

VARIABLES	(1)	(2)	(4)	(5)	(6)
	Cash in hand	Decision Land Purchase	Decision Child Ill	Joint Bank Account	Mobility
ROSCA Membership	1.73*** (0.18)	1.43*** (0.12)	2.00*** (0.27)	1.80*** (0.11)	1.30*** (0.07)
NGO Membership	1.26 (0.25)	1.15 (0.11)	1.26 (0.32)	1.41*** (0.18)	1.38** (0.17)
Loan from Govt. Prog.	0.89 (0.31)	0.85 (0.12)	0.44*** (0.13)	1.09 (0.25)	0.84 (0.19)
Loan micro-credit	1.34*** (0.10)	1.07 (0.06)	1.11* (0.10)	1.41*** (0.07)	1.18*** (0.05)
SHG Membership	1.72*** (0.13)	1.25*** (0.07)	1.16* (0.10)	2.19*** (0.10)	1.38*** (0.06)
Household Controls	Y	Y	Y	Y	Y
District	370	370	370	370	370
Caste	4	4	4	4	4
Observation	30873	31711	25700	23814	33348

Robust standard errors in parentheses

** * $p < 0.01$, * * $p < 0.05$, * $p < 0.1$

Note: Observations are noted for regression with ROSCA membership as the independent variable. Control variables include: Log income of the household, women's education, women's age, number of children in the household, household head sex, household head age, urban, caste and districts.

Social Accounting Matrix of ROSCAs

Table: 10. Fixed Interest Bidding ROSCA (Interest Rate 1%)

Month	Draw	Bid	Pot	Interest	Player 1 Organizer		Player 2		Player 3		Player 4		Player 5	
					Receive	Pay	Receive	Pay	Receive	Pay	Receive	Pay	Receive	Pay
1	1	0	500	0%	500	100	0	100	0	100	0	100	0	100
2	2	5	495	1%	0	100	495	100	1.66667	100	1.66	100	1.66	100
3	3	5	495	1%	0	100	0	105	496.66	100	4.16	100	4.16	100
4	4	5	495	1%	0	100	0	105	0	105	499.16	100	9.16	100
5	5	0	500	0%	0	100	0	105	0	105	0	105	514.6	100

Author's elaboration of a typical bidding ROSCA with 1% fixed interest.

▶ Slide 4

Table: A1: Summary Statistics by Women's ROSCA Participation and Non-Participation, IHDS, 2012

Variables	ROSCA			No ROSCA			p-val
	Obs.	Mean	sd	Obs.	Mean	sd	
Real income (Base 2005) Rs/1000	2783	67.65	104.97	36696	77.25	125.03	***
Household Member in ROSCA	2567	1	0	32482	0.05	0.21	***
Household Head Education	2783	9.00	4.74	36696	8.75	4.91	
Household Head Sex	2782	1.13	0.34	36694	1.13	0.33	
Household Head Age	2782	47.89	11.54	36694	48.51	12.62	
Household Size	2783	4.97	2.21	36696	5.49	2.48	
Urban (0/1)	2783	0.32	0.47	36696	0.34	0.47	
Women's Age	2783	37.70	8.72	36696	36.23	9.93	
Number of Children Alive	2783	2.45	1.20	36682	2.56	1.58	
Women's Education (0-3)	2783	1.16	0.46	36504	1.19	0.52	***
Women's Questionnaire (0/1)							
Cash in hand for expenditure	2779	0.94	0.25	36646	0.91	0.29	
Ownership of property	2688	0.25	0.43	35303	0.16	0.37	***
Currently Employed	2774	0.55	0.50	36651	0.41	0.49	***
Can go to health center alone	2757	0.72	0.45	36293	0.71	0.46	
Can visit friends/relatives alone	2756	0.74	0.44	36182	0.77	0.42	
Can go to Kirana store alone	2675	0.85	0.36	34658	0.79	0.41	*
Can travel short distance alone	2757	0.51	0.50	36196	0.53	0.50	
Use contraceptives	2477	0.78	0.41	32591	0.74	0.44	*
Joint Bank account with husband	2177	0.70	0.46	25569	0.54	0.50	***
Member of Mahila Mandal	2782	0.29	0.45	36695	0.04	0.19	***
Decision on how many children to have	2668	0.95	0.21	35342	0.92	0.27	
Decision making ability on work	2539	0.48	0.50	30257	0.46	0.50	
Decision on major household purchases	2773	0.90	0.30	36438	0.76	0.42	***
Decision on buying land	2718	0.87	0.34	36118	0.74	0.44	***
Decision on Wedding Expenses	2772	0.92	0.28	36490	0.79	0.40	***
Decision on son/daughter marriage	2716	0.95	0.22	34517	0.88	0.33	**
Decision on food and vegetable consumption	2780	0.75	0.43	36650	0.57	0.49	***
Decision on what to do when child ill	2726	0.96	0.20	34719	0.90	0.30	*
Decision on what to do in sickness	2776	0.94	0.24	36621	0.85	0.36	**
Membership Mahila Mandal	2782	0.29	0.45	36695	0.04	0.19	***
Membership Self Help group	2782	0.52	0.50	36694	0.11	0.31	***
Women ROSCA Member	35086	0.07	0.26				
Women Member SHG	35088	0.14	0.34				
Women Member NGO	42088	0.01	0.11				
Loan Government Prog.	41252	0.003	0.05				
Loan micro-credit (group lending)	42114	0.09	0.29				
Loan NGO	42152	0.005	0.07				

p-value: Difference in mean tests between sub-samples

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table: A2. Descriptive Statistics- Principal Component Analysis (PCA) of empowerment variables, IHDS, 2012

Indices	Rank	Empowerment Variables (0/1)	Obs.	Mean	sd	Weight (PCA)	Interval
Economic Freedom	1	Cash in hand for household expenditure	39460	0.91	0.29	0.64	
	3	Name on home ownership papers	38023	0.17	0.37	0.53	
	2	Currently Employed	39461	0.42	0.49	0.57	(-2.58 1.95)
Mobility	1	Can visit health center alone	39079	0.71	0.45	0.52	
	2	Can visit friends/relatives alone	38966	0.77	0.42	0.52	
	3	Can go to grocery shop alone	37358	0.8	0.4	0.48	
	4	Can go short distance travel alone	38980	0.53	0.5	0.47	(-3.37 1.07)
Agency	4	Currently use contraceptives	35101	0.74	0.44	0.43	
	1	Name on bank account	27769	0.55	0.5	0.59	
	2	Member of Mahila Mandal	39481	0.06	0.23	0.52	
	3	Decide number of children to have	38042	0.92	0.27	0.44	(-3.09 2.91)
Economic Decisions	4	Most say in decisions about your work	32826	0.46	0.5	0.15	
	3	Decide purchasing expensive item	39243	0.77	0.42	0.56	
	1	Decides whether to buy land/property	38867	0.75	0.44	0.58	
	2	Decide wedding expense	39294	0.8	0.4	0.57	(-3.37 1.07)
Household Decisions	2	Decide to whom your children should marry	37261	0.88	0.32	0.56	
	4	Does food shopping	39465	0.58	0.49	0.22	
	1	Decides what to do if a child falls sick	37474	0.91	0.29	0.59	
	3	Decide what to do if you fall sick	39430	0.85	0.35	0.54	(-4.95 0.79)

Factor loads are the score of individual variables in the empowerment indices and all indices are standardized with mean zero and standard deviation one