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Keywords: ROSCA, Household Welfare, Community Bonding

JEL Classification: O12, C26, C33

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Abstract

We examine the effects of Rotating Savings and Credit Associations (ROSCAs) on household welfare in India. The identification strategy is based on household fixed effects and instrumental variables (using the geographic *leave-one-out* instrument). We find that ROSCA membership increases household assets, consumption, energy efficiency and school expenditure, but only in rural areas. Welfare effects are stronger for poorer households and for those living in communities with stronger social ties. We argue that the persistence and success of ROSCAs depends on social ties, which are often stronger in rural communities.

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1 Introduction

Rotating Savings and Credit Associations (ROSCAs) are one of the most common informal financial institutions around the world and provide an alternative solution to borrowing and lending. They remain popular despite the gradual expansion of formal financial markets that we are observing globally [Besley et al., 1993; Rutherford, 2014]. Common across the world, ROSCAs all work in the same way: a set of individuals, who typically live in the same community, form a group and gather for a series of meetings. At each meeting, each individual contributes a pre-determined amount into a collective *pot* which is then given to one member. The meeting process repeats itself until each member has received the pot. Past recipients are excluded from receiving the pot in future meetings, until everyone in the group has received the pot, while still being obliged to contribute. There can be substantial variation in the way groups determine the frequency of the meetings, the amount of the contribution, the number of members and the way the order of the winners is determined. However, the basic organizational structure is the same.

The literature has identified four major potential benefits of ROSCA membership. First, ROSCAs can provide individuals with lump-sum funds which enable purchases of indivisible goods [see Besley et al., 1993; Besley and Levenson, 1996; Levenson and Besley, 1996].[1] Second, present biased individuals can use ROSCAs and their regular meetings as a commitment device for saving [Anderson and Baland, 2002; Ambec and Treich, 2007; Gugerty, 2007]. Third, ROSCAs can generate welfare gains from mutual insurance when participants are subject to idiosyncratic shocks [Calomiris and Rajaraman, 1998; Klonner, 2008; Czura and Klonner, 2018]. Fourth, from a gendered perspective, ROSCAs can empower women through improvements in property ownership, employment, earnings, decision making ability and mobility [Ardener, 1964; Anderson and Baland, 2002; Sedai et al., 2021].

In this paper, we use nationally representative longitudinal data from India to examine whether and to what extent ROSCA participation affects the welfare of households. The main problem

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[1] Besley et al. [1993] show that in the absence of a credit market, ROSCAs allow most members to finance a fixed investment or purchase an indivisible good sooner than when saving in autarky.

with establishing causal effect estimates is the fact that households choose to become members of ROSCAs and ignoring this can lead to selection bias. For example, Households at the two extremes of the income distribution are less likely to participate in ROSCAs: those at the lower end of the income spectrum may be unable to afford to join; while those at the upper end may not need to join a ROSCA as they have access to alternative sources of credit.[2] Additionally, there is self-selection and sorting involved based on income, caste, household size, trustworthiness and knowledge of the neighborhood, among other factors [see, for example De Aghion and Morduch, 2004; De Aghion et al., 2007]. Finally, there are unobserved characteristics such as likelihood of default among members, productive potential of the members and the ability to perceive risk among others which could affect ROSCA membership, all of which are hard to account for using observational data.

We use household fixed effects to capture the selection bias emanating from time invariant unobserved heterogeneity since membership in ROSCAs is primarily dependent on largely time invariant factors such as location, caste and social capital. To account for any remaining time varying unobserved heterogeneity, we use a geographic leave-one-out instrument: average household ROSCA membership at the community level in the district, excluding the community of the household. Leave-one-out instruments have been used previously to understand selection in contexts as varying as federal spending in the US, corruption and the impact of electricity and piped water in developing countries [see, for example Levitt and Snyder Jr, 1997; Lamichhane and Mangyo, 2011; Bai et al., 2019; Dang and La, 2019; Sedai et al., 2020]. The use of an instrumental variable (IV) lends additional credence to the interpretation of our results as causal impacts.

Our results show that ROSCAs are highly effective in improving household welfare: we find a large and statistically significant increase in the number of assets owned by the household, real household consumption expenditure, use of clean fuel for cooking, household expenditure on schooling and a reduction in the relative expenditure on *bads* (e.g., tobacco). However, these positive effects are concentrated among rural households, with little evidence of ROSCAs improving household

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[2]Anderson and Baland [2002] show that there is, indeed, an inverted u-shaped relationship between household income and ROSCA membership.

welfare among urban households. In terms of mechanisms, we find that strong social ties within the community significantly amplifies the effectiveness of ROSCAs.

Early literature considered ROSCAs largely to be social associations fulfilling the needs of lumpy durables, savings and providing social support. ROSCAs can provide event insurance, by eliminating the need to pawn assets at "give-away" prices, potentially promoting financial stability among low-income households. For example, Calomiris and Rajaraman [1998] argue that the objective of ROSCAs is largely to acquire durable assets and/or event insurance in times of expected or unexpected financial need, such as a family marriage, annual school fees or death of a household member. ROSCAs can potentially increase household welfare through savings discipline and better consumption choices [Anderson and Baland, 2002]. More recently, researchers have examined how ROSCAs can provide assistance in generating incomes, consumption smoothing, credit provisioning and provision of insurance against covariate risks, like natural disasters [Anderson et al., 2009; Bauchet and Larsen, 2018; Czura and Klonner, 2018; Bonan et al., 2019; Baland et al., 2019].

Traditionally ROSCAs formed endogenously by a group of interested individuals – typically women. ROSCAs were developed well before 'agency based' microcredit came into being [Geertz, 1962]. In India, endogenously built community ROSCAs (known as *Kamethi*s) were registered as early as 1912, and are still prevalent in rural areas of the country [Ardener and Burman, 1995; Czura and Klonner, 2018]. Increasingly however, ROSCA's are also formed by banks, firms or government agents (these are exogenous or commercial ROSCAs) with the explicit aim of increasing bank linkages to the community [Bali Swain and Wallentin, 2017]. Czura and Klonner [2018] give the example of a single commercial ROSCA organizer where groups are formed by compiling interested individuals into lists, which are posted in each branch. Hence the members of a given group may or may not know one another outside of the ROSCA. This is different from the within community ROSCAs where all members are socially connected. While the endogenous ROSCAs are more popular in rural areas where formal financial penetration and investment motives are low, especially among women, the more formal and agency based ROSCAs appear to be more prevalent in the urban areas of India [Handa and Kirton, 1999; Anderson et al., 2009; Calomiris

and Rajaraman, 1998].

The rest of the paper is organized as follows. Section 2 discusses the India Human Development Survey panel data (2005–2012) and the descriptive statistics of the variables used in our empirical framework. Section 3 discusses the estimation framework. Section 4 discusses the empirical findings and, finally, Section 5 concludes.

2   Data

Our analysis uses data from two waves of the India Human Development Survey (IHDS) conducted in 2005 and 2012 (henceforth referred to as IHDS1 and IHDS2, respectively). This is a nationally representative, multi-topic survey of 41,554 households in 1,503 villages and 971 urban neighborhoods across India. IHDS1 collected representative data from 384 of the 593 districts in India. Around 83% of the households were re-interviewed in 2011–2012 for IHDS2. The re-interviewed sample includes both original households and split households located in the same village. IHDS2 included 2,134 additional households in urban areas and in some rural areas of the northeastern states of India to compensate for households that had moved permanently and could not be tracked. The final sample for IHDS2 is representative of 384 districts spanning over 1,400 villages and over 1,000 urban blocks.[3] The survey collected information on health, education, employment, economic status, marriage, fertility, gender relations, membership of groups and social capital.

A unique feature of the IHDS is that it the only available representative longitudinal dataset which has a variable related to household's membership in ROSCAs. Specifically, the respondents were asked if *their household is a member of a credit/savings group or chit fund.* Households that respond with a *yes* to this question are categorized as ROSCA member households. As shown in Table 1, ROSCA membership increased by 3.5 percentage points between the two survey waves: 7.2% of households in 2005 report being members of a ROSCA, compared to 10.7% in 2012, a

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[3]More details are available at https://www.icpsr.umich.edu/icpsrweb/content/DSDR/idhs-II-data-guide.html

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statistically significant increase. Figure A1 presents the extent of ROSCA membership by district for each survey wave. The proportion of households that are ROSCA members has increased substantially in the states of Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu. These trends are not unexpected as these states have historically had higher participation in ROSCAs [Ardener and Burman, 1995; Klonner, 2008]. In addition, the Reserve Bank of India impetus on the SHG bank Linkage program since 2005, which was based on the structure of ROSCAs [Bali Swain and Wallentin, 2017], was more likely to increase ROSCA membership in areas with historically higher participation and knowledge of ROSCAs.

The key outcome variables in our analysis are measures of household welfare: household assets, real annual household consumption, likelihood of owning a non-farm business, real annual consumption expenditure on food items, likelihood of using clean liquefied petroleum gas (LPG) as the primary source of cooking fuel, ratio of consumption of *bads* (intoxicants) over total consumption expenditure, and real annual total educational expenditures.[4] As shown in Table 1, asset ownership, real annual consumption, share of *bads* in total consumption expenditure, LPG use and annual schooling expenditures are significantly higher in 2012 compared to 2005. On the other hand, expenditure on food is slightly lower and the likelihood of owning a non-farm business remained unchanged.

Table 1 also presents descriptive statistics for additional variables used in our analysis. Comparing across survey waves, 30% of households in 2005 and 32% of households in 2012 were urban residents. There was also an increase in the average household head's education (7.4 to 8.1 years) and age (46 years to 50 years). Household size declined considerably from 5.8 to 4.8 members. While 33% of households had an official below poverty line (BPL) card in 2005, this increased to

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[4]Consumption expenditure is deflated using the standard IHDS deflator to adjust for the inflation between the survey waves, see IHDS deflator for details. Expenditure on food is computed by aggregating over the expenditures on the following items: rice, wheat, sugar, kerosene, cereals, pulses, meat, gur and sweeteners, oil, eggs, milk, milk products, cereal products, vegetables, salt and spices, tea, coffee, fruits, and processed foods. Consumption expenditures on *bads* is defined as the total amount spent on paan (beetle leaves and chewing tobacco) and other cigarette and tobacco products.

almost 35% in 2012. Average household and community income decreased between survey waves as has the proportion of the community that are categorized as being poor (from 22.7% in 2005 to 16.8% in 2012).[5]

The survey also collected data on variables that measure social networks of households and alternate access to credit outside of ROSCAs. Households reported increased connection with doctors/health workers, teachers/school workers and politicians/police and the military, but a reduction in connection with government administrators between survey waves. There was a large increase in membership in Self Help Groups (SHGs) from 10% in 2005 to 19% in 2012.[6] Likewise, the share of households reporting having a bank loan increased from 12% to 18%. In contrast, a smaller proportion of households reported being a member of a NGO.[7]

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[5]Communities are defined by the primary sampling unit of the survey and are generally at the block level in urban areas and villages in rural areas. Community income and poverty rates are simple averages of the sampled households in each community. In IHDS, household poverty is based on monthly consumption per-capita and the official Planning Commission poverty line as of 2005. Poor is a dichotomous (0/1) variable indicating whether the household is below this poverty line or not. The poverty line varies by state and urban/rural residence. It is based on 1970s calculations of income needed to support minimal calorie consumption and has been adjusted by price indices since then. See https://ihds.umd.edu/poverty for more details.

[6]A SHG is a community-based group typically with 12–25 members. Members are usually women from similar social and economic backgrounds, all voluntarily coming together to save small sums of money, on a regular basis. They pool their resources to become financially stable, taking loans from their collective savings in times of emergency or financial scarcity, important life events or to purchase assets. Most SHGs are linked with banks for the delivery of micro-credit and are often organized by banks and microfinance organizations [Bali Swain and Wallentin, 2017]. The Reserve Bank of India regulations mandate that banks offer financial services, including collateral free loans to these groups, on very low interest rates, thereby allowing poor women to circumvent the challenges of exclusion from institutional financial services. In some sense SHGs are a special kind of ROSCAs – the difference being that SHGs are typically linked to banks and microfinance institutions, while ROSCAs are not. Additionally the within group lending and borrowing rules are much better organized in ROSCAs.

[7]In our regressions, we control for NGO membership because in many communities, NGOs facilitate formation of ROSCAs.

Finally, to measure the effect of social ties, we leverage a unique community bonding variable from the IHDS survey. The variable is based on the following question in the IHDS: *In some communities, when there is a community level problem, people bond together to solve the problem. In other communities, people take care of their own families individually. What is your community like?*. We create a binary variable *Good Bonding Community*, which takes the value of 1 if the household reports that individuals *bond together to solve problems* and 0 otherwise (if household reports *each family solves individually*, i.e., weak community bonding). The share of households that report residing in a community with good bonding increased from 58% to 73% between survey waves. We would also note that a higher share of rural households reported good community bonding than urban households. Specifically, the share increased from 58% to 74% among rural households and from 55% to 71% among urban.

3 Estimation Framework

To investigate the impact of ROSCA membership on household welfare we estimate the following regression:

$$Y_{it} = \beta_0 + \beta_1 \text{ROSCA}_{it} + \gamma \mathbf{X}'_{it} + \eta_i + \delta_t + \epsilon_{it}. \tag{1}$$

Here Y_{it} represents the outcome of interest (e.g., household assets) for household i in survey year t. ROSCA_{it} indicates ROSCA membership. $\mathbf{X}'_{it}$ is a vector of time varying household and community level observable socioeconomic and demographic characteristics, which could potentially affect the outcome variables of interest. These include memberships in SHGs, NGOs, loan from banks, real income of the household, household head education and age, social networks, community income and average poverty, and household size. η_i and δ_t are household and time fixed effects. Finally ϵ_{it} is the error term (that are IID or come from a low-order moving-average process, with variance σ^2). Our primary interest is on the effect of ROSCA membership on measures of household welfare (β_1).

If ROSCAs were randomly occurring, then the estimated $\hat{\beta}_1$ from equation (1) would provide causal estimates of the impact of ROSCA membership on the relevant outcome variable of interest.

However, in practice, ROSCA membership is not randomly assigned. There is self-selection and sorting involved based on income, caste, household size, trustworthiness and knowledge of the neighborhood, among other observed and unobserved characteristics such as likelihood of default among members, productive potential of the members and the ability to perceive risk among others, which could affect ROSCA membership. All these are hard to account for using observational data. These issues lead to potential endogeneity, resulting in bias in the estimated effects.

Our regressions control for an extensive set of household and individual observable characteristics that could also be driving household outcomes and ROSCA membership. Important time-invariant characteristics such as caste, religion, and geography are also controlled for by the household fixed effect η_i, which also captures any time-invariant unobserved household characteristics. The time fixed effect γ_t further controls for aggregate time trends. Nevertheless, we cannot rule out any bias arising from time-variant unobserved heterogeneity. We therefore use an IV approach. We instrument for a household's decision to join a ROSCA with the average community-level membership in ROSCAs in the district, leaving out their own community. More specifically, the geographic *leave–one–out* instrument is constructed by calculating ROSCA membership at the community level, then averaging across all communities in the household's home district (excluding the household's own community).

The argument is that the popularity of ROSCAs in neighboring communities leads to higher membership in a household's home community, and consequently increases the probability of household membership. However, we argue the exogeneity condition for the instrument holds as low scale–low stakes ROSCAs in neighboring communities are unlikely to otherwise directly affect the welfare of the household. Furthermore, by excluding the household's own community from the instrument, we avoid capturing spillover effects of local ROSCAs on household outcome variables.[8]

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[8]Figure A2 shows variation in the instrument by region and waves. At the community level, ROSCAs were present in all regions. The highest participation and variation across time was observed in the Southern and Western regions, which are where the increase in ROSCA membership were the highest during the time period. These regions have been identified as the most ROSCA active regions (see Figure A1). Some increase in community

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The instrument also satisfies the monotonicity criterion of validity [Angrist et al., 1996], since higher neighboring communities ROSCA membership is likely to increase a household's likelihood of membership.

Lastly, in order to explore potential mechanisms for heterogeneous effects of ROSCAs on household welfare, we also estimate an extended version of equation (1) where we interact *Good Bonding Community* with ROSCA membership:

$$
\begin{aligned}
Y_{it} = {} & \alpha_0 + \alpha_1 \text{ROSCA}_{it} + \alpha_2 \text{Good Bonding Community} \\
& + \alpha_3 (\text{ROSCA}_{it} \times \text{Good Bonding Community}) \\
& + \gamma \mathbf{X}'_{it} + \eta_i + \delta_t + \varepsilon_{it}.
\end{aligned} \tag{2}
$$

This specification is used to test our hypothesis that social ties are an important pre-requisite for the endogenous formation and operation of welfare enhancing ROSCAs. $\hat{\alpha}_1$ gives us the estimated effect of ROSCA membership for households that reports weak community bonding, while $\hat{\alpha}_3$ is the additional effect of ROSCA membership on welfare for households that report good community bonding. So $\hat{\alpha}_1 + \hat{\alpha}_3$ is the total effect of ROSCA membership on welfare for households that report good community bonding.

4   Results

4.1   Effect of ROSCA Membership

We now turn to our key regression results. These are presented in Table 2. As discussed earlier we consider a range of outcome variables: household assets, annual household consumption expenditure, entrepreneurship and expenditure on food, use of LPG fuel, share of expenditure on *bads*

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level ROSCA membership was also visible in the North-Eastern states, where formal banking services are relatively sparse. Participation rates and the change in participation rate over the period 2005–2012 were lower in the North, East and Central regions of the country.

and annual school (educational) expenditure for children in the household. In all cases we present separate regressions for the rural and the urban samples. In all regressions, we also present the sharpened two stage q-values [Anderson, 2008] to reduce the likelihood of false rejections, given the large number of outcome variables.

Columns 1–3 in Table 2 present the OLS results for the full sample (column 1) and separately for the rural and urban samples (columns 2 and 3 respectively). Columns 4–6 present the corresponding IV regression results using the *leave–one–out* instrument. The first stage F-statistic is always greater than 10, supporting instrument validity.[9] The IV estimates are generally larger than the corresponding OLS estimates (i.e., the OLS estimates are attenuated). This is consistent with the notion of negative selection effects, discussed above.

Our discussion will focus on the IV results (columns 4–6), but similar patterns hold for the OLS estimates. Consider first, the result for the full sample (presented in Column 4). ROSCA membership results in an additional 1.5 assets; a 7.26 percentage point (pp) increase in the likelihood of owning a non-farm business; a 17.6 percent increase in food expenditure; a 27.7 pp increase in the likelihood of using LPG as cooking fuel, a 24.5 percent decline in the share of *bads* in total consumption expenditure and a 33 percent increase in annual educational expenditure. All of these estimates are statistically significant at conventional levels.

The overall results appear to be driven by the effects of ROSCA membership in rural areas. The effects of ROSCA membership on economic outcomes is generally statistically insignificant in the urban sample, and this is true irrespective of whether we consider the results in column 3 (OLS) or column 6 (IV). In contrast, the IV results for the rural sample (Column 5) show that ROSCA membership results in rural households owning 2.26 additional assets; a 9 percent increase in annual consumption expenditure; a 22.5 percent increase in food consumption; a 10.8 pp increase in the likelihood of owning a non-farm business and a 29 pp increase in the likelihood of using LPG as the main cooking fuel. It also results in a 39 percent decline in the share of *bads* in total consumption expenditure and a 47 percent increase in annual educational expenditure.

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[9]Table A1 presents the first stage results of the IV estimation.

Our results on the effects of ROSCAs are consistent with the existing literature that posits that a ROSCA serves as a savings mechanism in order to purchase indivisible goods. Besley and Levenson [1996], using data from Taiwan, show that controlling for income, households who participate in ROSCAs exhibit higher ownership rates (or expenditure levels) of indivisible goods. Anderson and Baland [2002] obtain similar results using their survey data from Kenya: they find that households with ROSCA members have higher expenditures on 12 of the 18 indivisible good categories, including school fees and clothing. Our results show similar patterns: ROSCA membership is related to increased asset ownership, increased use of LPG as a fuel (which requires lump-sum investment), increased ownership of non-farm businesses and increased expenditure on schooling. Consistent with the argument that women use ROSCAs to hide money from their husbands, the share of expenditure on *bads* is also lower in ROSCA member households.

4.2 Effect by Poverty Status

Table 3 presents the heterogeneity of effects along a second dimension: household poverty status. Specifically, we examine whether the effects of ROSCA membership on household outcomes are different for households below and above the poverty line. This is an important question because while ROSCA's are *per se* not targeted at them, these schemes are particularly attractive to poor women and evidence suggests that ROSCA's are increasingly less important as households get richer. It is therefore worthwhile examining whether the impacts of ROSCA membership varies across poor and non-poor households: here defined by below poverty line (BPL) and above poverty line (APL) households.[10]

The IV regression results, separately for the APL and BPL households by rural and urban residence are presented in Table 3. Consistent with the results presented in Table 2, ROSCA membership has no effect on outcomes for urban households; and this result generally holds irrespective

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[10]A household is categorized as a BPL household if it reports having a BPL card in the IHDS-1 survey. As a measure of robustness, we conduct a similar analysis of the effects of ROSCAs using the official poverty line to classify poor and non-poor households. See Table A2.

of whether or not the household is APL or BPL.[11] ROSCA membership leads to rural BPL households owning 2.75 additional assets and rural APL households owning 1.9 additional assets. For Rural BPL households, ROSCA membership leads to an 11.7 percent increase in annual household consumption expenditure, a 15.1 pp increase in the likelihood of owning a non-farm business, a 26.4 percent increase in food consumption, a 43.7 pp increase in the likelihood of using LPG as cooking fuel and finally a 55.8 percent increase in school expenditures. The corresponding point estimates for the rural APL households are all smaller at 7.7, 8.4, 21.0, 17.7, and 42.9. However the effect of ROSCA membership on consumption of *bads* is stronger for APL households at 48.5 percent compared to 36.3 percent for rural BPL households. Overall though, results suggest that ROSCAs have the strongest impact on poorer rural households.

4.3 Mechanism

The results presented so far imply that the effects of ROSCAs are more pronounced in rural areas, while they are minimal or non-existent in urban areas. Why are the effects stronger in rural areas? We argue that social ties are the key to the positive and significant impact of ROSCAs on household welfare. To explore this hypothesis, Table 4 presents results from equation (2) where our community bonding indicator is interacted with ROSCA membership. We report the coefficients on ROSCA membership ($\hat{\alpha}_1$) and the interaction with good community bonding ($\hat{\alpha}_3$) separately. We also present the linear combination ($\hat{\alpha}_1 + \hat{\alpha}_3$) to more easily see the impact of ROSCAs on households residing in communities that they perceive as having good bonding. Columns 1 and 2 present results for BPL households, while columns 3 and 4 present the corresponding results for APL households. In this analysis, we are limited to using household fixed effects as we lack an additional instrument to account for the interaction effects.

The effects of ROSCA membership on rural households that report good community bonding are generally stronger than the effects for households that report weak community bonding. For

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[11]Exceptions include a 28 pp increase in the likelihood of using LPG as cooking fuel and 85 pp increase in educational expenditure for Urban BPL households and a 22 pp increase in food consumption for Urban APL households.

rural BPL households, the interaction term ($\hat{\alpha}_3$) is positive and statistically significant for assets, food consumption, use of LPG fuel, and school expenditures. For rural APL households, the interaction is significant only for assets and use of LPG fuel. However, note that the overall effect of ROSCA membership for rural households that report strong community bonding ($\hat{\alpha}_1 + \hat{\alpha}_3$) are almost always statistically significant, even when $\hat{\alpha}_1$ and $\hat{\alpha}_3$ are not. The only exception is share of consumption on *bads*. Consistent with the results presented in Tables 2 and 3, the effects and interactions are weaker for urban households in terms of household assets and school expenditures, but are similar for rural and urban households with regards to total consumption, food consumption and LPG usage. Urban ROSCAs show trends in the direction of greater impact in communities with strong bonding, but we don't have requisite data to tease out these effects with precision given the seemingly smaller overall impact of ROSCAs in urban areas. In addition, it could also be more likely that urban households join ROSCAs outside their "community" given the density of the population and that a rural household is in a ROSCA in their own community.

5 Conclusion

Using panel data from India, this paper examines the effect of ROSCA membership on a range of measures of household welfare. We show that ROSCAs have a significant positive effect on household welfare. The effects are more pronounced in rural areas as compared to urban areas and are relatively stronger for poorer households. We account for selection using fixed effects (that capture time invariant unobserved heterogeneity) and the geographic *leave-one-out* instrument (that captures all other time varying unobserved heterogeneity at the household level).

The IV-FE estimates identified no significant effect of urban ROSCAs on household asset accumulation, likelihood of entrepreneurship and consumption of *bads*, and relatively weaker effects for all the other outcome variables compared to rural areas. We find that community bonding (social ties), which are critical for repayments in an informal set-up, are a significant determinant of the success of ROSCAs in rural India. Our findings are consistent with the notion that the fundamental structure of informal loans and the harnessing of social ties provides a way to con-

vert income flows into large sums or durable assets through a device that—for the present-biased group—is more effective than the alternative of saving up on one's own. The evidence from this study opens the possibility of a behavioral interpretation of ROSCAs and establishes causal links between informal credit and household welfare.

The interpretation of our results rests on the way that ROSCAs provide discipline and peer pressure absent in the textbook lending contract. But these attributes seem to be stronger and more effective in rural areas, at least partially owing to stronger social ties. The evidence here suggests that a key to the popularity of ROSCAs may rest in their role to help borrowers discipline their financial lives in an environment that reduces the likelihood of peers defaulting on each other. Further research is required to quantify the roles of specific-mechanisms and informal micro-credit contracts that may aid self-discipline and yield household welfare. In-kind ROSCA based questions in survey research could shed light on our understanding of the patterns and practices of informal credit institutions in developing countries.

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Table 1: Descriptive Statistics, India, IHDS, 2005–2012

	2005			2012			
	Obs (1)	Mean (2)	SD (3)	Obs. (4)	Mean (5)	SD (6)	Difference (7)
ROSCA Membership (0/1)	39938	0.072	0.258	39926	0.107	0.309	0.035***
Outcomes							
Assets (0-30)	39998	11.793	6.046	39961	14.621	6.159	2.828***
Real annual consumption (Rs.)	39954	100062.300	95376.750	39964	115781.900	119390.600	15719.600***
Non Farm Business (0/1)	39998	0.214	0.410	39982	0.209	0.407	-0.004
Food Consumption (Rs)	39954	3241.801	2017.245	35653	3156.444	1744.702	-85.357*
LPG use (0/1)	39998	0.384	0.486	39982	0.451	0.498	0.067***
Ratio of Intoxicant Cons. To Total Cons.	39954	0.002	0.003	39949	0.002	0.003	0.000*
Annual School Expenditures (Rs.)	39954	2610.703	9138.209	39955	4439.754	15472.42	1824.051***
Additional Variables							
Urban (0/1)	39998	0.295	0.456	39982	0.318	0.466	0.023***
Head Education (years)	39947	7.431	5.013	39970	8.113	5.002	0.682***
Head Age (years)	30202	46.056	12.482	39084	49.881	13.581	3.825***
Household Size	39998	5.839	2.968	39981	4.869	2.331	-0.970***
BPL Card (0/1)	39998	0.328	0.470	39955	0.346	0.476	0.018***
Real Annual Household Income (Rs.)	39998	98784.390	148846.100	39982	68097.410	117725.300	-30686.980***
Real Annual Community Income (Rs.)	39998	98784.390	68841.08	39982	68097.410	53883.85	-30686.980***
Community Poverty Rate	39998	0.227	0.235	39982	0.168	0.173	-0.059***
Network Doctors/Health Workers (0/1)	39619	0.317	0.465	39916	0.562	0.496	0.245***
Network Teachers/School Workers (0/1)	39565	0.402	0.490	39915	0.592	0.492	0.190***
Network Politicians/Police/Military (0/1)	39385	0.336	0.472	39913	0.508	0.500	0.172***
Network Government Administrators (0/1)	39385	0.336	0.472	39912	0.300	0.458	-0.036***
SHG Membership (0/1)	39945	0.098	0.297	39929	0.190	0.392	0.092***
NGO Membership (0/1)	39935	0.017	0.131	39921	0.013	0.111	-0.005***
Loan from Banks (0/1)	39998	0.120	0.325	39982	0.178	0.383	0.058***
Community Bonding (0/1)	39840	0.581	0.493	39913	0.733	0.442	0.152***

Notes: IHDS data 2005 and 2012 used. Column 7 presents the difference in average between 2012 and 2005. Significance: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 2: Effect of ROSCA on Householrd Outcomes.

	FE-All	FE-Rural	FE-Urban	IV-All	IV-FE-Rural	IV-FE-Urban
	(1)	(2)	(3)	(4)	(5)	(6)

Household Assets

ROSCA Membership	0.416***	0.603***	0.085	1.496***	2.267***	0.125
	(0.0587)	(0.0721)	(0.0973)	(0.2017)	(0.2451)	(0.363)
F test (instrument)				1,390	977	514
Sharpened two-stage q-values	0.003	0.008	0.672	0.008	0.005	0.766
Number of Observations	67,565	45,496	22,052	66,756	44,786	21,953
Number of households	39,277	26,750	12,510	38,814	26,344	12,453

Log Annual household Consumption Expenditure

ROSCA Membership	0.0521***	0.0582***	0.0413**	0.0276	0.0893**	-0.0149
	(0.00998)	(0.012)	(0.018)	(0.0335)	(0.0397)	(0.0652)
F test (instrument)				1,386	974	511
Sharpened two-stage q-values	0.001	0.004	0.071	0.118	0.015	0.419
Number of Observations	67,557	45,493	22,048	66,748	44,783	21,949
Number of Households	39,277	26,751	12,510	38,814	26,345	12,453

Owning a non-farm business

ROSCA Membership	0.0048	0.0184**	0.017	0.0726***	0.108***	0.0298
	(0.00716)	(0.00834)	(0.0138)	(0.0234)	(0.0264)	(0.0502)
F test (instrument)				1392	966	490
Two stage sharpened q-values	0.811	0.011	1	0.001	0.001	0.554
Number of Observations	67,574	45,502	22,055	66,765	44,792	21,956
Number of Households	39,278	26,751	12,510	38,815	26,345	12,453

Log Food consumption

ROSCA Membership	0.0268***	0.0346***	0.0102	0.176***	0.225***	0.1000*
	-0.00761	-0.00905	-0.0139	-0.0284	-0.0325	-0.0603

Table **2** (Continued): Effect of ROSCA on Household Outcomes.

	FE-All	FE-Rural	FE-Urban	IV-All	IV-FE-Rural	IV-FE-Urban
	(1)	(2)	(3)	(4)	(5)	(6)
F test (instrument)				1,275	829	413
Two stage sharpened q-values	0.001	0.001	1	0.003	0.001	0.088
Number of Observations	63,413	42,604	20,793	62,656	41,946	20,694
Number of Households	38,149	25,894	12,239	37,705	25,507	12,182

Using LPG as cooking fuel

ROSCA Membership	0.0343***	0.0474***	-0.00221	0.277***	0.294***	0.140***
	(0.00736)	(0.00915)	(0.0122)	(0.0258)	(0.0313)	(0.0463)
F test (instrument)				1,419	966	530
Two stage sharpened q-values	0.001	0.001	1	0.009	0.001	0.003
Number of Observations	67,574	45,502	22,055	66,765	44,792	21,956
Number of Households	39,278	26,751	12,510	38,815	26,345	12,453

Log ratio of consumption (bad/total)

ROSCA Membership	-0.0392	-0.0473	-0.00235	-0.245***	-0.389***	0.278
	(0.0282)	(0.0319)	(0.0607)	(0.0949)	(0.111)	(0.196)
F test (instrument)				645	496	309
Two stage sharpened q-values	0.621	0.034	1	0.189	0.001	0.331
Number of Observations	42,232	30,972	11,252	41,710	30,502	11,200
Number of Households	28,214	20,328	7,878	27,864	20,020	7,836

Log real annual school expenditure

ROSCA Membership	0.1422***	0.2703***	-0.0363	0.3281**	0.4702**	0.4704**
	(0.0454)	(0.0608)	(0.0640)	(0.1503)	(0.1971)	(0.2342)
F test (instrument)				628	430	384
Two stage sharpened q-values	0.002	0.004	0.844	0.021	0.044	0.084
Number of Observations	37,699	24,004	13,690	37,277	23,656	13,616

Continued ...

Table 2 (Continued): Effect of ROSCA on Household Outcomes.

	FE-All	FE-Rural	FE-Urban	IV-All	IV-FE-Rural	IV-FE-Urban
	(1)	(2)	(3)	(4)	(5)	(6)
Number of Households	26,680	17,291	9,384	26,375	17,037	9,333

Notes: OLS regression results presented. All regression specifications include household fixed effects. Coefficients are interpreted as percentage point changes. Additional independent variables in all regressions: log of real annual household income, log of real annual community income, average level of poverty in the community, household head education, age of household head, household size, wave dummy and social networks with teachers, educators, health practitioners, lawyers, government official, local political leaders. In all the results, the coefficients for real total household consumption, food expenditure, consumption of bads and school expenditures are interpreted as percentage change. The sharpened two stage q-values are derived from Anderson [2008] to reduce the likelihood of these false rejections. The measure is a way of adjusting for the fact that we are testing multiple hypotheses. Robust standard errors (clustered at the household level) in parentheses. Significance ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 3: Effect of ROSCA on Economic Outcomes. Regressions by Household Poverty Status

	BPL Households		APL Households	
	IV-Rural	IV-Urban	IV-Rural	IV-Urban
	(1)	(2)	(3)	(4)
Household Assets				
ROSCA Member	2.763***	0.764	1.868***	-0.707
	(0.361)	(0.569)	(0.342)	(0.478)
F test (instrument)	512	390	891	467
Sharpened two-stage q-values	0.004	0.272	0.006	0.311
Number of Observations	17,965	5,586	26,790	16,357
Number of Households	10,269	3,154	16,057	9,294
Log Annual Household Consumption Expenditure				
ROSCA Member	0.117**	0.0998	0.0771*	-0.0696
	(0.0589)	(0.097)	(0.054)	(0.0884)
F test (instrument)	506	382	853	421
Two stage sharpened q-values	0.002	0.462	0.092	0.771
Number of Observations	17,964	5,587	26,788	16,352
Number of Households	10,269	3,154	16,058	9,294
Owning a non-farm business				
ROSCA Member	0.151***	0.0365	0.0837**	-0.0573
	(0.0379)	(0.0775)	(0.038)	(0.0674)
F test (instrument)	522	397	871	462
Two stage sharpened q-values	0.002	0.644	0.024	0.313
Number of Observations	17,966	5,588	26,795	16,358
Number of Households	10,269	3,154	16,058	9,294
Log Food Consumption				

Effect of ROSCA on Economic Outcomes. Regressions by Household Poverty Status (Continued)

	BPL Households		APL Households	
	IV-Rural	IV-Urban	IV-Rural	IV-Urban
	(1)	(2)	(3)	(4)
ROSCA Member	0.264***	0.0939	0.210***	0.222**
	(0.047)	(0.0797)	(0.0471)	(0.0905)
F test (instrument)	517	306	747	455
Two stage sharpened q-values	0.001	0.143	0.001	0.021
Number of Observations	16,995	5,315	24,924	15,372
Number of Households	10,036	3,093	15,454	9,084

LPG as cooking fuel

ROSCA Member	0.437***	0.282***	0.177***	-0.00459
	(0.0483)	(0.0864)	(0.0418)	(0.0518)
F test (instrument)	534	322	698	482
Two stage sharpened q-values	0.001	0.009	0.008	0.452
Number of Observations	17,966	5,588	26,795	16,358
Number of Households	10,269	3,154	16,058	9,294

Log ratio of consumption (bad/total)

ROSCA Member	-0.363**	-0.19	-0.485***	0.061
	(0.164)	(0.302)	(0.153)	(0.057)
F test (instrument)	422	245	237	211
Two stage sharpened q-values	0.043	0.652	0.001	0.544
Number of Observations	12,735	3,224	17,749	7,973
Number of Households	8,159	2,188	11,848	5,645

Log real annual school expenditure

Effect of ROSCA on Economic Outcomes. Regressions by Household Poverty Status (Continued)

	BPL Households		APL Households	
	IV-Rural (1)	IV-Urban (2)	IV-Rural (3)	IV-Urban (4)
ROSCA Member	0.558**	0.844**	0.419	0.289
	(0.276)	(0.382)	(0.301)	(0.304)
F test (instrument)	224	78	161	151
Two stage sharpened q-values	0.017	0.032	0.164	0.609
Number of Observations	8,719	3,100	14,919	10,509
Number of Households	6,310	2,180	10,713	7,149

Notes: OLS regression results presented. All regression specifications include household fixed effects. Coefficients are interpreted as percentage point changes. Additional independent variables in all regressions: log of real annual community income, average level of poverty in the community, household head education, age of household head, household size, wave dummy and social networks with teachers, educators, health practitioners, lawyers, government official, local political leaders. The sharpened two stage q values are derived from Anderson [2008] to reduce the likelihood of these false rejections. The measure is a way of adjusting for the fact that we are testing multiple hypotheses. Robust standard errors (clustered at the household level) in parentheses. Significance ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 4: Effect of ROSCAs on Household Assets and Consumption Depending on the Level of Bonding in the Community

	BPL Households		APL Households	
	Rural	Urban	Rural	Urban
	(1)	(2)	(3)	(4)
Household Assets				
ROSCA Member ($\hat{\alpha}_1$)	0.324*	0.141	0.324*	0.244
	(0.171)	(0.296)	(0.177)	(0.191)
Good community bonding ($\hat{\alpha}_2$)	-0.180***	-0.0175	-0.0371	-0.0385
	(0.063)	(0.110)	(0.054)	(0.062)
ROSCA × Good community bonding ($\hat{\alpha}_3$)	0.456**	-0.064	0.346*	-0.177
	(0.193)	(0.341)	(0.203)	(0.228)
$\hat{\alpha}_1 + \hat{\alpha}_3$	0.780**	0.075	0.670***	0.066
	(0.117)	(0.201)	(0.117)	(0.141)
Number of Observations	18,360	5,638	27,426	16,533
Number of Households	10,427	3,168	16,323	9,340
Log Annual Household Consumption Expenditure				
ROSCA Member ($\hat{\alpha}_1$)	0.0381	0.0244	0.0957***	0.0114
	(0.0281)	(0.0484)	(0.0301)	(0.0360)
Good community bonding ($\hat{\alpha}_2$)	-0.0109	-0.0409**	-0.00312	-0.0140
	(0.0110)	(0.0183)	(0.0093)	(0.0114)
ROSCA × Good community bonding ($\hat{\alpha}_3$)	0.0206	0.0480	-0.0104	0.0527
	(0.0341)	(0.0607)	(0.0351)	(0.0432)
$\hat{\alpha}_1 + \hat{\alpha}_3$	0.058***	0.072*	0.085***	0.064**
	(0.019)	(0.038)	(0.020)	(0.024)
Number of Observations	18,218	5,599	27,186	16,404
Number of Households	10,422	3,167	16,310	9,333

Owning a Non-farm business

Effect of ROSCAs on Household Assets and Consumption Depending on the Level of Bonding in the Community (Continued)

	BPL Households		APL Households	
	Rural	Urban	Rural	Urban
	(1)	(2)	(3)	(4)
ROSCA Member ($\hat{\alpha}_1$)	0.00476	-0.00985	0.0287	-0.0205
	(0.0189)	(0.0374)	(0.0205)	(0.0249)
Good community bonding ($\hat{\alpha}_2$)	0.00374	0.0176	-0.00300	0.0124
	(0.00774)	(0.0147)	(0.00653)	(0.00880)
ROSCA × Good community bonding ($\hat{\alpha}_3$)	0.0234	-0.0162	-0.0241	-0.00933
	(0.0217)	(0.0444)	(0.0237)	(0.0314)
$\hat{\alpha}_1 + \hat{\alpha}_3$	0.028**	-0.026	0.004	-0.029
	(0.012)	(0.027)	(0.0137)	(0.020)
Number of Observations	18,220	5,600	27,193	16,410
Number of Households	10,422	3,167	16,310	9,333
Log Food Consumption				
ROSCA Member ($\hat{\alpha}_1$)	-0.0114	-0.0207	0.0599***	0.00857
	(0.0215)	(0.0402)	(0.0219)	(0.0265)
Good community bonding ($\hat{\alpha}_2$)	-0.0196**	-0.0227	-0.0129*	0.00108
	(0.00898)	(0.0150)	(0.00746)	(0.00864)
ROSCA× Good community bonding ($\hat{\alpha}_3$)	0.0855***	0.0860*	-0.0139	0.00732
	(0.0254)	(0.0455)	(0.0258)	(0.0327)
$\hat{\alpha}_1 + \hat{\alpha}_3$	0.074***	0.065***	0.045***	0.015
	(0.014)	(0.024)	(0.015)	(0.020)
Number of Observations	17,368	5,367	25,523	15,543
Number of Households	10,203	3,110	15,737	9,132
LPG as cooking fuel				
ROSCA Member ($\hat{\alpha}_1$)	0.0309	-0.0447	-0.00919	-0.0280

Effect of ROSCAs on Household Assets and Consumption Depending on the Level of Bonding in the Community (Continued)

	BPL Households		APL Households	
	Rural	Urban	Rural	Urban
	(1)	(2)	(3)	(4)
	(0.0216)	(0.0439)	(0.0215)	(0.0207)
Good community bonding ($\hat{\alpha}_2$)	-0.0160**	-0.00350	-0.00859	-0.0148**
	(0.00777)	(0.0158)	(0.00694)	(0.00677)
ROSCA × Good community bonding ($\hat{\alpha}_3$)	0.0729***	0.0706	0.0483*	0.0455*
	(0.0253)	(0.0500)	(0.0252)	(0.0256)
$\hat{\alpha}_1 + \hat{\alpha}_3$	0.103***	0.025	0.039***	0.017
	(0.015)	(0.027)	(0.014)	(0.016)
Number of Observations	18,220	5,600	27,193	16,410
Number of Households	10,422	3,167	16,310	9,333
Log ratio of consumption (bad/total)				
ROSCA Member ($\hat{\alpha}_1$)	0.0401	-0.124	-0.135*	-0.0171
	(0.0734)	(0.155)	(0.0752)	(0.122)
Good community bonding ($\hat{\alpha}_2$)	0.0211	0.0757	-0.0422*	-0.105***
	(0.0271)	(0.0547)	(0.0235)	(0.0353)
ROSCA × Good community bonding ($\hat{\alpha}_3$)	-0.0736	0.110	0.109	0.0571
	(0.0846)	(0.189)	(0.0892)	(0.148)
$\hat{\alpha}_1 + \hat{\alpha}_3$	-0.033	-0.014	-0.026	0.399
	(0.049)	(0.120)	(0.054)	(0.086)
Number of Observations	12,911	3,229	18,006	8,001
Number of Households	8,276	2,197	12,035	5,668
Log real annual school expenditure				
ROSCA Member ($\hat{\alpha}_1$)	-0.0642	-0.0932	0.312**	-0.0155

Continued ...

Effect of ROSCAs on Household Assets and Consumption Depending on the Level of Bonding in the Community (Continued)

	BPL Households		APL Households	
	Rural (1)	Urban (2)	Rural (3)	Urban (4)
	(0.157)	(0.197)	(0.153)	(0.118)
Good community bonding ($\hat{\alpha}_2$)	-0.144**	-0.0650	-0.0506	-0.0736*
	(0.0630)	(0.0855)	(0.0440)	(0.0404)
ROSCA× Good community bonding ($\hat{\alpha}_3$)	0.440**	0.137	-0.0980	0.00900
	(0.176)	(0.236)	(0.173)	(0.153)
$\hat{\alpha}_1 + \hat{\alpha}_3$	0.375***	0.043	0.214**	-0.006
	(0.104)	(0.144)	(0.092)	(0.096)
Number of Observations	8,601	3,067	14,749	10,432
Number of Households	6,282	2,170	10,696	7,144

Notes: Robust standard errors (clustered at the household level) in parentheses, p-values—***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Additional independent variables in all regressions: log of real annual household income, log of real annual community income, average level of poverty in the community, household head education, age of household head, household size. $alp\hat{h}a_1 + alp\hat{h}a_3$ gives the total effect of ROSCA membership in a good bonding community.

Online Appendix

Table A1: First Stage Results

	All (1)	Rural (2)	Urban (3)
SHG member	0.179***	0.180***	0.182***
	(0.007)	(0.008)	(0.013)
NGO member	0.127***	0.134***	0.119***
	(0.018)	(0.023)	(0.027)
Loan from bank	0.014***	0.017***	0.008
	(0.005)	(0.006)	(0.009)
Real annual household income (Rs.)	0.006***	0.004	0.011***
	(0.002)	(0.002)	(0.004)
Real annual community income	0.000***	0.000***	0.000
	(0.000)	(0.000)	(0.000)
Community poverty	0.009	0.000	0.032*
	(0.010)	(0.011)	(0.019)
Household adult education years	0.001	0.001	0.000
	(0.010)	(0.001)	(0.001)
Head age in years	0.000	0.000	-0.001
	(0.000)	(0.000)	(0.001)
Household size	0.002**	0.002*	0.003
	(0.001)	(0.001)	(0.002)
Year 2012	-0.006*	-0.015***	0.011*
	(0.004)	(0.004)	(0.006)
Network Doctors/Health workers	0.901	0.002	-0.003
	(0.004)	(0.005)	(0.006)
Network Teachers/School workers	0.306	0.005	0.006
	(0.004)	(0.005)	(0.006)
Network Politicians/Police/Military	0.002	0.003	0.001
	(0.005)	(0.007)	(0.009)
Network Government Administrators	0.008	0.004	0.016*
	(0.006)	(0.007)	(0.009)
ROSCA participation rate (excluding own community)	0.798***	0.820***	0.744***
	(0.021)	(0.026)	(0.038)
Constant	-0.068**	-0.042	-0.137**
	(0.027)	(0.031)	(0.055)
F test (instrument)	1,390	977	514
σ_u	0.201	0.204	0.195
σ_e	0.248	0.251	0.241
ρ	0.398	0.399	0.395
Observations	66,756	44,786	21,953
Number of households	38,814	26,344	12,453

Table A2: Effect of ROSCA on Economic Outcomes. Regressions by Household Poverty Status. Alternative Definition of Poverty

	BPL Households		APL Households	
	IV-Rural	IV-Urban	IV-Rural	IV-Urban
	(1)	(2)	(3)	(4)
Household Assets				
ROSCA Membership	2.192***	2.462	2.061***	0.334
	(0.756)	(1.801)	(0.259)	(0.380)
F test (instrument)	125	20	739	335
Two stage sharpened q-values	0.001	0.219	0.001	0.114
Number of Observations	8,741	2,375	36,032	19,572
Number of households	5,130	1,355	21,205	11,093
Log Annual Consumption Expenditure				
ROSCA Membership Exp.	-0.263**	-0.573**	0.0322	0.0449
	(0.117)	(0.279)	(0.0421)	(0.0676)
F test (instrument)	125	20	739	335
Two stage sharpened q-values	0.045	0.033	0.439	0.880
Number of Observations	8,741	2,375	36,033	19,569
Number of households	5,130	1,355	21,206	11,093
Owning non-farm business				
ROSCA Membership	-0.138**	-0.409*	0.122***	-0.0221
	(0.0696)	(0.243)	(0.0292)	(0.0531)
F test (instrument)	125	20	739	335
Two stage sharpened q-values	0.029	0.088	0.001	0.711
Number of Observations	8,742	2,375	36,036	19,575
Number of households	5,130	1,355	21,206	11,093
Log Food Consumption				

Effect of ROSCA on Economic Outcomes. Regressions by Household Poverty Status. Alternative Definition of Poverty (Continued)

	BPL Households		APL Households	
	IV-Rural	IV-Urban	IV-Rural	IV-Urban
	(1)	(2)	(3)	(4)
ROSCA Membership	0.0203	0.0276	0.143***	0.108*
	(0.111)	(0.317)	(0.036)	(0.0612)
F test (instrument)	102	17	698	311
Two stage sharpened q-values	0.324	0.854	0.001	0.097
Number of Observations	8,008	2,194	33,929	18,495
Number of households	4,900	1,307	20,598	10,870

LPG as Cooking Fuel

ROSCA Membership	0.163**	0.372	0.300***	0.183***
	(0.0779)	(0.302)	(0.0346)	(0.0480)
F test (instrument)	125	20	739	335
Two stage sharpened q-values	0.038	0.244	0.001	0.001
Number of Observations	8,742	2,375	36,036	19,575
Number of households	5,130	1,355	21,206	11,093

Log Ratio of consumption (bad/total)

ROSCA Membership	-0.167	-1.072	-0.270**	0.489**
	(0.357)	(1.481)	(0.119)	(0.208)
F test (instrument)	87	12	610	213
Two stage sharpened q-values	0.881	0.524	0.014	0.033
Number of Observations	6,601	1,554	23,895	9,643
Number of households	4,200	1,024	15,814	6,809

Log Annual Expenditure on Education

|				
ROSCA Membership	-0.102	12.82	0.434**	0.569**

Continued ...

Effect of ROSCA on Economic Outcomes. Regressions by Household Poverty Status. Alternative Definition of Poverty (Continued)

	BPL Households		APL Households	
	IV-Rural (1)	IV-Urban (2)	IV-Rural (3)	IV-Urban (4)
	(1.029)	(16.21)	(0.204)	(0.239)
F test (instrument)	53	6	467	298
Two stage sharpened q-values	0.672	0.768	0.022	0.018
Number of Observations	3,890	1,264	19,156	12,185
Number of households	2,920	916	13,829	8,355

Notes: 2SLS regression results presented. All regression specifications include household fixed effects. Additional independent variables in all regressions: log of real annual community income, average level of poverty in the community, household head education, age of household head, household size, wave dummy and social networks with teachers, educators, health practitioners, lawyers, government official, local political leaders. The sharpened two stage q values are derived from Anderson [2008] to reduce the likelihood of these false rejections. The measure is a way of adjusting for the fact that we are testing multiple hypotheses. Robust standard errors (clustered at the household level) in parentheses. Significance ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Definition of Poverty: IHDS calculated household poverty based on the monthly consumption per capita and the official Planning Commission poverty line as of 2005. Poor is a dichotomous (0/1) variable indicating whether the household is below this poverty line or not. Users can calculate a poverty line ratio by dividing the monthly consumption per capita by the official poverty line. The poverty line varies by state and urban/rural residence. It is based on 1970s calculations of income needed to support minimal calorie consumption and has been adjusted by price indices since then. https://ihds.umd.edu/poverty.

Figure A1: Intensity of ROSCA Membership at the District Level

Panel A: 2005

Panel B: 2012
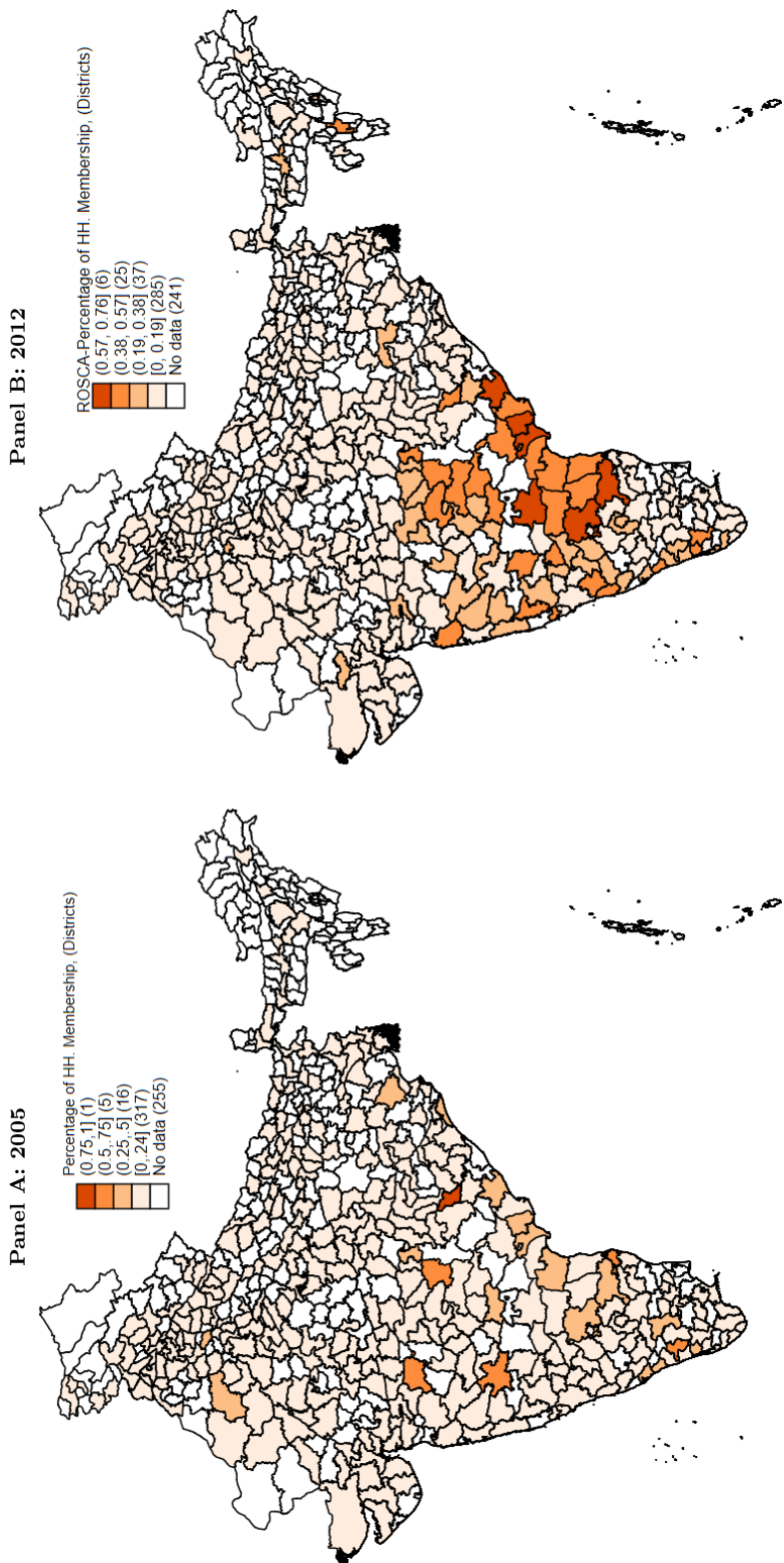
Notes: Authors' computations using IHDS-1 and IHDS-2.

Figure A2: Average Non-Self PSU Level Household Membership in ROSCA in the District, India, 2005–2012.
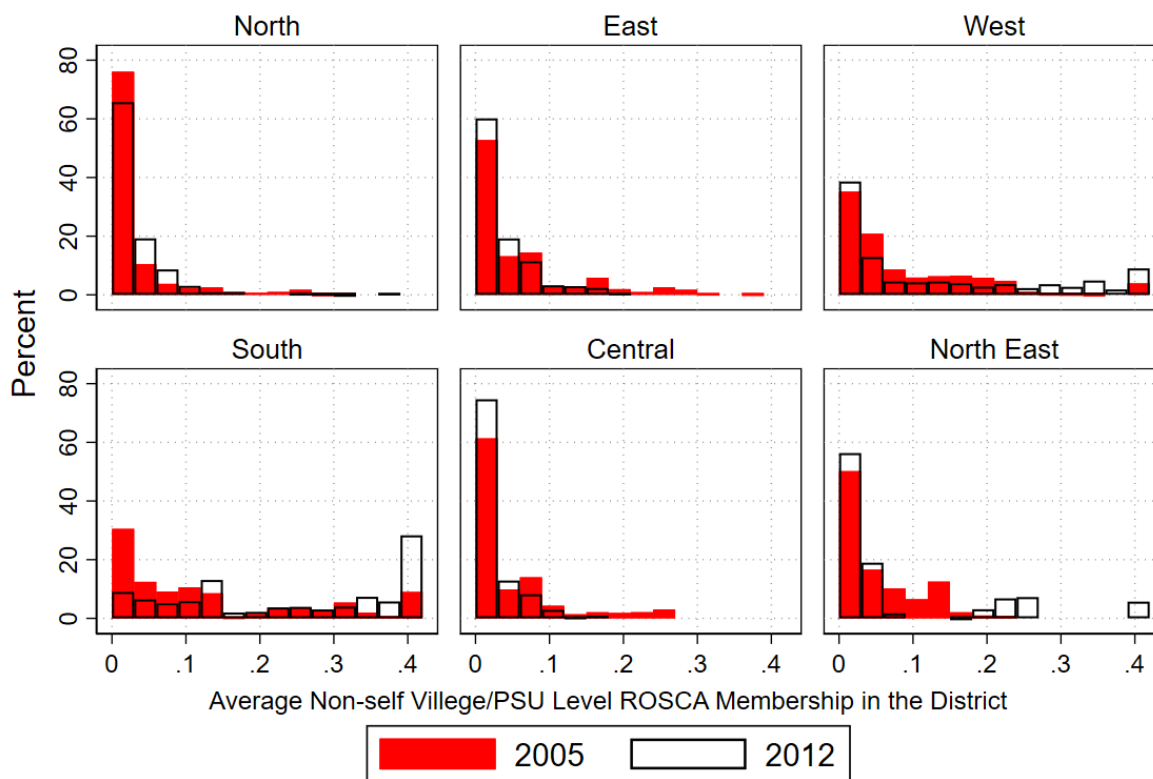
Graphs by Administrative Regions, India, IHDS

Notes: North Zone includes Jammu and Kashmir, Himachal Pradesh, Punjab, Uttarakhand , Uttar Pradesh and Haryana. East Zone includes Bihar, Orissa, Jharkhand, and West Bengal. West Zone includes Rajasthan, Gujarat, Goa and Maharashtra. South Zone includes Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. In 2014, the state of Andhra Pradesh was divided into the two states of Andhra Pradesh and Telangana. Central Zone includes Madhya Pradesh and Chhattisgarh. North East Zone includes Assam, Sikkim, Nagaland, Meghalaya, Manipur, Mizoram, Tripura and Arunachal Pradesh